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SECTION 02332 - EMBANKMENT  
(Dec-06)

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of furnishing all plant, labor, equipment, tests, and materials, except as otherwise specified in Section 02318, "EXCAVATION", and performing all operations in connection with foundation preparation and construction of embankments,{{ including [Designer to provide specific features]}} and other incidental earthwork as may be necessary to complete the embankments, as shown on the drawings, and as hereinafter specified. {{Fill and backfill for structures are covered in Section 02320, "STRUCTURAL EXCAVATION, FILL AND BACKFILL"}}

1.2 REFERENCES

The following publications of the issues listed below, but referred to before and thereafter by the basic designation only, form a part of this specification to the extent indicated by the references thereto:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 698	(2000a) Laboratory Compaction Characteristics of Soil Using Standard Efforts (12,400ft-lbs/ft <sup>3</sup> (6000KN-m/m <sup>3</sup> ))
D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
D 2216	(2005) Laboratory Determination of Water, (Moisture) Content of Soil and Rock by Mass
D 2487	(2006) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D 2922	(2005) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D 2974	((2000) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
D 4318	(2005) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

D 4643 (2000) Determination of Water (Moisture) Content of Soil by Microwave Method

E 329 (2006) Agencies Engaged in Construction Inspection and/or Testing

### 1.3 MEASUREMENT

#### 1.3.1 Embankment[ and Berms]

Unless otherwise specified,[ compacted fill,][ uncompacted fill,]{{ hydraulic fill,}} and required fill and backfill materials of any description specified in this section[ including fill placed by reason of soft material in the foundation being forced outward from the section] will be measured for payment by the cubic yard, and quantities will be determined by the average end area method. The basis for the measurement will be cross sections of the areas to be filled taken prior to clearing, grubbing, and vegetation removal operations and the theoretical[ gross][ design] sections of the completed levee constructed within the specified tolerance.[ Embankment not constructed to design grade and section including allowable tolerance as indicated on the Contractor's compliance survey will not be accepted.]

(1) Volumes occupied by drainage structures will not be included in measurement of embankment for payment.

[(2) The basis for measurement of fill placed by reason of soft material in the foundation being forced outward from the section will be a survey of the area taken prior to the filling operations and a second survey of the same area after completion of the filling operations.]

#### 1.3.2 Settlement

Measurement of additional fill material placed in each settlement measurement range shown on the drawings by reason of foundation settlement, will be based on measurements on the respective settlement gage installed as specified in paragraph 3.8.1 and will be determined as follows:

(1) The settlement measured at each settlement gage will be considered to apply to the foundation area throughout the length of the settlement ranges specified herein where the gage is located. In the event that embankment over a settlement gage is constructed to a height in excess of the specified [ gross][ design] construction lines[ plus the tolerance permitted under paragraph 3.7]. No measurement of settlement will be made and will result in forfeiture of any payment that may be due the Contractor for the settlement range applying to that settlement gage. Further, in instances where settlement plates have been set and cannot be found after completion of the embankment, no measurement for

settlement will be made, and any payment which may be due the Contractor for the settlement range applicable to that settlement gage will be forfeited.

(2) [The foundation settlement under the embankment at each transverse cross section within a settlement range will be considered to vary uniformly between break points in the cross section. At each breakpoint, the settlement allowance will be based upon the proportion that the specified fill height at the break point bears to the specified fill height at the settlement gage, in accordance with the following formula:  $S = h \times s_m / h_m$ , where S = settlement to be computed at a break point; h = specified gross fill height at S;  $s_m$  = measured or adjusted settlement gage;  $h_m$  = specified gross fill height above settlement gage. Except as provided above and in paragraph 3.8.2, no measurement for payment for additional fill materials placed by reason of foundation settlement will be made.]  
{{The foundation settlement under the levee side slopes at each transverse cross section within a settlement measurement range will be considered to vary uniformly from zero settlement at the levee toes to a maximum settlement, equal to the amount of settlement measured on the respective settlement gage, at points under the tops of the slopes. Except as provided above and in paragraph 3.8.2, no measurement for payment for additional materials placed by reason of foundation settlement will be made.}}

(3) The Contractor will not be compensated for foundation settlement caused by moisture control operations performed on the existing berms. All initial settlement gage readings are required to be taken prior to moisture control operations on the existing berms. In instances where the Contractor performs moisture control after initial gage reading were taken, the Contractor must perform settlement gage readings prior to commencing moisture control operations in the area to receive compensation for settlement in that area and if no measurement is taken for settlement any payment which may be due the Contractor for the settlement range applicable to that settlement gage will be forfeited. The Contractor may seek compensation for settlement after all moisture control operations have terminated and new settlement gage readings are performed in the area.

### 1.3.3 Embankment Materials Testing

No measurement will be made for testing, regardless of the location of the material, i.e., in the borrow area, in a stockpile area, or in place.

## 1.4 PAYMENT

### 1.4.1 Embankment[ and Berms]

Payment for all[ compacted,][ uncompact,]{{ hydraulic fill}} material placed as required in embankments[, and berms], and including additional material placed by reason of foundation settlement[ and by reason of soft material in the foundation being forced outward from the section] during construction, will be made at the [

applicable] contract unit price per cubic yard for[ "Embankment, Compacted Fill][ "Embankment, Uncompacted Fill"]{{ "Embankment, Hydraulic Fill"}}. Price and payment shall constitute full compensation for furnishing all plant, labor, testing, employ of professional engineering services, equipment and material( except earth material), and performing all operations necessary for excavation, all testing, hauling, foundation preparation, material processing for moisture control and blending, placing and compacting the material and other incidental work required to complete the embankment or fill.

#### 1.4.2 Settlement Gages

The cost of furnishing, installing, and maintaining during embankment construction the settlement gages specified herein, if used, including measurements required to be made by the Contractor shall be at the expense of the Contractor. No separate payment will be made for compaction of fills around and over the settlement gages or for interference with the Contractor's operations resulting from the settlement gage installations.

#### 1.4.3 Forfeiture of Payment for Settlement of Foundation

Failure to utilize settlement gages in strict accordance with the specifications and drawings will result in total forfeiture of any payment that may otherwise be due the Contractor for settlement of the foundation. In each case of 1) failure to recover any settlement gage, 2) construction of embankment over a settlement gage in excess of specified construction lines plus the tolerance permitted under paragraph 3.7, or 3) failure to comply with the 72-hour requirement in paragraph 3.8.1, for determining gage elevations, payment will be totally forfeited for the reach attributable to each gage so affected.

#### 1.3.4 Establishment of Turf

The Contracting Officer will withhold 5 percent payment for embankment pending the satisfactory results of fertilizing and seeding operations as specified in Section 02922

### 1.5 QUALITY CONTROL

#### 1.5.1 General

The Contractor shall establish and maintain quality control for embankment construction operations to assure compliance with contract requirements, and maintain records of its quality control for all construction operations including but not limited to the following:

- (1) Equipment. Type, size, and suitability for construction of the prescribed work.

(2) Foundation Preparation. Breaking surface in advance of embankment[ and berm] construction, and during fill placement when necessary, drainage of foundation and partially completed fill.

(3) Materials. Applicable tests, location of material testing sites.

(4) Construction. Layout, maintaining existing drainage, moisture control, thickness of layers, spreading and compacting.

(5) Grade and Cross Section. Crown width, crown slope, side slopes, and grades.

(6) Roads and Ramps. Location of temporary roads to fields or buildings, location and placement of fills for ramps in accordance with specified dimensions and grades.

(7) Grade Tolerances. Check fills to determine if placement conforms to prescribed grade and cross section.

(8) Settlement of Foundation. Location of settlement gages established or measurements taken to determine settlement, location of sudden failures.

(9) Slides. Location and limits; methods and equipment used where remedial work has been directed.

#### Option 1

[(10) It is intended that borrow material shall be placed in the embankment[ and berm] at its natural moisture content.]

#### Option 2

[(10) Control Testing.

The Contractor shall perform all control testing such as soil classification, moisture content, control compaction curves, organic content, and in-place density. The results all tests shall be reported to the Contracting Officer's representative within 24 hours of sampling, except for the organic test results, which shall be reported within 48 hours of sampling. To ensure contract compliance, the Contractor shall submit the results of the in-place density test, moisture content test, and organic content test to the Contracting Officer's representative so they can be faxed to Chief of Geotechnical Branch @ 504-862-2987. Testing shall be performed by a Government approved testing agency,[ or] organization[ or field laboratory] including on-site testing labs operated by QC personnel. Criteria used for obtaining Government approval shall be in accordance with ASTM E 329. Microwave testing for moisture control in accordance with ASTM D 4643 is allowed in the contractor's field laboratory. No additional payment will

be made for control testing required in this paragraph. All costs in connection therewith shall be included in the contract unit price for "Embankment, Compacted Fill ". Documentation of sampling locations for the following tests shall be clearly defined by levee station and offset and also by lift number or elevation. As a minimum, the following tests are required:

1. Soil Classification Tests. Determination of soil classification shall be in accordance with ASTM D 2487. Atterberg Limits Test required for soil classification shall be performed in accordance with ASTM D 4318. One Atterberg test shall be obtained from the sample material used for each control compaction curve and one shall be obtained from the sample material used for each in-place density test. If the Nuclear Method is used, the material to be tested shall come from within a radius of 12 inches of the center of the in-place density test site. The soil classification obtained from in-place density tests will serve as the basis for determining the applicable control compaction curves.[ In addition, classification tests shall be performed on uncompacted fill at a minimum frequency of one test per 1,000 linear feet per lift placed in the levee section.]

2. Control Compaction Curves - Compacted Fills. Control compaction curves shall be established in accordance with ASTM D 698 (Standard Proctor Compaction Tests). Two control compaction curves will be required for each type of material from each source. Where construction operations result in blending of several types of material prior to or during fill placement within the embankment design sections, two control compaction curves will be required for each resulting blend of material and will be utilized in lieu of those required for the "unblended materials". The average of the two tests shall be the controlling optimum moisture content and maximum dry density.

3. In-Place Density Tests. In-place density tests for compacted fill material shall be made in accordance with ASTM D 2922 (Nuclear Method) or ASTM D 1556 (Sand Cone Method), and shall be made at a minimum frequency of one density test per [1500] cubic yards of compacted fill placed in the levee per lift, but not less than one density test per [500] feet per lift. At least one test shall be performed in any shift that compacted fill is placed. A lift on any one side of the existing embankment will be considered one lift. The location of the test shall be representative of the area being tested or as directed by the Contracting Officer. For each in-place density test, the Contractor shall determine the percentage of ASTM D 698 maximum dry density and the deviation from optimum



water content in percentage points (plus or minus), using the control compaction curves for the same type of material. The appropriate control compaction curve shall be selected by using visual soil classification and soil classification tests.

If the nuclear method is selected for field density testing, the sand-cone method shall be used to confirm the accuracy of the nuclear method. This can be accomplished by performing an initial comparison test of the two methods at the start of construction. If the nuclear method wet density is within 3 percent of the sand cone method, no correction of the nuclear method wet density will be required and the testing may continue with the nuclear method. The nuclear method wet density shall be verified throughout the project at a rate of one sand-cone test for every ten nuclear tests thereafter. If the variance at any time exceeds 3 percent, a correction factor will be required to be determined prior to any further testing. For comparison purposes, the nuclear and sand-cone wet densities should represent the same layer thickness within the testing area selected. When a nuclear density result is in doubt, the sand-cone density test shall be used for acceptance.

The correction factor shall be determined by conducting ten comparison tests (five D-2922 and five D-1556) and calculating the average difference (correction) for each soil type encountered. The developed correction shall be used for adjusting the nuclear wet density readings.

4. Moisture Content Tests. Moisture content tests at each density test location shall be taken to assure compliance with requirements for fill placement within the design sections as specified in paragraph 1.7.3. Determination of moisture content shall be performed in accordance with ASTM D 2216 or ASTM D 4643.

5. In-place Organic Content Tests. Organic content tests shall be taken at each in-place density test location.[ In addition, organic content tests shall be performed on uncompacted fill at the same locations as the soil classification tests as specified in paragraph 1.5.1(10)1.] Determination of organic content shall be in accordance with ASTM D 2974, method C.

6. Additional Tests. In addition to the above frequency of tests, additional tests shall be required as follows:

- a. Where the Contracting Officer's representative has reason to doubt the adequacy of the compaction, organic content or moisture control.

- b. Where the Contractor is concentrating fill operations over a relatively small area.
- c. When, in the opinion of the Contracting Officer, embankment materials change, the Contracting Office may direct additional testing.
- d. Where non-traditional compaction procedures/equipment are being used.
- e. When areas are found not meeting the specified in-place density, Atterberg Limits, and/or in-place organic content requirements, the Contractor shall retest at no additional cost to the Government after corrective measures have been applied.

(11) Compliance Surveys. Furnish plotted cross sections at intervals and locations corresponding to the Government's original survey. Upon completion of suitable reaches of embankment, the Contractor shall perform, plot and submit compliance cross section surveys at a maximum of 300-foot intervals and all P.I.'s, curve P.C.'s, P.T.'s, levee transitions and breakpoints. All sections shall be taken at locations corresponding to the Government original survey. They shall be plotted by the Contractor on a minimum scale of 1-inch equals to 10 feet horizontally and 1 inch equals to 5 feet vertically with the theoretical design cross section and allowable grade tolerances superimposed thereon. Additionally, the Contractor shall perform, plot, and submit a levee centerline profile with shots taken at a maximum of 20-foot intervals.

(12) Quantity Surveys. Provide plotted cross sections of all surveys for progress payments at a maximum of 300-foot intervals. Perform, plot and submit partial levee cross sections at a maximum of 300-foot intervals for determining progress payments. Plot on the same scale noted above.

#### 1.5.2 Reporting

The original and two (2) copies of these records of inspections and tests, as well as the records of corrective action taken, shall be furnished the Government daily. Format of the report shall be as prescribed in Section 01451, "CONTRACTOR QUALITY CONTROL".

#### 1.6 QUALITY ASSURANCE

Government Testing. As a control, the Government will perform assurance and check tests for maximum dry density for all materials in accordance with ASTM D 698. If values for maximum dry density as determined by the Contractor and as

determined by the Government do not agree, the Government will determine the values to be used. The Government will also perform check and assurance testing of the other control testing required by the Contractor in paragraph 1.5.1(10).

#### Option 1

[1.7 RESERVED]

#### Option 2

[1.7 EQUIPMENT

##### 1.7.1 General

Compaction equipment shall be capable of properly compacting the soil so that no planes of weakness or laminations are formed in the fill. Equipment shall be capable of compacting a layer of soil not less than 12 inches thick to the requirements specified herein and shall be operated at speeds not to exceed 3.5 miles per hour.

##### [1.7.2 Hand Tampers

Hand tamping shall be used in the compaction of fill within three feet of any structure or other drainage feature and near same where vehicular equipment cannot be used. These hand tampers shall be of the power driven, hand operated type.]

##### [1.7.3 Miscellaneous Equipment

Scarifiers, disks, spring-tooth or spike-tooth harrows, spreaders, power tampers, hand compactors, garden tillers, vibrators and other equipment shall be suitable for the type of construction required and acceptable to the Contracting Officer. Hand-operated power tampers for use in compacting impervious materials in confined areas, areas not to be disturbed, or against structures shall have a minimum static weight of 100 pounds. All hand-operated power tampers and vibratory compactors must be field checked prior to their use on fill to assure that the required results can be obtained. Such field checks shall be accomplished under the direction and supervision of the Contracting Officer. Any hand-operated equipment found not producing the required results will not be allowed on the fill.]

##### [1.7.3 Miscellaneous Equipment

Scarifiers, disks, spring-tooth or spike-tooth harrows, spreaders, power tampers, and other equipment shall be types suitable for construction of embankments [ and berms.]]

##### 1.7.4 Sprinkling Equipment

Sprinkling equipment shall be designed to apply water uniformly and in controlled quantities to variable widths of surface.]

## 1.8 EMBANKMENT[ AND BERM] MATERIALS

### 1.8.1 General

The embankment[ and berms] shall be constructed of earth obtained from the borrow areas{{{ the existing levee}[ ditches][ channels]}} (Government furnished and Mandatory Contractor furnished), and other required excavations as prescribed in Section 02318, "EXCAVATION" and to the extent shown on the drawings.

### 1.8.2 Materials

The embankment shall be constructed of earth materials naturally occurring or Contractor blended. Materials that are classified in accordance with ASTM D 2487 as CL or CH are suitable for use as embankment fill. Materials classified as ML are suitable if blended to produce a material that classifies as CH or CL according to ASTM D 2487. All fill materials shall be free from masses of organic matter, sticks, branches, roots, and other debris including hazardous and regulated solid wastes. As earth from the designated excavation areas may contain excessive amounts of wood, isolated pieces of wood will not be considered objectionable in the embankment provided their length does not exceed 1 foot, their cross-sectional area is less than 4 square inches, and they are distributed throughout the fill. Not more than 1 percent (by volume) of objectionable material shall be contained in the earth material placed in each cubic yard of the levee section. Pockets and/or zones of wood shall not be placed in the embankment. The Contractor shall notify the Contracting Officer whenever the in-place Plasticity Index of the material is 15 or less. Materials placed in the section must be at or above the Plasticity Index of 10. Materials placed in the section must be at or below organic content of 9 percent by weight, as determined by ASTM D 2974, Method C.

#### Option 1

##### [1.8.3 Moisture Control

Material shall be placed in the embankment[ and berm] at its natural moisture content.]

#### Option 2

##### [1.8.3 Moisture Control

###### 1.8.3.1 Moisture Control-Compacted Fill

The Contractor shall control the moisture content of the embankment material. The optimum moisture content shall be determined in accordance with paragraph 1.5.1(10). The Contractor shall perform the necessary work in moisture control to bring the borrow material within the moisture content range specified in paragraph 1.8.4. Borrow material is considered too wet to be placed directly upon the levee

compacted fill footprint, if it has a moisture content greater than 10 percentage points above the optimum moisture content resulting from the Standard Proctor Compaction Test ASTM D 698. Borrow material is considered too dry to be placed directly upon the levee compacted fill footprint, if it has a moisture content more than 10 percentage points below the optimum moisture content resulting from the Standard Proctor Compaction Test ASTM D 698. If the borrow material is too wet, it shall either be stockpiled and allowed to drain and/or the wet material shall be processed by disking and harrowing, if necessary, until the moisture content is reduced sufficiently. When it is discovered that wet fill has been placed over existing levee or newly constructed compacted fill footprint, the incident layer and previous layer will be tested in a minimum of two locations for density and moisture compliance. If the borrow material is too dry, it shall be prewet in the source area. If the top or contact surfaces of a partially filled section becomes too dry to permit suitable bond between these surfaces and the additional fill to be placed thereon, the Contractor shall loosen the dried materials by scarifying, disking, or other approved methods, and shall recompact this layer in accordance with the applicable requirements of paragraph 1.8.4. If the top or contact surfaces of a partially filled section becomes too wet to permit suitable bond between these surfaces and the additional backfill to be placed thereon, the wet material shall be scarified and permitted to dry, assisted by disking or harrowing. The material shall be recompact in accordance with the applicable requirements of paragraph 1.8.4. No additional payment will be made for any moisture control required in this paragraph.

#### 1.8.3.2 Moisture Control-Uncompacted Fill

There are no moisture control requirements for uncompacted fill. Uncompacted fill shall be placed at its natural water content.]

#### Option 1

[1.8.4 Reserved]

#### Option 2

[1.8.4 Compaction

The first and each successive layer of compacted fill material shall be compacted to at least 90 percent of maximum dry density as determined by ASTM D 698 (Standard Proctor Compaction Test) at a moisture content within the limits of plus 5 to minus 3 percentage points of optimum moisture content determined from ASTM D 698.[ For the first layer above the geotextile, a tractor having a ground pressure no greater than 4.7 plus or minus 0.2 psi shall be used to spread and then compact the layer.]]

#### 1.8.5 Dressing

The entire embankment[ and berm], including topsoil where specified, shall be brought to not less than the prescribed[ gross][ design] cross section, within allowable

tolerance, at all points. Unreasonable roughness of the surface shall be dressed out to permit fertilizing,[ and] seeding[ and mulching] operations.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 EMBANKMENT[ AND BERM] FOUNDATION PREPARATION

#### 3.1.1 Foundation Preparation

After clearing and grubbing and any required excavation of the [embankment[ and berm] foundation]{[ and] inspection ditch,}[ and] cutoff trench,}[ and] test pits}} and other similar cavities and depressions shall be broken down, where so directed, to flatten out the slopes.[ The entire earth surface on or against which fill is to be placed, except areas covered with water and not drained as specified in paragraph 3.1.3, shall be thoroughly broken to a depth of 6 inches.][ Areas on which geotextile is to be placed shall be dressed, to provide a smooth surface within the allowable tolerance, and left unbroken.][ If for any cause, this broken surface becomes compacted in such a manner that, in the opinion of the Contracting Officer, a plane of seepage or weakness might be induced, it shall again be adequately scarified before depositing material thereon.][ For levee enlargement work, both the natural surface of the ground and the surface of the existing levee to be occupied by the new work shall be prepared as specified above.][ All scarifying and breaking of ground surface shall be done parallel to the centerline of the levee.][ The slopes and bottom of the[ inspection ditch][ cutoff trench] shall be scarified to the extent practicable.] All of the foregoing work shall be completed at least [200] feet but not greater than [500] feet in advance of the embankment[ and berm] construction.

#### 3.1.2 Frozen Ground

No fill shall be placed upon frozen ground.

#### [3.1.3 Drainage

The foundation receiving fill{[ the inspection ditch][ and] cutoff trench] provided for in paragraph[s][ 02318-3.3.2][ and] 02318-3.3.3], respectively,}} and all partially completed fill shall be kept thoroughly drained except for the following:

- (1) Drainage of areas covered with water{[ extending from station \_\_\_\_\_ to station \_\_\_\_\_, and station \_\_\_\_\_]}[ that are indicated on the drawings]] will not be required; however, the Contractor may at its option and expense, drain the areas. Drainage to areas outside the right-of-way limits will be allowed only after the Contractor has submitted to the Contracting Officer a copy of the conveyance that it has obtained permission from the appropriate landowner(s) for such drainage.

{{(2) Embankments being constructed by hydraulic methods. The Contractor shall be solely responsible for all damages, claims, and liability of any nature whatsoever arising from drainage to areas outside the right-of-way limits.}}

## 3.2 EMBANKMENT[ AND BERM] CONSTRUCTION

### [3.2.1 Compacted Fill

The location and extent of the compacted fill is shown on the drawings. Compacted fill shall not be placed in water. The materials for compacted fill shall be placed or spread in layers, the first or bottom layer and the last two layers not more than 6 inches in thickness and all layers between the first and the last two layers not more than 12 inches in thickness prior to compaction[ except the first layer on top of the geotextile shall be 15 inches thick, plus or minus 3 inches, as specified in Section 02077, "GEOTEXTILE" (for details see drawings)]. Layers shall be started full out to the slope stakes and shall be carried substantially horizontal and parallel to the levee centerline with sufficient crown or slope to provide satisfactory drainage during construction.[ Areas on which geotextile is to be placed shall be dressed out and leveled to the grade indicated on the drawings. When placing fill on the geotextile, mechanical equipment shall not be allowed to come in contact with the geotextile in any way).][ Benching into the slope of the existing embankment is required in order to place and compact the material in horizontal layers as described on the drawings. Benching shall consist of excavating the existing levee embankment as shown on the drawings and described herein. The vertical face of the existing embankment resulting from the benching operation shall be a minimum of 1 foot in height but shall not exceed 2 feet in height as shown on the drawings. Material excavated from the benching operations shall be used as compacted fill.] When the surface of any compacted layer is too smooth to bond properly with the succeeding layer, it shall be adequately scarified before the next layer is placed thereon[ except as specified in paragraph 3.1.1].[ The elevation of the levee embankment shall not exceed the elevation of the berm embankment(s) by more than 3 feet.][ Layers of fill adjacent to and above the geotextile shall be placed as specified in 02077-3.1.]

### [3.2.2 Uncompacted Fill

The location and extent of the uncompacted fill is shown on the drawings. Uncompacted fill shall be placed in approximately horizontal layers not exceeding 3 feet in thickness. The layers shall be uniformly spread, distributed, and otherwise manipulated during placement to such an extent that individual loads of material deposited on the fill will not remain intact, and large, open voids in the fill will be eliminated. Layers shall be started full out to the slope stakes, and shall be carried in lifts approximately horizontal and parallel to the centerline with sufficient crown or slope to provide satisfactory drainage during construction. Lifts shall be placed in a manner that prevents shrinkage cracks and open voids from developing in previously

placed lifts. Where material must be placed in water, it shall be dumped therein until it reaches an elevation 1.0 foot above the water surface, or until a stable fill surface is obtained before layer construction will be required. The material deposited under water shall be placed in such a manner as to ensure that any soft material will be forced progressively outward from the section and not be trapped within the base of the embankment.]

### 3.2.3 Embankment Construction Advancement

The Contractor shall prosecute the embankment work such that no more than [5,000] linear feet of levee shall be under embankment construction at any time between the limits of the approved levee cross section that has been fertilized, seeded and mulched and the farthest extent of levee clearing ahead of the embankment work. If the Contractor elects to perform embankment work in multiple locations within the total contract length, the sum of the lengths of the multiple embankment construction locations allowed shall not exceed the above given total length of [5,000] linear feet. The limits of embankment work for each of the multiple locations as they fall within the total contract length shall be between the limits of the approved levee cross section that has been fertilized, seeded and mulched and the farthest extent of levee clearing ahead of the embankment work as pertinent to that particular location. During the hurricane season (1 June – 30 Nov), all above mentioned embankment work limits shall be reduced to [1,000] linear feet.

### 3.2.4 Compliance Surveys and Fertilizing and Seeding

Within 10 days of performing the compliance survey for any reach of completed levee section the Contractor shall commence the fertilizing and seeding operations for the completed section of levee.

## 3.3 CROSS SECTIONS AND ZONING OF MATERIALS

### 3.3.1 Embankment Sections

Unless otherwise specified, the dimensions and slopes shall conform to the applicable cross sections including the allowable tolerance, shown on the drawings.

### 3.3.2 Zoning of Materials for Levee Construction

In general, the levee section[ including berms] shall be homogeneous; however, where materials of varying permeabilities are encountered in the borrow areas, the more impervious material shall be placed toward the floodside slope, and the more pervious material toward the protected side slope.

### {{3.3.3 Berms



Berms shall be constructed at the locations and to the grade and cross section shown on the drawings.}}

### 3.4 ACCESS ROADS, RAMPS AND CROSSINGS, RUNWAYS, AND DETOURS

#### 3.4.1 Access Roads

##### 3.4.1.1 Criteria

Access roads shall be[ located as indicated on the drawings][ located and constructed as approved by the Contracting Officer]. They shall be[ designed to maintain the intended traffic and be free draining,][ shall be constructed by the placement of fill as specified in paragraph 3.2.1,][ shall be maintained in good condition throughout the contract period and restored to pre-construction conditions upon completion of the levee construction]. The pre-construction and post-construction conditions shall be verified/documentated by the use of Contractor furnished surveys and/or videos at the direction of the Contracting Officer. In addition to all Contract Clauses, the Contractor shall take note of the requirements of the Section 00700, Contract Clauses entitled *Permits and Responsibilities (FAR 52.236-7)* and *Operations And Storage Areas (FAR 52.236-10)* in the performance of the work required herein. The Contractor should also be aware that truck routes and truck speed limits are subject to change and it should check with the appropriate state and/or parish officials for the applicable regulations. The Contractor shall furnish and use equipment (i.e., front-end loaders and street sweepers) as necessary to continuously keep any public street used free and clean of mud and other debris resulting from its hauling operations. This is necessary to insure safe operation of all vehicles using public streets.[ No separate payment will be made for this work.][ Payment for this work will be made at the contract lump sum price for "Access Roads."]

##### 3.4.1.2 Temporary Roads

At locations[ shown on the drawings] where existing roads are destroyed because of the work required under this contract, the Contractor shall provide temporary roads to give access during the construction period. The temporary roads shall be constructed by placement of fill as specified in paragraph 3.2.1. The temporary roads shall be removed after permanent access has been provided.[ No separate payment will be made for this work.]

##### 3.4.1.3 Watering

The Contractor shall water down the access roads that are within the construction easement area as necessary to keep dust from being blown or drifting into the adjacent[ subdivision(s)][ areas][ highway(s)]. The Contractor shall be responsible for providing a minimum 500-gallon capacity water truck designed to apply water uniformly in controlled quantities over variable widths of surface to control dust during construction.

#### 3.4.1.4 Speed

Except in an emergency, all vehicles operating within the construction easement area shall not exceed \_\_\_\_ mph.

#### 3.4.2 Ramps and Crossings

##### 3.4.2.1 Criteria

Ramps and crossings shall be constructed at the locations shown on the drawings by placement of fill as specified in paragraph 3.2.1. Ramps shall be constructed only by adding material to the levee crown and slopes. Ramps shall have a \_\_\_\_ foot crown width, 1V -on- \_\_\_\_ H crown slope, and 1V-on- \_\_\_\_ H side slopes. Material used for ramp construction will be [ paid ] [ included ] in the contract unit of lump sum price for \_\_\_\_.

##### 3.4.2.2 Modifications

The Contracting Officer reserves the right to modify the dimensions and/or shift the locations of the ramps, to eliminate ramp construction, and/or to order the construction of additional ramps at other locations, all without change in the contract prices, subject to the provisions entitled "*VARIATIONS IN ESTIMATED QUANTITIES*" (FAR 52.211-18) of the Contract Clauses.

#### 3.4.3 Speed

Except in an emergency, all vehicles operating within the construction easement area shall not exceed 15 mph.

#### [3.4.4 Runways

##### 3.4.4.1 Criteria

Where material is hauled over an existing levee for construction, the Contractor at its expense will be permitted to construct temporary runways over the levee by the addition of material to the levee cross section. In the construction of runways, the Contractor may cut the existing levee provided the cut does not exceed a depth of \_\_\_\_\* feet below the crown, the cut is made with side slopes no steeper than 1V on 1H and no flatter than 1V on 3H, and the haul road has a minimum width of 25 feet for one-way traffic and 60 feet for two-way traffic. Cutting into the existing levee at intervals of less than 500 linear feet for the 25-foot bottom widths or less than 1,000 linear feet for the 60-foot bottom widths will not be allowed, and no more than \_\_\_\_ runways shall be open at one time. The Contractor shall stockpile, as directed by the Contracting Officer, sufficient embankment material to construct emergency closure of the cuts. As soon as any runway has served the purpose for which it was

constructed, the levee shall be restored to the prescribed grade and section, the crown resurfaced and the disturbed areas dressed, fertilized, and turfed as specified in Section 02922,["FERTILIZING AND SEEDING"]["FERTILIZING, SEEDING AND MULCHING"], all at no additional cost of the Government. Just prior to such restoration, the bottom of any cut made in the levee shall be broken to a depth of 6 inches, and the side slopes thoroughly scarified. The restoration shall be made with embankment material, placed and compacted as provided in paragraph 3.2.1. Material used in the construction of the approach ramps of the runways shall be removed and may be used for borrow, if approved by the Contracting Officer. If not used for borrow, the material shall be disposed of as specified in 02318-3.2. The areas on the levee slopes formerly covered by the ramps shall be returfed. No section of the levee shall be degraded or weakened to provide runways nor shall existing runways remain open during the non-work season without prior written approval of the Contracting Officer.

#### 3.4.4.2 Closures

Where runways have been cut through the levee, the Contracting Officer reserves the rights to order their closure at no additional cost to the Government at any time that such runways may endanger the security of the levee. In such an emergency should the Contractor, after specific notification from the Contracting Officer, fail to close the runways without delay and in the manner specified herein, the Contracting Officer shall have the right to utilize the Contractor's equipment and labor and to employ any other equipment and labor that may be needed to perform such work at no additional cost to the Government.[ Any damages or expenses occasioned by the refilling of the runways or by delays incidental thereto or by any operations necessary or incidental to the restoration of protection impaired by the Contractor, will not be a basis for a claim.]

#### 3.4.5 Detours

### {{3.5 INSPECTION DITCH[ AND CUTOFF TRENCH]

#### [3.5.1 Inspection Ditch

After inspection and approval by the Contracting Officer, the inspection ditch shall be backfilled with embankment material placed and compacted as specified in paragraph 3.2.1. Backfilling shall be completed at least 200 feet in advance of embankment construction.]

#### [3.5.2 Cutoff Trench

After inspection and approval by the Contracting Officer, the cutoff trench shall be backfilled with impervious material conforming to the following requirements:

This material shall be placed and compacted as specified in paragraph 3.2.1. Pervious material, including \_\_\_\_\_, that may have accumulated in the cutoff trench shall be removed at no additional cost to the Government before the trench is backfilled. Backfilling shall be completed at least 200 feet in advance of embankment construction.}}

### 3.6 DITCHES AND DEPRESSIONS

All sloughs, ditches, or depressions beyond the limits of the levee and/or berm foundation but within the rights-of-way shall be filled with embankment material to the natural surface of the ground or to a height sufficient to ensure drainage after shrinkage of the fill, whichever is higher. The material for the fill shall be placed as specified in paragraph 3.2.2.

### 3.7 GRADE TOLERANCES

All embankments shall be constructed to the [ gross][ design] grade and cross section shown on the drawings. [ For compacted fill, at all points, a tolerance of 3/10 of 1 foot][ For uncompacted fill, at all points, a tolerance of 5/10 of 1 foot]{{ For hydraulic fill, at all points, a tolerance of 5/10 of 1 foot}} above or below the prescribed [ gross][ design] grade and cross section shown will be permitted in the final dressing provided that the crown of the levee drains, there are no abrupt humps or depressions in surfaces or bulges in the width of the crown, and the side slopes are uniform. Any partial fill or material temporarily placed within the [gross][design] section shall not exceed the [gross][design] grade or [gross][design] slopes of the embankment by more than \_\_\_\_\_ [ foot][ feet], and shall have side slopes not steeper than \_\_\_\_\_ V on \_\_\_\_\_ H.

### 3.8 SETTLEMENT OF FOUNDATION

#### 3.8.1 Additional Fill

Should the Contractor desire payment for placing additional fill due to foundation settlement during construction, it shall furnish and install settlement gages for determination of such settlement. Prior to placing fill material, each gage shall be installed on the prepared foundation of the location shown on the applicable typical cross section at intervals not to exceed 300 feet, and shall be maintained during construction. Settlement gages at each end of the work shall be placed within 150 ft. of the upper and lower limits of the work. Each gage shall be set on a smooth level surface on undisturbed ground [ or top of the geotextile where applicable]. Leveling of gage beds shall be accomplished by removing the minimum amount of earth necessary to produce an even foundation and in such manner that the density of gage beds will remain at the same density as the undisturbed adjacent ground. Burying the settlement gage below the existing ground surface will not be permitted. Leveling of gage beds by the addition of fill will not be permitted. The type of gage used shall be as shown on the drawings. The Contractor shall determine elevations

of the gages prior to placing of fill material, and again within 72 hours after compliance cross sections have been taken over the completed embankment at the sites of the gages to determine settlement of the foundation. The 72-hour requirement is an absolute pre-condition for payment for settlement of the foundation. The initial and final elevation of the gages will be verified by the Contracting Officer's representative at the site. Measurement of additional fill material placed due to settlement of the foundation will be as stated in paragraph 1.3. Installation of and measurement on gages shall be at the option and expense of the Contractor. When the settlement gage is located by boring with rotary drill, the drill hole shall be backfilled with embankment material and tamped throughout. At the Contractor's option, the drill hole may be filled with a neat cement-grout tremied from the bottom of the drill hole to the top of the drill hole.[ If a rotary drill is used in locating the settlement gages, it shall be advanced no closer than two feet of the anticipated settlement gage elevation. The elevation of the settlement gage shall then be determined with a sounding rod.]

### 3.8.2 Failures

In clearly established cases of sudden failure of the foundation, 1) where no provision has been made for the measurement of settlement, there will be no measurement made for settlement; 2) where settlement measuring devices have been installed, but the nature of settlement is such as to destroy their utility, the settlement shall be determined from the average elevation of the nearest surviving settlement plates on each side of the failure or, if necessary, the settlement plate nearest the failure. For hydraulic fills, other methods that are mutually agreeable will be used to measure settlement.

### 3.8.3 Postpone Operations

Where settlement of the foundation develops to such an extent as to make it inadvisable, in the opinion of the Contracting Officer, to continue to add material, and advisable in its opinion, to postpone until a considerably later date all attempts to bring that portion of the embankment to full grade and cross section, the Contracting Officer shall have the right to omit further work on that portion of the embankment and to accept it as completed.

## 3.9 SLIDES

Should a slide occur in any part of the embankment during its construction, or after its completion, but prior to its acceptance, the Contractor shall, upon written order of the Contracting Officer, either cut out and remove the slide from the embankment and then rebuild that portion of the embankment, or construct a stability berm of such dimension, and placed in such manner, as the Contracting Officer shall prescribe. In case the slide is caused through fault of the Contractor, the foregoing operations shall be performed at no additional cost to the Government. In case the slide is not the fault of the Contractor, the repair shall be made by an equitable adjustment under the

Section 00700 Clause entitled, *Changes (FAR 52.243-4)*. The method of slide correction will be determined by the Contracting Officer.

{{Where setback or set forward levees are constructed of material borrowed from the existing controlling levee, it is imperative that a continuous and closed line of protection be maintained at all times. A minimum interim grade is shown on the drawings, and the work shall be so planned and executed that as material is removed from the existing levee and placed in the new levee, the minimum grade is maintained along a continuous and closed line. In the event the Contractor's method of construction requires tie-in embankments in order to maintain the minimum grade along a continuous and closed line, such tie-in embankments shall be constructed at the Contractor's expense. Embankment for tie-in levees shall be placed and compacted in accordance with paragraph 3.2.1 and shall have a cross section not less than the cross section of the existing controlling levee.}}