

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>			1. CONTRACT ID CODE N/A	PAGE OF PAGES 1   53
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2. AMENDMENT/MODIFICATION NO. 0003	3. EFFECTIVE DATE 03 MAY 7	4. REQUISITION/PURCHASE REQ. NO. N/A	5. PROJECT NO. (If applicable) SPEC. NO. 1294
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6. ISSUED BY  DEPARTMENT OF THE ARMY CORPS OF ENGINEERS SACRAMENTO 1325 J STREET SACRAMENTO, CALIFORNIA	CODE	7. ADMINISTERED BY (If other than Item 6)  SEE ITEM 7	CODE
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8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)	(√) <input checked="" type="checkbox"/>	9A. AMENDMENT OF SOLICITATION NO. DACW05-03-B-0005
	<input checked="" type="checkbox"/>	9B. DATED (SEE ITEM 11) 15 APR 2003
		10A. MODIFICATION OF CONTRACTS/ORDER NO. N/A
		10B. DATED (SEE ITEM 13) N/A
CODE	FACILITY CODE	

**11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS**

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers  is extended,  is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

**13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

(√) A.	THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
B.	THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
C.	THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
D.	OTHER (Specify type of modification and authority)

**E. IMPORTANT:** Contractor  is not,  is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)  
AMERICAN RIVER WATERSHED PROJECT(COMMON FEATURES), CALIFORNIA LEVEE STRENGTHENING, ALTERNATE METHODS CONTRACT A SACRAMENTO, CALIFORNIA

- 2 ENCLS 1) 01355, 01505, 02330, 02331, 02332, 02335, 02350 AND 02371.  
2) DRAWING SHEET G-4.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)
15B. CONTRACTOR/OFFEROR  _____ (Signature of person authorized to sign)	15C. DATE SIGNED
16B. UNITED STATES OF AMERICA  BY _____ (Signature of Contracting Officer)	16C. DATE SIGNED

The Contractor shall obliterate all signs of temporary construction facilities such as haul roads, access routes, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction as directed by the Contracting Officer. It is anticipated that excavation, filling and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon and the entire area seeded in accordance with SECTION 02371: EROSION CONTROL SEEDING. Restoration to original contours is not required; however, disturbed areas shall be graded to drain. After completion and acceptance of post-construction cleanup, the Contractor shall take photographs, and video tape, of the same area where pre-construction photographs and video tape, were taken and shall furnish copies to the Contracting Officer. No separate or direct payment will be made for post-construction cleanup or obliteration and all costs thereof shall be considered incident to and included in the applicable contract unit price items requiring such temporary facilities.

### 3.1.5 U.S. Department of Agriculture (USDA) Quarantined Considerations

The Contractor shall thoroughly clean all construction equipment at the prior job site in a manner that ensures all residual soil is removed and that egg deposits from plant pests are not present. The Contractor shall consult with the USDA Plant Protection and Quarantine (USDA - PPQ) jurisdictional office for additional cleaning requirements that may be necessary.

### 3.1.6 Disposal of Solid Wastes

Solid waste is rubbish, debris, waste materials, garbage, and other discarded solid materials (excluding clearing debris and hazardous waste as defined in following paragraphs). Solid waste shall be placed in containers and disposed on a regular schedule. All handling and disposal shall be conducted in such a way as to prevent spillage and contamination. The Contractor shall transport all solid waste off site and dispose in compliance with Federal, State, and local requirements. ~~The Florin-Perkins landfill is available for disposal of non-hazardous materials. See SECTION 01505 for details.~~

### 3.1.7 Clearing Debris

Clearing debris includes trees, tree stumps, tree trimmings, shrubs, leaves, vegetative matter, excavated natural materials (e.g., soil, sand, and rock), and demolition products (e.g., brick, concrete, glass, and metals).

- a. The Contractor shall collect trees, tree stumps, tree trimmings, shrubs, leaves, and other vegetative matter; and shall transport from the project site for proper disposal in compliance with Federal, State, and local requirements. The Contractor shall segregate the matter where appropriate for proper disposal. Untreated and unpainted scrap lumber may be disposed of with this debris where appropriate.
- b. Excavated natural materials shall be transported from the site for proper disposal in compliance with Federal, State, and local requirements.
- c. Demolition products shall be transported from the site for proper disposal in compliance with Federal, State, and local requirements.

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subsidiary obligation of the Contract. Also see Paragraph 1.21, DAMAGE TO ROADS AND BIKE TRAIL.

### 1.13.3 Levee Gates, Mile Markers and Other Signage Relocations

All levee gates, mile markers and other maintenance road and bike trail signage that require removal for construction operations shall be the responsibility of the Contractor. The removal and replacement of the gates and mile markers shall be coordinated with and to the satisfaction of the American River Flood Control District. The Contractor shall contact Paul Devereux, American River Flood Control District, at (916) 929-4006 providing a minimum of 5 days notice before any gate or mile marker removal. For measurement and payment see SECTION 02050.

### 1.13.4 Contractor Experience and Qualifications Requirements

The contractor experience and qualifications shall comply with the requirements of SECTION 02330, SLURRY CUTOFF WALL.

### 1.13.5 Disposal of Spoil Materials

Spoil generated by the construction shall become the property of the Contractor and shall be disposed of off-site in accordance with all State, Federal and local regulations and codes, such as the Clean Water Act and the National Historic Preservation Act. ***The contractor shall be responsible for finding a disposal site.*** ~~Florin-Perkins Landfill is available for disposal of non-hazardous materials. For spoil generated by construction operations, the landfill user fee shall be paid for by the State of California. A copy of the landfill Spoil Agreement is attached. The Contractor shall abide by the terms of the agreement. Significant agreement terms include, but are not necessary limited to, the following:~~

~~(1) Spoil up to 40,000 cubic yards may be spoiled.~~

~~(2) Spoil will generally consist of:~~

~~(a) Grubbing and stripping materials.~~

~~(b) Any soils that are surplus at the end of construction.~~

~~(c) Cobbles mixed with soil and/or slurry.~~

~~(d) Road aggregate base and asphaltic concrete pavement mixed with soil.~~

~~(e) Soil mixed with small amounts of bentonite and cement not to exceed a moisture content of 20 percent.~~

~~(3) The landfill will not accept the following:~~

~~(a) Whole vehicle tires, metal, ashes, appliances, paper products, hazardous waste, household waste, and creosote and pressure treated or lead base painted woods.~~

~~(4) The Contractor shall not be responsible for any grading or other handling at the landfill.~~

~~(5) Landfill operation hours are:~~

~~Monday through Friday 6:00 a.m. to 6:00 p.m.~~

~~Saturday and Sunday 7:00 a.m. to 4:00 p.m.~~

~~The location of the landfill is shown on sheet G-4. The address is 4201 Florin Perkins Road, Sacramento, CA 95826. The telephone number is (916) 383-2122.~~

#### 1.14 Borrow Area Requirements

~~The following designated borrow site available to the Contractor.~~

##### ~~(A) Borrow Area Location~~

~~The borrow area is located approximately 3 kilometers (1.9 miles) south of Reclamation District 900 South Levee and extends about 0.8 km (0.5 miles) southward, between the Sacramento River Deep Water Ship Channel and the Yolo Bypass levee. The borrow site is approximately 0.8 km (0.5 mile) long and 160 m (500 feet) wide. The area is an unmined cell (Cell #3), south of cells # 1 and #2, which are currently mined for borrow material. Access to the borrow area cell #3 is shown on Sheet G-4 (General Note 9). The use of this borrow site shall be coordinated with Mr. Thomas Scheeler of the Port of Sacramento at (916) 371-8000, Ext. 350.~~

##### ~~(B) Clearing and Grubbing~~

~~The Contractor shall clear and grub all vegetable cover, rubbish, and other objectionable materials. Vegetable cover shall be removed to a depth of 50.8 mm (2 inches).~~

##### ~~(C) Surface Layer Removal, Stockpile, and Respread~~

~~The Contractor shall remove and stockpile the upper 0.15 to 0.30 meters (6 to 12 inches) of the surface soil for respread over the borrow area after replacement of overburden material. During periods of dry weather, the stripping operation shall be coordinated with the excavation operation to minimize reduction of the existing moisture content of the undisturbed material. Stripping will not extend beyond the monthly need for earth material. No known hazardous material has been identified at the borrow site. If material suspected to be hazardous is encountered, the Contractor shall stop excavation and immediately contact the Contracting Officer.~~

##### ~~(D) Suitable Material~~

#### 1.14 **Borrow Source for Materials**

~~The suitable material is available for use as levee fill, impervious fill, earthfill, Contractor shall use a commercial borrow source for obtaining suitable soil materials to be used as levee fill material, earthfill berm, impervious blanket, and slurry backfill mix in compliance with each material specifications specification. The moisture content could vary in places with depth. The Contractor shall moisture condition/aerate the excavated material before use, if found to be too wet or too~~

~~dry to meet the required moisture content range. The Contractor shall become familiar with the borrow site and shall take the necessary number of samples for testing to evaluate the subsurface condition. Contractor shall develop an appropriate borrow excavation plan for submittal to Contracting Officer. The Contractor may need to remove up to 7 feet of overburden material before reaching the suitable materials.~~

~~(E) Borrow Site Excavation Constraints and Closure~~

~~The borrow area shall be left in a reasonably smooth and self-draining condition. Final slopes on all sides of the borrow area shall not be steeper than 5H:1V. Any excavation of borrow material shall not be closer than 60 meter (200 feet) to the mapped toe of the Yolo Bypass levee or 15 meters (50 feet) from the ship channel levee and no deeper than 3 meters (10 feet). After completion of excavation operation, the borrow area shall be uniformly covered with the overburden soil placed in lift thicknesses varying from 0.15 to 0.30 meters (6 to 12 inches) and track walked with two (2) passes of a dozer. The area shall receive erosion control seeding in accordance with SECTION 02371, EROSION CONTROL SEEDING. Upon completion of borrow operation, the Contractor shall restore the haul road to the borrow site to preconstruction condition.~~

1.15 SOIL DENSITY TEST (USING METERS CONTAINING RADIOACTIVE MATERIALS)

- (A) Nuclear methods are not acceptable for soil and soil-aggregate density tests required by this contract except as stated in DIVISION 2. Testing for official results shall be conducted as specified in DIVISION 2 of this contract. If the Contractor proposes to use meters containing radioactive materials to obtain unofficial results for his own convenience, the Contractor shall adhere to the following requirements:
- (B) In accordance with 06.E of EM 385-1-1, Safety and Health Requirements Manual, the Contractor shall obtain a service permit to use, store, operate, or handle a radiation producing machine or radioactive materials within the project area. The service permit shall be obtained from the appropriate U.S. Army Command through the Contracting Officer's Representative. The Contractor should notify the Contracting Officer during the pre-work conference if a radiation producing device will be utilized within the project area in order to determine the permit application requirements, and allow a lead time of 45 days for obtaining a permit.
- (C) The Contractor is responsible for providing a copy of any Nuclear Regulatory Commission (NRC) licenses per the Code of Federal Regulations 10 CFR "Energy" for all radioactive sources brought onto the project area by the Contractor and/or subcontractors. These licenses shall be provided to the Contracting Officer's Representative, before the radioactive sources is allowed on the DoD installation.

1.16 CONTRACTOR SAFETY PERSONNEL REQUIREMENTS

- (A) Full-time, on-site, safety coverage by contractors shall be required for the life of the contract.
- (B) The following conditions shall be met:

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ENCL 1 TO AMEND NO.0003

- (1) The Contractor shall employ, to cover all hours of work at the project site(s), at least one safety and health person to manage the Contractor's safety program; duties which are not germane to the safety program shall not be assigned to this person(s). The principal safety and health person shall report to and work directly for the Contractor's top on-site manager, corporate safety office, or other high-level official of equivalent position. The safety and health person(s) shall have the authority to take immediate steps to correct unsafe or unhealthful conditions. The employment of a safety and health person(s) shall not abrogate the safety and health responsibilities of other personnel.
- (2) Qualifications for Safety and Health Person(s).
  - (a) Safety and Health Person(s) shall have a degree in engineering or safety in at least a four year program from an accredited school and shall have been engaged in safety and occupational health for at least one (1) year of experience (no time being credited to this one (1) year unless at least fifty (50) percent of the time was devoted to safety and occupational health), and shall have at least one (1) year experience in construction, or--
  - (b) Safety and Health Person(s) shall have legal registration as a Professional Engineer or a Certified Safety Professional and shall have been engaged in safety and occupational health for at least one (1) year of experience (no time being credited to this one (1) year unless at least fifty (50) percent of the time was devoted to safety and occupational health), and shall have at least one (1) year experience in construction, or--
  - (c) Safety and Health Person(s) shall have a degree other than that specified in paragraph 1.15(B)(2), Qualifications for Safety and Health Person(s) above, and shall have been engaged in safety and occupational health for at least three (3) years of experience (no time being credited to these three (3) years unless at least fifty (50) percent of the time each year was devoted to safety and occupational health), and shall have at least two (2) years experience in construction, or--
  - (d) In lieu of a degree, Safety and Health person(s) shall have been engaged in safety and occupational health for at least five (5) years of experience (no time being credited to these five (5) years unless at least fifty (50) percent of the time each year was devoted to safety and occupational health) and shall have at least two (2) years experience in construction.
  - (e) First aid work is not a creditable experience.
- (3) The name and qualifications of the nominated safety and health person(s) shall be furnished to the Contracting Officer for acceptability and a functional description of duties shall be provided prior to the pre-work conference.

NOTE: The Contractor shall have one or more Safety and Health Persons, each of whom meets the qualifications of (B)(2) Qualifications for Safety and Health Person(s), physically present on the actual site of the work whenever work of any sort is being performed by a Contractor, subcontractor, or supplier personnel on the work site. The foregoing clause language shall not be interpreted to contravene this note.

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## SECTION 02330

## SLURRY CUTOFF WALL

## PART 1 GENERAL

## 1.1 SCOPE

The work covered by this section consists of furnishing all plant, labor, equipment, and materials and of performing all operations in connection with the construction of slurry cutoff wall, in accordance with these specifications and applicable drawings. The cutoff wall construction method specified in this specification shall be by the slurry trench method of excavation and backfill.

## 1.2 REFERENCES

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

## AMERICAN PETROLEUM INSTITUTE (API) STANDARD SPECIFICATIONS

API RP 13B-1	(1997) Recommended Practice Standard Procedure for Field Testing Water-Based Drilling Fluids
API Spec 13A	(1993) Specification for Drilling-Fluid Materials

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 143/ C143M	(1990a) Slump of Hydraulic Cement Concrete
ASTM C 150	(1994) Standard Specification for Portland Cement
ASTM D 2488	(1993) Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 4832	(1995) Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
ASTM D 5084	(1990) Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

## 1.3 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted within 21 calendar days after receiving the Notice to Proceed or as specified herein. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-01 PRECONSTRUCTION SUBMITTALS

## Slurry Cutoff Wall Construction Method and Equipment; GA.

Data on equipment to be used in all the sequences of the slurry cutoff wall construction, including excavation, backfill placement, backfill mixing and equipment to be used in the Contractor's quality control testing. If on-site testing is to be performed, include the location of the laboratory trailer/structure.

## Slurry Mixing, Storage and Delivery Methods and Equipment; GA.

Data on equipment such as mixers capable of producing a stable colloidal suspension of bentonite slurry, cement-slurry or other mix combinations; storage facilities including tanks and methods of agitation; and delivery methods and equipment.

## Equipment and Procedures to Obtain Slurry Cutoff Wall Backfill Bulk Samples; GA.

Description of equipment and procedures used to obtain bulk samples just prior to placement of backfill material in the trench shall be provided.

## Schedule and Sequence of Operations; GA.

The schedule and sequence of operations shall include but are not limited to preparation prior to trench excavation, use of excavated material, soil blending procedures, waste management, slurry preparation, slurry placement, trench bottom cleaning, backfill preparation and placement, slurry cutoff wall backfill design mix, contingency plan for controlling slurry loss, final grade closure and Quality Control testing. Number of excavation headings, proposed dates of operation, haul distances for backfill to each heading shall be submitted.

## Contractor's Experience and Other Qualification Requirements; GA.

In accordance with the requirements of paragraph 1.6 "QUALIFICATIONS", ~~the~~ **the Contractor shall submit evidence of his qualifications** ~~the Project Team's demonstrated experience in slurry wall construction, paragraph 1.6~~ as well as the qualification experience of the slurry cutoff wall specialist, ~~and the~~ qualification experience of the slurry trench excavation equipment operator, **and trench logger**. This information shall be submitted within 21 working days after the Notice to Proceed. ~~The Contractor is also directed to comply with SECTIONS 100 "Instructions, Conditions, And Notices To Bidders/Offerers And Evaluation Criteria For Award" and SECTION 800 "Special Contract Requirements."~~

**The Project Team's demonstrated experience in slurry wall construction shall also include for Projects "A" and "B" the following: a) project title and location; b) name and address of prime/general contractor; b) complete name and address of customer/project owner agency, commercial firm, or other organization or entity for whom work was performed; c) date of contract award, d) date the customer/owner agreed that the project was satisfactorily completed, e) owners technical point of contact or owner's contracting or purchasing point of contact (name, title, address, telephone number and email address if known.**

*Other information to be provided is the following: a) name and address of the proposed team member whose corporate experience is being used to meet the Projects "A" and "B" experience requirements, b) identification of the components of the actual slurry wall construction performed by the in-house workforce of the proposed project team member, or corporate predecessor thereof, who is listed in item a) in this paragraph (Check all that apply):*

- *Prepared the trial mix designs;*
- *Performed the mixing and blending operations of the bentonite slurry and backfill;*
- *Provided technical oversight and had overall responsibility for the mixing and blending operations of the bentonite slurry and backfill.*

Quality Control Testing and Equipment Procedures; FIO.

Reports of inspections or tests, including summarization of test results, analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded. Details of laboratory test procedures for performing unconfined compression and permeability tests on soil-cement-bentonite shall be provided. Details shall include: storage requirements for samples, sample preparation, application of 69 kPa (10 psi) confining pressure, time duration needed to achieve saturation using specified permeate. Samples of testing data sheets and sample data reduction to obtain strength and permeability shall be submitted.

SD-02 SHOP DRAWINGS

Slurry Trench Construction; GA

The layout of operations for the construction of the slurry trench shall include but is not limited to drawings depicting bentonite storage area, slurry preparation area, hydration pond(s) slurry storage area, backfill storage and mixing area, location and sizes of all stationary equipment, [water storage tanks], pumps, valves, lines, hoses, and materials, and waste areas.

SD-04 SAMPLES

Slurry Backfill Bulk Samples; FIO.

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work collected for Government testing or as directed by the Contracting Officer shall be submitted.

SD-06 TEST REPORTS

Chain of Custody Form for Quality Control and Quality Assurance Samples; FIO.

The Contractor shall submit a sample of the chain of custody form used to keep track of all Quality Control (QC) and Quality Assurance (QA) samples taken by the Contractor. The form shall include who formed the samples,

transfer of ownership, dates, time, batch number and location (Stationing and heading numbers) of QC/QA samples.

Results of Cutoff Wall Backfill Trial Mix Design and Testing; GA.

Prior to the start of excavation for the installation of the slurry cutoff wall, the Contractor shall submit a laboratory test report along with the Contractor's proposed initial mix design for the construction of the slurry cutoff wall backfill. The report shall summarize the test results and address the suitability of the proposed backfill mix design as it relates to the specification requirements and shall contain mix proportions and test results for all the trial batches. In addition proposed gradation ranges (bands) for the slurry backfill and soil part of the backfill mix shall be submitted for approval.

Cutoff Wall Depth, Backfill Slope, Width Measurements and Material Description; FIO.

Sounding data and an as-built profile of the trench bottom, backfill slope, width measurements, and descriptions of materials encountered in the trench shall be continuously maintained by the Contractor. These records, data, and drawings shall be made available daily and furnished no later than 24 hours after the tests, measurements, and/or observations are made.

Contractor shall submit manufacturer's information and operation manuals for all instruments for measuring the depth of the trench and also mechanical calipers required for continuous measuring the change in trench width versus depth. In addition to the number of copies to be furnished in accordance with Section 01330 SUBMITTAL PROCEDURES, one additional copy shall be submitted to the Contracting Officer for distribution to Engineering Division, Soil Design Section.

Quality Control Test Reports; FIO

The contractor shall submit test results for all bentonite, water, bentonite slurry, and backfill material quality control testing in both hardcopy and digital form. Test results shall be submitted both in summary table and laboratory data sheet format.

SD-07 CERTIFICATES

Cement Certification; FIO. Bentonite Certification; FIO.

Statements signed by an authorized official to certify on behalf of the manufacturer of the materials attesting that the products meet specified requirements. The statement must be dated after the award of the contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements which are being certified. The Contractor shall submit a statement certifying each lot of bentonite and each lot of cement.

## 1.4 GEOTECHNICAL SITE CONDITIONS

### 1.4.1 Explorations

Subsurface exploratory borings have been obtained by the Government. Logs of explorations are included in the contract drawings. Difficult drilling conditions and highly pervious zones (high potential slurry loss) are discussed in Section 02020 SUBSURFACE DATA. It is estimated that 15 to 30

percent of the excavated volume of material contains cobbles. It is possible even small boulders exist. The groundwater level indicated in the explorations was that at the time of drilling and can vary depending on time of year and river stage. Refer to SECTION 02020, SUBSURFACE DATA for more details regarding subsurface conditions.

#### 1.4.2 Contractor's Responsibility

It is the Contractor's responsibility to become acquainted and satisfied as to the distribution, character, quality, and quantity of surface and subsurface materials by inspecting the sites and by evaluating information included in these Contract Drawings or derived from the referenced exploratory work and the explorations that may have been accomplished by others. The Contractor is responsible for becoming acquainted with all the available information and site conditions and for properly estimating the difficulty and cost of successfully performing the required work. The Contractor shall perform additional subsurface explorations to obtain representative slurry wall mix material that will be used in the mix design (see paragraph 3.1.1 Trial Mixes).

#### 1.4.3 Modifications to Slurry Wall Depth

The Contracting Officer may at any time prior to or during construction require a change in the depth of the slurry wall. The objective of the slurry cutoff wall is to block potential seepage through the levee and layers of foundation sand, gravel, or cobbles. The cutoff wall may be optimized by increasing or decreasing the depth of the cutoff. The potential variation from the depth indicated in the plans is estimated to range up to plus or minus 1.5 meters (5 feet).

### 1.5 DEFINITIONS

The terms used in this section are defined as follows and as shown on the drawings:

#### 1.5.1 Slurry Cutoff Wall

The slurry cutoff wall is a minimum 0.61 meter (24-inch) wide barrier installed below the prepared working surface using the slurry trench excavation and backfill method as defined herein.

#### 1.5.2 Impervious Cap

The impervious cap is a zone of compacted impervious fill material placed slightly below or between the top of the slurry cutoff wall and the final grade of the levee to be restored prior to placement of the aggregate base course.

#### 1.5.3 Bentonite Slurry

Bentonite slurry is a colloidal mixture of bentonite (fully hydrated) and water and other suitable admixtures approved by the Contracting Officer

#### 1.5.4 Cement Slurry

Cement slurry is a colloidal mixture of Portland cement Type I or Type II (per ASTM C 150) and water and other suitable admixtures approved by the Contracting Officer.

### 1.5.5 Bentonite

Bentonite is an ultra fine natural clay whose principal constituent is sodium cation montmorillonite.

### 1.5.6 Admixture

Any additive used to modify the properties of the bentonite slurry or the backfill material as approved by the Contracting Officer.

### 1.5.7 Slurry Cutoff Wall Backfill

A homogeneous mixture of soil, bentonite, cement and water and/or other admixtures approved by the Contracting Officer that is used to construct the slurry cutoff.

### 1.5.8 Working Surface

The working surface is defined as the working surface from which the slurry cutoff wall is constructed as shown on the Drawings.

### 1.5.9 Levee Crown

The levee crown is defined as the top of levee, excluding the aggregate surfacing.

### 1.5.10 Impervious Fill Material

Impervious fill material is defined in Section 02332, LEVEE RESTORATION AND EARTHWORK. Impervious fill material referenced in this specification shall meet the requirements in Section 02332, LEVEE RESTORATION AND EARTHWORK.

### 1.5.11 Levee Preparation

Levee preparation includes all activities necessary to establish a satisfactory working surface for the construction of the slurry cutoff wall including construction layout staking. For payment purposes, the levee degradation will be compensated as described in paragraph 1.9 of this section.

### 1.5.12 Ground Water Level

There have been no piezometers or wells installed for this project. The ground water levels shown on the log of explorations are those measured at the time of the exploration. The ground water level can vary depending on river stage and season. See Section 02020 SUBSURFACE DATA.

## 1.6 QUALIFICATIONS

### 1.6.1 Contractor

~~The prime contractor or subcontractor shall have experience on at least one (1) but not more than three (3) completed soil-cement-bentonite cutoff wall construction projects that extended to at least 15 meters depth and had minimum length of 450 meters. The construction team experience for the projects shall be that of and by the prime contractor (or subcontractor) who actually performed the work. The experience shall be that the company actually worked on and was the entity that was awarded the contract with the owner (an individual's experience from former companies does not qualify).~~

~~Multiple headings in a single contract are considered as one construction project. The referenced projects should be of similar complexity to the instant of work, where the contractor has acted as a prime contractor or subcontractor. The project experience must be after 1989. The term "complexity" in the above would include subsurface conditions, quantities of backfill placed per day to maintain the construction schedule, hydraulic conductivity requirement, space restrictions which affect material conveyance and placement, and overhead restrictions.~~

~~Overhead lines at Site R4 are in the vicinity of the proposed cutoff wall and cross the staging areas. The Contractor shall take necessary measures to work safely in the close proximity to these lines during slurry wall placement (see Section 02730, UTILITIES, "LOW OVERHEAD CLEARANCE CONSTRUCTION SECTION").~~

**1.6.1 Project Team's Demonstrated Experience in Slurry Wall Construction**

**The General Contractor or the Specialty Contractor's delivery team shall submit one project which meets the criteria of "Project A" as described below and one project which meets the criteria of "Project B" as described below. The projects submitted must have had satisfactory completion since January 1, 1990.**

**Criteria:**

<i>Type of Slurry Wall:</i>	<i>"Project A": Soil-Cement-Bentonite Cutoff or Plastic-Concrete  Diaphragm Cutoff</i>	<i>"Project B" Soil-Cement-Bentonite Cutoff, Soil-Bentonite  Cutoff, or Plastic-Concrete Diaphragm Cutoff</i>
<i>Minimum Depth:</i>	<i>8 meters</i>	<i>15 meters</i>
<i>Minimum Length:</i>	<i>450 meters</i>	<i>450 meters</i>
<i>Minimum Unconfined Compressive Strength of Backfill:</i>	<i>15 psi</i>	<i>15 psi, however N/A for Soil- Bentonite Cutoff</i>
<i>Maximum Permeability of Backfill:</i>	<i>1 x 10<sup>-6</sup> cm/sec</i>	<i>1 x 10<sup>-6</sup> cm/sec</i>
<i>Method of Construction:</i>	<i>Open Trench or Panel Excavation</i>	<i>Open Trench or Panel Excavation</i>

**For the projects submitted the following components of the actual slurry wall construction must have been performed by a member of the Proposed Project Team.**

- **Prepared the trial mix designs; and either**

- *Performed the mixing and blending operations of the bentonite slurry and backfill; or*
- *Provided technical oversight and had overall responsibility for the mixing and blending operations of the bentonite slurry and backfill.*

*The proposed project team may use the demonstrated experience of the in-house workforce of one or more of the following business entities: the Contractor; a proposed subcontracting/teaming partner; a Joint Venture participant; or a corporate predecessor of any of the foregoing entities. The term "project team member" does not mean an individual team member.*

*Multiple headings on any one contract cannot be used to satisfy the requirement for two projects. "Confidential" projects cannot be used to meet the experience requirement of this project unless all of the information required is provided to the Government.*

#### ~~1.6.11.6.2~~ Slurry Cutoff Wall Specialist

The slurry cutoff wall specialist shall be experienced in providing supervision of mix design and field control composition, mixing, placing, of the bentonite slurry and backfill, and maintenance of the bentonite slurry in the trench. The slurry cutoff wall specialist shall be an individual with a minimum of five (5) years of successfully supervision experience in all aspects of slurry cutoff wall construction which includes but is not limited to: (1) controlling composition, mixing, placing, testing, cleaning, and maintaining bentonite slurry; (2) supervision of alignment, verticality and depth of slurry trenches; (3) controlling blending, mixing, and placement of backfill for soil-cement-bentonite or soil-cement-bentonite and plastic concrete diaphragm combination cutoff wall projects; and (4) a thorough knowledge of cutoff wall trench construction equipment and material testing. The slurry cutoff wall specialist shall have cutoff wall experience for at least three (3) completed cutoff wall construction projects ~~projects that extended a depth of at least 15 meters and a minimum length of 450 meters of similar complexity (as defined under paragraph 1.6.1. The cutoff wall construction projects should consist of one of the following (in no case will a soil-bentonite slurry trench project be accepted as past performance experience):~~

~~(1) Three (3) soil-cement-bentonite cutoff wall construction projects.~~

~~(2) Two (2) soil cement bentonite cutoff wall construction projects and one (1) plastic concrete diaphragm wall construction projects.~~

~~(3) One (1) soil cement bentonite cutoff wall construction projects and two (2) plastic concrete diaphragm cutoff wall construction projects.~~

~~Multiple headings in a single contract will be considered as one construction project.~~

***The submitted information to demonstrate the experience and qualifications of the slurry cutoff wall specialist shall include projects on which the slurry cutoff wall specialist performed work.***

#### ~~1.6.21.6.3~~ Slurry Trench Excavation Equipment Operator

The slurry trench excavation equipment operator shall have experience using similar slurry trench excavation equipment ~~as that proposed~~ ***similar to the***

**equipment required** for this project. The experience shall include at least three (3) completed cutoff wall projects with a minimum depth of ~~15 meters~~ **8 meters** and a minimum length of ~~450 meters~~ **8 meters** and using similar slurry trench excavation equipment. **The projects shall be submitted to the Contracting Officer for approval. The submitted cutoff wall project experience information shall include the project name, date of construction, type of cutoff wall, depth of cutoff wall, and the type of equipment used.**

#### ~~1.6.3~~1.6.4 Trench Logger

The excavated material from the slurry cutoff wall excavation is to be described and classified as indicated Part 2 of this specification section. The description and classification of the excavated material shall be performed by a geologist, geotechnical engineer, or civil engineer with a minimum of five (5) years experience using ASTM D 2488. **The experience information shall be submitted to the Contracting Officer for approval. The submitted experience shall include project name, phone number of customer and point of contact, date of construction, description of project feature in which classification of material was performed.**

### 1.7 RECORDS

Records shall be maintained by the Contractor for all test results, descriptions, measurements, and inspections performed to ascertain that the cutoff wall construction meets the specifications. All data records shall be furnished to the Contracting Officer in both hardcopy and digital form (3.5" disks) in IBM compatible form for import into Windows XP. All laboratory test data, test result summaries, any data acquisition from instruments, production information on amount of bentonite and cement used, volume of backfill placed, volume of excavation, soundings of backfill versus stationing, depth of materials and types of materials excavated versus stationing shall be digitally written for import into EXCEL, QuattroPro, or in a digital format as directed by the Contracting Officer. All digital supplied data shall be presented in a usable format and have appropriate table headings, legends, quantities, location, and any other identifying elements required for QA evaluation. All required reports, records, and documentation shall be furnished to the Contracting Officer daily. The Contractor's required records and data are outlined below.

#### 1.7.1 As-Built Profile

A daily as-built profile drawing (electronic data file, electronic CAD and a hard copy of the CAD file) showing width and depth of the trench bottom, backfill slope, and descriptions of materials encountered throughout the trench and at the trench bottom shall be continuously maintained by the Contractor. The daily profile drawing shall be in AutoCad 2002 format as well as in electronic format written for import into EXCEL, QuattroPro, or in a digital format to develop a continuous subsurface profile as directed by the Contracting Officer. Material encountered in the trench and bottom of the trench shall be described in accordance with ASTM D 2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) by the approved geologist, geotechnical engineer, or civil engineer. This profile shall indicate extent of excavation and the backfill profile at the beginning and end of each work day or shift, as determined from the soundings. The Contractor shall furnish profile drawings, individual and summary of records for all observations, measurements, and tests performed, identified with the location and time of testing. These drawings and records shall be furnished no later than 24 hours after the tests, measurements, and/or observations were made.

### 1.7.2 Construction Control Test Results

The results of all construction control testing required in these specifications, including water tests, slurry tests and backfill tests shall be furnished to the Contracting Officer. The Contractor shall furnish records of all observations, measurements, and tests performed, identified with the location and time of testing. These records shall be furnished no later than 24 hours after the tests, measurements, and/or observations were made. Test summaries comparing test results with contract requirements shall be maintained in an electronic data base and updated daily with both digital and hard copies submitted at least weekly and with progress payment requests.

### 1.7.3 Construction Log

The Contractor shall maintain a construction log of daily activities which shall include delays encountered during construction, causes of delays, locations of affected areas, and extent of delays. The log shall also record excavation problems, slurry losses and unusual conditions or problems encountered, and the dispositions made. The Contracting Officer shall be immediately notified of unusual conditions or problems and followed by a written description.

## 1.8 EQUIPMENT

### 1.8.1 General

The Contractor shall furnish all necessary plant and equipment for efficiently stripping, excavating, and/or filling to form the working surface and staging area surface; excavating the trench; mixing and placement of backfill; disposal of unsatisfactory excavated material in accordance with other provisions of this contract; and for testing of the materials used in such process. The Contractor shall obtain and maintain at the job site a supply of spare critical replacement parts or backup equipment sufficient to allow the slurry cutoff wall construction to proceed with minimum loss of time due to mechanical breakdown or equipment failure.

### 1.8.2 Equipment Weight, Speed and Width

Weight of equipment to be used on the levee crown shall be limited to a maximum gross loaded axle weight of 16,300 kg (36,000 pounds), and a maximum track vehicle contact pressure of 120 kPa (2,500 pounds per square foot). The maximum operating speed of all equipment used on the levee crown roads shall be 24 km/h (15 mph). The maximum overall width of equipment used on the levee shall be limited to 5.5 meters (18 feet). The maximum weight of the excavator shall not exceed 181,400 kilograms (400,000 lbs) without prior approval and after evaluation by the Contractor of the effect on levee stability by use of stability analyses. Hauling trucks and other construction equipment shall be limited to weight and distance along the slurry trench to insure trench stability as required by subparagraph 1.8.7, "Hauling Equipment".

### 1.8.3 Cutoff Wall Construction

Equipment for constructing the slurry cutoff wall shall be any type of earth moving machinery capable of performing the indicated work on the drawings and/or as specified herein. The equipment shall be that which reduces live-load surcharge to a level that will produce no significant contribution to the instability of the trench. The trench shall be excavated by extended-

reach backhoe. The bucket shall be designed to maintain the width of the trench and to minimize raveling of the trench sides during use. Regardless of the equipment used, the bucket shall be capable of excavating the minimum required width in a single pass. The excavator bucket teeth shall be replaceable with rock excavating teeth and capable of being fitted with a ripper tooth. The equipment shall be able to reach at least 1.5 meters (5 feet) deeper than the maximum depth shown on the drawings. Regardless of the equipment type used, it shall be capable of achieving the required depth. Equipment shall be certified by the manufacturer.

#### 1.8.4 Mixing and Delivering Bentonite and Cement Slurries

Bentonite and cement mixing and placing equipment require approval by the Contracting Officer. The slurry mixing plant shall be a colloidal batch or continuous mixing plant. It shall include the necessary equipment, including a high speed colloidal mixer capable of producing a stable, fully hydrated colloidal suspension of cement slurry, or other mix combination approved by the Contracting Officer. It shall include pumps, valves, hoses, supply lines, tools, and other equipment and materials required to adequately supply slurry to the mixing area and cutoff wall sites. The Contractor shall have sufficient ponds and pits for storage of hydrated bentonite slurry. Tanks or other storage facilities for storage of hydrated slurry shall be mechanically or hydraulically agitated. The Contractor shall submit to the Contracting Officer for approval the equipment proposed for mixing and delivering the cement and bentonite slurries.

The slurry mixing equipment shall have a controlled weighing system to assure that the dry and wet constituents of the slurry are properly proportioned. Mixing equipment shall have the capability for easy access to slurry for obtaining fresh samples of any slurry made at the batch plant.

During the mixing of any slurry used in the backfill mix, real time acquisition will be used to obtain the weight of any dry powders or liquid used to mix the slurry. Whenever the slurries are pumped, the slurry density, flow rate and total volume of slurry pumped will be obtained versus clock time and date using a data acquisition system with real time monitoring of the pumping process. The pump flow rate and density will be displayed on screen and made available for Government QA inspection so that the proportions of the various slurry mixes can be checked. Data acquisition display will be easily accessible to QA inspectors and will not interfere with Contractor's activities. At the end of each shift, the Contractor will submit a hardcopy output of all the data collected along with a digital record of the slurry mix used. Digital record shall be compatible with Windows XP for import into Microsoft EXCEL, QuattroPro or other spreadsheet approved by the Contracting Officer.

Slurry plant(s) will have mud balance, API Marsh funnel and filter press, and Fann Viscometer equipment available for manual checking of the cement and bentonite slurries.

Manual checks of all slurry shall be performed at each batch plant, once in the morning (start of shift) and once in the afternoon, or whenever the setting on the batch weighing system is changed

#### 1.8.5 Mixing, Transporting, and Placing Backfill

The equipment used for mixing and placing of the backfill material, shall be capable of mixing backfill materials into a homogeneous mixture conforming to the contract requirements and be suitable for placement of the backfill material in the trench as specified herein. Equipment used for transporting

backfill shall be suitable for containing the materials without spillage and be capable of delivering backfill quantities without delaying placement or inducing discontinuities in the wall. Blending of the soil with hydrated bentonite and cement shall be accomplished by pug mill or similar technique. Initial placement of backfill on the trench bottom shall be by a method approved by the Contracting Officer and shall prevent free fall, segregation, and entrapment of slurry and/or unblended soil within the backfill material. Starter dikes or dams placed in the trench bottom shall not be used during the initial placement of the backfill. If the Contractor elects to use tremie tubes or pumps for initial placement, these methods shall be used until the surface of the backfill rises above the surface of the slurry trench at the end of the trench. All non-complying material shall be removed and replaced at the expense of the Contractor. Excavation equipment may be needed to obtain supplemental material from borrow area.

#### 1.8.6 Retaining Berms

Suitable grading and earth-moving equipment shall be available for preparing the work area for slurry cutoff wall installation including equipment for the construction of slurry spill retainment berms or ditches.

#### 1.8.7 Hauling Equipment

Hauling equipment shall consist of pneumatic-tired vehicles with bodies suitable for the material being hauled and meeting the requirements of subparagraph 1.8.2 "Equipment Weight, Speed and Width." To insure trench stability, the Contractor shall establish and maintain a minimum set back distance from the open trench side walls to the hauling equipment path.

#### 1.8.8 Cleaning of Slurry

Slurry cleaning equipment shall include but not be limited to a vibratory shaker screen, centrifugal sand separator, and/or stilling ponds.

#### 1.8.9 Preparation of Trench Bottom

The bottom of the trench shall be prepared by using airlift pumps, vibrating shaker screens, probe pipes, and necessary pipes, hoses, and fittings for other suitable equipment.

### 1.9 MEASUREMENT AND PAYMENT

#### 1.9.1 Measurement

Measurement for the Slurry Cutoff Wall shall be based on the area in square meters measured in a vertical plane through the centerline of the slurry cutoff wall within the boundaries established by the construction working surface, the bottom of the slurry cutoff wall and vertical lines at each end of the slurry cutoff wall. Measurement shall be based on surveys and measurements taken at the site as directed and approved by the Contracting Officer. Area shall be calculated to the nearest square meter. Payment shall be made on the basis of a slurry wall constructed to the depth indicated on the drawings unless excavation to a greater or lesser depth is directed by the Contracting Officer.

#### 1.9.2 Payment

Payment for Slurry Cutoff Wall shall be made at the contract price per square meter of bid item "Slurry Cutoff Wall". Such prices shall include all

costs of slurry cutoff wall installation, stockpiling or disposing of spoiling materials generated during the slurry cutoff wall installation, obtaining backfill materials, mixing, blending, placing the slurry cutoff wall backfill and any other task incidental to the construction and completion of the slurry cutoff wall. For payment purposes, the impervious cap at location of cut and replacement of utilities and the levee degradation will be compensated for by the bid item "Levee Restoration and Earthwork". At Site L5 there will not be any payment for levee degradation work. No separate payment will be made for materials including bentonite, cement, additives, soil, equipment and mixing, handling and cleaning the slurry, diking around the open trench, and overtime during continuous operations, cleanup, assistance in the collection and maintenance of measurement and records and quality control testing; such items being included in the price of the slurry cutoff wall. Final acceptance of the slurry cutoff wall will be based on meeting all the requirements for the slurry cutoff wall dimensions, bentonite slurry mix, backfill mix, permeability and strength requirements and the approved mix design or any Contracting Officer approved modifications to the backfill mix design.

## PART 2 PRODUCTS

### 2.1 MATERIALS

The Contractor shall maintain at the job site a sufficient quantity of raw materials and other supplies such that the work can proceed uninterrupted by material shortages. The bentonite slurry, cement slurry and slurry wall backfill to be used shall be suitable for the project. The Contractor shall modify the cutoff wall backfill design mix to meet the specification requirements for strength and hydraulic conductivity (permeability) specified in paragraph, 3.4 "SLURRY CUTOFF WALL CONSTRUCTION." The Contractor shall undertake any additional tests necessary to assist in material selection, to verify compliance with the specifications, and to demonstrate the impermeability and strength of the slurry cutoff wall.

### 2.2 REQUIREMENTS FOR SLURRY CUTOFF WALL

#### 2.2.1 Cement

Cement shall be Portland Cement Type I or Type II (per ASTM C 150). A written certification specifying cement quality shall be provided by the cement supplier and the Contractor shall provide a record copy to the Contracting Officer.

#### 2.2.2 Bentonite

The bentonite shall be a sodium cation base montmorillonite powder (Premium Grade Wyoming-type bentonite) that conforms to the standards set forth in API SPEC 13A, Section 4. The Contractor shall furnish to the Contracting Officer a certificate of compliance and a copy of the test reports from the bentonite manufacturer for each lot of bentonite shipped to the site stating that the bentonite complies with all applicable standards. No bentonite from the bentonite manufacturer shall be used prior to acceptance by the Contracting Officer. All bentonite will be subject to inspection, sampling, and verification of quality by Contractor Quality Control testing and Government Quality Assurance testing. Bentonite not meeting the specifications shall be promptly removed from the site and replaced with bentonite conforming to specification requirements at the Contractor's expense. Bentonite shall be protected from moisture during transit and storage.

### 2.3 ADMIXTURES

In the event the Contractor uses any additional admixture, it shall be subject to approval of the Contracting Officer and the Contractor shall have on file a written statement from the manufacturer as to the use of any such admixture, its effect on the slurry, its long-term performance and stability, and its effect on the environment. Admixtures of the type used in the control of oil field drilling mud such as thinners, dispersants, and flocculants may be used to control standard properties of the slurry such as apparent viscosity and filtration characteristics subject to the approval of the Contracting Officer. Peptizing or bulking agents shall not be mixed with the slurry.

### 2.4 WATER

The Contractor shall supply all water required for mixing with bentonite and cement to produce slurry and slurry backfill. Prior to start of construction and once a month subsequent to the start of construction the water shall be tested. The water shall be free of turbidity, clean, fresh, and comply with the standards set below:

- a. A pH equal to 7.0 plus or minus 1.0.
- b. Total dissolved solids not greater than 500 parts per million.
- c. Oil, organics, acids, alkali, or other deleterious substances not greater than 50 parts per million each.
- d. Hardness less than or equal to 50 ppm (recommendation only).

Hydrants are not noted on the drawings. If the Contractor intends to use hydrants he shall: 1) note the locations of hydrants he intends to use, and 2) procure permits and permission from the County Water Management District (WMD) for hydrants within the County and from the City for hydrants within the city boundaries. Points of Contract are as follows: County, Tami Willis (916) 875-6899; and City, Department of Utilities, Water and Flood Control (916) 264-5371.

The Contractor shall abide by any and all regulations and other requirements governing such use. The Contractor shall include the cost of all related fees in the bid items pertinent to the work. Water shall not be taken from the river for construction activities, except when require for testing. No pumping from the river is allowed.

### 2.5 BENTONITE SLURRY

The bentonite slurry for supporting the sides of the trench shall consist of the specified bentonite in water. It is the responsibility of the Contractor that the slurry meets the necessary properties. Adjustments to the slurry mixture shall be made by the Contractor to ensure a stable excavation at all times. Slurry shall consist of a stable colloidal suspension of powdered, premium grade bentonite in water and shall be controlled in accordance with the most current API RP 13B-1 and shall conform to the following requirements:

#### 2.5.1 Initial Bentonite Slurry Mixture

At the time of introducing bentonite slurry into the trench excavation, the slurry mixture shall be a mixture of at least 5 percent bentonite by weight of water, with a minimum apparent viscosity of 40 seconds as measured by the Marsh funnel. The initial slurry density shall be a minimum of 1060 kg/m<sup>3</sup> (66 pounds per cubic foot). The water loss shall not be greater than 20 cubic centimeters (1.2 cubic inches) in 30 minutes as measured by a filter

press at 690 kPa (100 psi). Additional bentonite or admixtures may be required depending on the hardness and temperature of the water and the quality of the bentonite.

#### 2.5.2 Trench Bentonite Slurry Mixture

The minimum apparent viscosity of the bentonite slurry mixture in the trench at any time shall be 40 seconds as measured by the Marsh funnel. The density of the slurry in the trench at any depth shall be greater than 1060 kg/m<sup>3</sup> (66 pounds per cubic foot) and a maximum density to satisfy 15 percent maximum sand content. The water loss shall not be greater than 20 cubic centimeters (1.2 cubic inches) in 30 minutes as measured by the filter press at 690 kPa (100 psi). The maximum sand content of the bentonite slurry within the trench shall be 15% of the total weight. The trench bentonite slurry shall have the following properties measured at the cited frequency for each excavation heading:

Property	Test Method	Minimum Frequency	Requirement
a. Density	API RP 13B-1	2 Samples twice per shift per heading	> 1060 kg/m <sup>3</sup> (66 lbs/ft <sup>3</sup> ) and a maximum density to satisfy 15% maximum sand content
b. Viscosity	API RP 13B-1	2 Samples twice per shift per heading	> 40 sec Viscosity to satisfy 15% maximum sand content
c. Sand Content	API RP 13B-1 and by field wash sieve	2 Samples twice per shift per heading	15% maximum
d. pH		2 Samples twice per shift per heading	6.5 to 10
e. Filtrate		2 Samples twice per shift per heading	< 20 cm <sup>3</sup>

Samples of trench slurry shall be taken at the locations specified in paragraph 3.10.4., "Slurry Properties".

Sand content shall be determined by API sand tube test and also by performing a field wash sieve for separating the minus No. 200 sieve material. The Contractor shall have on-site sufficient equipment for measuring the sand content of the slurry. All moist sand extracted from the field wash sieve shall be oven dried in a microwave oven. The sand content of the trench slurry shall be calculated, as follows:

Percentage Sand = Wt. of dry sand/ (total initial weight of slurry sample)

## 2.6 SOIL

Soils obtained from the cutoff wall excavation, imported material, borrow site or combination thereof, for use in the slurry cutoff wall backfill, shall contain no material sizes larger than 76 mm (3 inches) in diameter, shall be free of roots, debris, and all other deleterious material that may adversely affect the properties of the backfill. The Contractor is responsible for changes in the gradation and chemistry of soils used in the slurry wall cutoff construction and their effect on the desired properties of the backfill. Material larger than 76 millimeters (3 inches) shall be separated from finer material with "scalping" screen at the mixing plant.

## 2.7 SLURRY BACKFILL MATERIAL

The initial design mix for the slurry cutoff wall backfill shall be developed by the Contractor and approved by the Contracting Officer based upon specification requirements and advance testing as specified herein. Modifications to the initial design mix shall be made only with the approval of the Contracting Officer. Soil used in the backfill shall meet the requirements of paragraph 2.6, "SOIL". The minimum amount of cement which shall be used in any mix design and subsequently used during production shall be equivalent to 68 kilograms (150 pounds) of cement per 0.765 cubic meters (cubic yard) of backfill material.

## 2.8 MATERIAL STORAGE FACILITIES

The Contractor shall provide all necessary materials, bins, tanks, silos, equipment and personnel to store bentonite, cement and other additives under conditions to prevent moisture or other contaminants from mixing with the materials prior to use in the slurry batch plant.

## 2.9 IMPERVIOUS CAP

Materials placed and compacted in the impervious cap shall meet the specification requirements for impervious fill material as specified in Section 02332, LEVEE RESTORATION AND EARTHWORK.

### 2.9.1 Environmental Protection

The raw materials and other supplies used in the construction of the slurry cutoff wall and any spoil disposed of at any landfill shall be non-hazardous and shall comply with SECTION 01355, ENVIRONMENTAL PROTECTION, to prevent, and provide for abatement and control of, any environmental pollution arising as a part of the work.

### 2.9.2 Disposal Site

Cutoff wall trench excavated material not suitable for backfill material shall be disposed of off-site in the disposal site indicated in the contract specifications, SECTION 01505, GENERAL REQUIREMENTS.

## PART 3 EXECUTION

### 3.1 BACKFILL MIX DESIGN TEST PROCEDURES

The Contractor shall begin the trial mix designs within 7 calendar days from the Notice to Proceed. The Contractor shall develop a laboratory testing program to demonstrate the adequacy of the proposed backfill mix design. Trial mix designs shall cover a range of percentages of bentonite, cement, and admixtures to correlate anticipated ranges of soil gradations. During

the phase of the mix design development, the minimum amount of cement which shall be used in any mix design and subsequently used during production shall be equivalent to 150 pounds of cement per total cubic yard of backfill mix. Any combination of soil, water, bentonite, cement, and additives can be used by the Contractor as long as the minimum cement criteria is adhered to. The Contractor shall fabricate a sufficient number of samples and mix designs to support the basis for the proposed mix design. The minimum number of trial mix designs shall be ten (10). The materials used to fabricate the test specimens shall be those proposed for use in construction including foundation soil, levee embankment soil, imported soil, bentonite, cement, water, admixtures, and any other materials. The performance criteria shall include hydraulic conductivity (permeability), compressive strength, and slump in accordance with the parameters and methods described herein. After trial batching, six (6) representative fabricated specimens of each trial mix shall be submitted to the Contracting Officer for Quality Assurance testing.

### 3.1.1 Trial Mixes

If levee embankment and foundation soil or imported soil is proposed for use in construction, trial mixes shall be made using soils which will represent the range of materials expected to be encountered or used along the entire extent of the project. If the Contractor elects not to use exclusively imported material for the backfill, the Contractor shall perform subsurface explorations in sufficient number to obtain soil samples representative of the material that will be encountered during the excavation for the cutoff wall trench. Soil samples obtained during design explorations stored in West Sacramento at the Corps of Engineers Bryte Yard are not available to the Contractor for development of mix design. The Contractor's test results, including moisture content, density, mix proportions, gradation, 7, 14, and 28-day permeability and 7, 14, and 28-day compressive strength shall be submitted to the Contracting Officer within 45 calendar days from the Notice to Proceed date.

### 3.2 POTHOLING (FIELD VERIFICATION)

Potholing shall occur to field locate the existing cutoff walls prior to construction of the new cutoff walls, to ensure that a proper tie-in is achieved. Potholing shall occur before the working platform excavation for the levee is made.

The Contractor shall carefully excavate to expose the top of the existing slurry wall at each location and confirm the information on the drawings. Potholing excavation shall meet all the requirements of other excavations as described in other sections and the drawings.

The Contracting Officer shall be informed a minimum of two calendar days prior to the start of potholing so the Contracting Officer may witness such work. If the potholing is not witnessed by the Contracting Officer, the Contractor shall report findings to the Contracting Officer within eight hours of discovery.

All excavations into the levee for potholing shall be backfilled with impervious fill material. Excavations affecting the existing slurry walls shall be backfilled with cement-bentonite slurry backfill material.

### 3.3 LEVEE PREPARATION

#### 3.3.1 Levee Surface

The Contractor shall prepare the degraded working surface of the levee section to a firm and essentially level condition for passage of the Contractor's machinery and equipment. A berm or other appropriate type of barrier shall be constructed within the construction easement to prevent off-site movement of waste materials, slurry spills, etc.

#### 3.3.2 Construction Staking

The Contractor shall provide, install, and maintain all temporary layout staking and necessary construction staking to locate the centerline of the wall within the allowable range of cutoff wall installation and the cutoff wall length shown on the contract drawings. The allowable range of cutoff wall installation with respect to the centerline of the levee is shown on contract drawings. Surveyor's caps, appropriately identified to include survey control number and name of the surveying company mounted on a 51 mm (2-inch) diameter, 610 mm (24-inch)-long steel pipe, driven into the ground, shall be provided at each end of the cutoff wall and at 30.5 meters (100 feet) maximum intervals between the ends. Coordinates and elevations shall have units consistent with the contract drawings. A tabulated list containing survey control numbers, grid coordinates, river station number, and elevations shall be submitted to the Contracting Officer within five (5) working days of completing each heading and a summary list at the completion of all survey controls. The beginning and ending of the cutoff wall shall be identified on this list. Survey construction control staking shall be performed by a California licensed surveyor and all survey data shall be stamped by the licensed surveyor.

##### 3.3.2.1 Initial and Final Elevation

The survey caps shall be surveyed to establish initial elevation and final elevation to an accuracy of plus or minus 0.03 meters (0.1-foot) and the construction stakes shall be maintained and protected from damage or movement throughout the work. The Contractor shall submit a report to the Contracting Officer for the cutoff installation showing any settlements that occurred and also indicating the final restored levee crown elevation in comparison to the pre-construction elevation. The cutoff wall stations shall have the as-constructed elevations of the bottom of the cutoff wall shown, and furnished as part of the submittal. A system for locating stations along the cutoff wall alignment and relating them to the plans shall be established by the Contractor and submitted to the Contracting Officer for approval. Upon completion of the cutoff wall installation, permanent metal marker stakes shall be installed to indicate the location of each end of the cutoff wall. The levee station and levee kilometer/mile shall be indicated on the permanent metal markers.

### 3.4 SLURRY CUTOFF WALL CONSTRUCTION

#### 3.4.1 General

The slurry cutoff wall as placed shall be homogeneous and shall be constructed to the elevations, lines, grades, and cross section shown on the drawings and in accordance with these specifications, unless otherwise directed by the Contracting Officer. The slurry cutoff wall shall be constructed to the following dimensions, hydraulic conductivity (permeability), and strength:

Width: 0.61 meters (24-inch) (minimum)  
 Depth: for Site R1A 18.3 m (60.0 ft), for site L5 23.0 m (75.5 ft), for Site R3 21.3 m (69.9 ft), for Site R4 23.0 m (75.0 ft) from the top of the levee, see drawings  
 Permeability (28-day):  $5 \times 10^{-7}$  centimeter/second (maximum)  
 Strength (28-day): 345 kPa (50 psi) (minimum)  
 2069 kPa (300 psi) (maximum)

Final acceptance of the slurry cutoff wall will be based on maintaining the approved mix proportions and on meeting the results of the laboratory tests of bulk samples and cutoff wall measurements as described in subparagraphs, 3.10.5, "Cutoff Wall Measurement", 3.10.6 "Backfill Sampling Procedure", and 3.10.7, "Backfill Testing". It is the intent of this specification to produce a cutoff wall, which meets the permeability and strength requirements 28 days after backfill placement. Results from strength and permeability tests performed more than 28 days after the placement of appropriate backfill batch shall not be accepted. All non-complying material shall be removed and replaced by the Contractor at no additional cost to the Government. The Government may modify the dimensions and quantities of the work as determined necessary. The Contractor shall submit a general work sequence schedule and layout plan of operations to the Contracting Officer for approval a minimum of 2 weeks prior to the start of construction.

***Overhead lines at Site R4 are in the vicinity of the proposed cutoff wall and cross the staging areas. The Contractor shall take necessary measures to work safely in the close proximity to these lines during slurry wall placement (see Section 02730, UTILITIES, "LOW OVERHEAD CLEARANCE CONSTRUCTION SECTION").***

#### 3.4.2 Working Surface

The working surface from which the slurry cutoff wall is to be constructed is defined in paragraph 1.5, "DEFINITIONS". For this project, the Contractor, at no additional expense to the Government, may select and construct a working surface to a level a maximum of 0.6 meters (2 feet) below the working surfaces indicated on the drawings.

Lowering of the levee crown more than indicated above will require the approval of the Contracting Officer. Upon completion of the slurry cutoff wall installation, the levee shall be restored to final alignment and grade in accordance with SECTION 02332 LEVEE RESTORATION AND EARTHWORK. Material requirements, placement and compaction shall be in accordance with SECTION 02332 LEVEE RESTORATION AND EARTHWORK.

#### 3.4.3 Blasting

Explosives shall not be used in connection with this contract.

#### 3.4.4 Excavation

The excavation shall be by the slurry trench method. Excavation shall be conducted in a manner that provides for a continuous 0.61 meters (2 feet) minimum width trench to the required depth at all points along the centerline of the excavation. The excavation shall be carried immediately to the depth shown at the point where excavation is started. The Contracting Officer may direct the Contractor to deepen the trench a maximum of 1.5 meters (5 feet) based on examination of bucket cuttings. The toe of

the front slope of the trench excavation shall not precede the toe of the backfill slope by less than 9 meters (30 feet) or more than 30 meters (100 feet).

The minimum thickness of backfill material placed perpendicular to the slope of the backfill for the full depth of the slurry trench for each shift at each heading shall be at least 1.5 meters (5 feet). If less than 1.5 meters (5 feet) has been placed as stated above, the material shall be re-excavated as described below.

The slurry trench shall be constructed without undue interruption until complete. Interruptions for any reason, include extended delays resulting in more than 48 hours in no backfill placement operation, will require re-excavation of the placed backfill. The re-excavation shall consist of the removal of a minimum of 1.5 meters (5 feet) perpendicular to the slope of the backfill for the full depth of the slurry trench. That section of the slurry trench backfill material that is removed and rebackfilled shall be considered incidental to the slurry trench cutoff wall pay item.

#### 3.4.5 Excavated Material

Material excavated from the trench meeting the requirements of paragraph 2.6, "SOIL", may be used in the backfill. Any material containing cobbles shall be processed to remove the plus 76 millimeter (3-inch) material before mixing the backfill. Material not used in the backfill shall become the property of the Contractor and shall be disposed of off-site, in accordance with all State, Federal, and local regulations and codes, such as the Clean Water Act and the National Historic Preservation Act.

#### 3.4.6 Placement of Bentonite Slurry

The bentonite slurry shall be introduced into the trench at the time excavation begins. The level of the slurry in open trenches shall be at all times maintained a minimum of 0.6 meters (2 feet) above the groundwater level and between 152 and 457 mm (6 and 18 inches) below the working surface until the placement of backfill material is complete. The Contractor shall have sufficient personnel, equipment, slurry storage areas, and stored slurry materials ready to raise the slurry level at all times in the excavated trench during construction within the limitations specified in paragraph 3.4 "SLURRY CUTOFF WALL CONSTRUCTION" and subparagraphs thereof. To this end, the Contractor shall have personnel on call to raise the slurry level at any time this occurs, weekends and /or holidays included. Dilution of the slurry by surface or ground waters shall be prevented. Gravel and cobble deposits particularly at the lower trench elevations may be relatively open to slurry loss and exhibit high permeabilities. It is anticipated that slurry losses will occur. The quality of the slurry shall be maintained at all times, including periods of work stoppage, in a condition which meets the requirements set forth in paragraph 2.5 "BENTONITE SLURRY". Conditioning and desanding of the slurry will require recirculation of the trench slurry through shaker screens or the addition of approved additives.

#### 3.4.7 Trench Cleaning

The trench bottom at each heading shall be cleaned by an air lift pump or other suitable equipment, as referenced in subparagraph 1.8.9 "Preparation of Trench Bottom", to insure removal of sand, gravel, sediment, and other material left in the trench during excavation and/or which has settled out of the slurry.

Cleaning equipment shall be operated in a manner which prevents removal of material from the walls of the trench. Trench bottom cleaning will be acceptable when the criteria set forth in subparagraph 3.4.8, "Soundings of Excavation Prior to Backfill Placement" has been satisfied, and the sand content of the trench slurry is below 15 percent.

Unless otherwise approved, the trench bottom at each heading shall be cleaned, as a minimum, at the start of each shift. If placement operations have ceased for longer than eight (8) hours, the lower one-third of the face of the backfill slope shall be cleaned prior to the placement of additional backfill material.

Extended delays resulting in more than forty-eight (48) hours between backfill placement, for any reason, will require re-excavation of 1.5 meter (5 feet) of the backfill slope, measured perpendicular to the backfill slope, prior to the placement of new backfill material. The Contracting Officer may require more frequent cleaning.

#### 3.4.8 Sounding of Excavation Prior to Backfill Placement

Immediately prior to placement of backfill into the trench, the open trench along the backfill slope and between the toe of the backfill to the toe of the excavation will be sounded every 6 meters (20 feet), or a minimum of at least three (3) locations, whichever is greater, unless otherwise specified, along the trench centerline using a dual set of weights. One weight will consist of a tape with a 4 kg (9 lbm.) weighted steel end which is 25 mm (1 inch) in diameter. The second tape will have a 127 mm (5 inch) diameter steel plate attached to the other end, with the plate weighing from 4 to 5 kg (9 to 12 lbm.). Soundings shall be measured to the nearest 30 mm (0.1 feet). When soundings from each device at the exact same location agree within 150 mm (6 inches), then the backfill can be placed over the bottom of the wall for that particular station. If the difference in the soundings is greater than 150 mm (6 inches), then the Contractor shall perform additional cleaning of the trench bottom that produces readings within 150 mm (6 inches) for each device used.

#### 3.4.9 Stability

The Contractor shall be responsible for ensuring and maintaining the stability of the excavated trench at all times for its full length and depth and shall be responsible for maintaining slurry properties and levels within specified limits. The Contractor shall control surcharges from all excavation and backfilling equipment, waste, berm construction, backfill stockpiles, and any other loading situations that may affect trench stability. It is the Contractor's sole responsibility to ensure that the mixing of backfill and any stockpiles do not affect the open trench stability. In the event of failure of the trench walls prior to completion of backfilling, the Contractor shall at his expense re-excavate the trench and remove all material displaced into the trench and take corrective action to prevent further deterioration at no additional cost to the Government.

### 3.5 BACKFILLING

#### 3.5.1 Mixing and Batch Plant Areas

Areas for mixing of backfill, batch plants and other operations shall be located within designated staging areas shown on the contract drawings, construction right-of-way or within areas approved by the Contracting Officer. All areas shall be cleaned up and restored upon completion of the work in accordance with paragraph 3.7 "CLEANUP".

### 3.5.2 Mixing

Stockpiled material generated from slurry cutoff wall installation and/or material from borrow or commercial sources shall be mixed and blended by approved methods.

For bulk mixing of the backfill using earth moving equipment, the Contractor shall construct a controlled volume mixing area. This area shall consist of an enclosed volume, bounded on the floor and walls by structural material such as, concrete or steel. Contractor shall proportion the backfill mixing area to be consistent with the production requirements and mixing area location. Earthen berms or pits dug in the earth will not be allowed for batch proportioning of the soil-bentonite-cement mix. The backfill material shall be thoroughly mixed into a homogeneous mass, free from large lumps or clods and pockets or layers of fines, sand, gravel, or materials of different gradation. Occasional, less than 1% by volume, clods or lumps of up to 76 mm (3 inches) in their largest dimension will be permitted if randomly distributed in the backfill.

The backfill material, just prior to placement in the trench, shall have a consistency to provide a slump of from 102 to 178 mm (4 to 7 inches) per ASTM C 143. Any damage to the slurry cutoff wall as a result of operating equipment near the wall or for other reasons shall be repaired or restored by the Contractor at no additional cost to the Government.

### 3.5.3 Placement

The backfill material shall be pumped, tremied or placed in the excavated trench in such a manner that no pockets of slurry are trapped in the completed slurry trench. The Contractor shall backfill continuously from the beginning of the trench in the direction of the excavation to the end of the trench. Placing operations shall proceed in such a fashion that the top of the backfill below the surface of the slurry shall follow a reasonably smooth grade and shall not have hollow or abrupt changes in grade which may trap pockets of slurry during subsequent backfilling. To this end, the face of the backfill below the surface of the slurry may require rodding, and the Contractor shall have such equipment available at the job site. Free dropping of backfill material through the slurry will not be permitted. Initial backfill shall be placed by lowering it to the bottom of the trench by methods approved by the Contracting Officer until the surface of the backfill rises above the surface of the slurry trench at the end of the trench. Backfill shall then be placed in such a manner that the backfill enters the trench by sliding down the forward face of the previously placed backfill. To accomplish this, the Contractor shall backfill from the initial backfill toward the opposite end of the trench. Backfilling operations shall proceed in such a manner that the slope of the initial backfill will be maintained. The minimum amount of backfill material to be placed per shift is 1.5 meters (5 feet) thickness, measured perpendicular to the slope of the backfill for the full depth of the slurry trench at each heading being excavated.

### 3.5.4 Mixing and Placing During Cold Weather

No mixing or placing of the backfill shall be performed when the air temperature is below 0 degrees C (32 degrees F). Frozen material shall not be placed in the slurry trench.

### 3.5.5 Backfilling in Case of High Water

In the event that the water surface elevation in the American River is forecasted by the State-Federal Flood Forecast Center to increase significantly for any reason, the Contracting Officer reserves the right to require the Contractor to begin continuous operations to complete all partially completed section(s) of slurry cutoff wall including levee restoration. Continuous operations shall consist of expeditiously performing the required operations twenty-four hours per day until the operations are completed. Additionally, during such flood conditions the Contracting Officer reserves the right to require the Contractor to remove all equipment from the levee crown upon completion of the required backfilling. Compensation including time extension for actions taken for backfilling due to high water shall be through a contract modification based on work directed by the Contracting Officer. The work shall only be initiated upon receiving written notification from the Contracting Officer.

### 3.5.6 Slurry Wall Protection

The Contractor shall take all necessary actions to protect the cutoff wall from disturbance. No construction activity on top of the wall will be permitted until the initial set has occurred. A temporary non-compacted soil cover shall be placed within two (2) days after backfill placement is completed over each 30 meter (100 feet) reach. No activity on top of the wall will be permitted for a minimum period of two days and until the wall has reached a minimum unconfined compressive strength of 103 kPa (15 psi). Heavy construction equipment and machinery shall only be driven over the cutoff wall at approved equipment crossing points which bridge and transmit no loads to the cutoff wall.

### 3.6 IMPERVIOUS CAP

The impervious cap shall be impervious fill material placed to the lines and grades shown on the drawings. After removing the soil cover on top of the slurry cutoff wall, the cutoff wall shall be capped with impervious fill material in accordance with the details shown on the drawings. The construction of the impervious cap shall be performed in such a manner that minimizes the exposure and drying of the cutoff wall. The maximum length of exposed cutoff wall shall be 30 meters (100 feet) or a length approved by the Contracting Officer. Any settlement of compacted impervious fill over the cutoff wall shall be backfilled with compacted impervious fill. Subgrade preparation, placement and compaction shall be in accordance with SECTION 02332 LEVEE RESTORATION AND EARTHWORK. After the impervious cap has been properly placed and compacted at the top of the slurry cutoff wall, the levee crown shall be restored to a wearing surface as shown on the contract drawings.

### 3.7 CLEANUP

The Contractor shall continually clean up slurry wastes, debris and leftover materials resulting from the cutoff wall construction process. After completion of the work, the site shall be cleared of all debris which may have accumulated in the execution of the work. The Contractor shall be responsible for disposal of waste materials off-site in accordance with all Federal, State, and local regulations and codes, such as the Clean Water Act and the National Historic Preservation Act.

### 3.8 DISPOSAL OF WASTE MATERIALS

Excavation spoil, slurry, unused backfill and spoil generated by the cutoff wall construction shall become the property of the Contractor and shall be disposed of off-site, in accordance with all State, Federal and local regulations and codes, such as the Clean Water Act and the National Historic Preservation Act. During final disposal of the slurry, the material shall be flocculated to separate the bentonite from the water. The flocculated bentonite material shall be placed in the designated disposal areas and the water shall be disposed of in an approved manner. Cutoff wall trench material not suitable for backfill shall be disposed of off-site. The Contractor may, at his option, use the designated disposal site to dispose of the cutoff wall trench material that is not suitable for backfill.

### 3.9 QUALITY ASSURANCE

The Contractor shall collect, prepare, and submit samples to the Government. The Government may collect and perform quality assurance testing on the bentonite slurry, cement slurry and slurry wall backfill materials. The number of samples provided to the Government and method of preparation shall be as specified in subparagraph 3.10.4, "Slurry Properties" and in subparagraph 3.10.6.1, "Protocol for Custody of Samples". The samples shall be labeled by station and depth, and dated. The Government testing will in no way relieve the Contractor of the responsibility of performing tests necessary to meet the construction requirements. All routine testing procedures being conducted by the Contractor shall be available for inspection by the Contracting Officer at any time.

### 3.10 QUALITY CONTROL

The Contractor shall be responsible for project quality control. Observations, measurements, and tests described in these specifications shall be performed for quality control. All quality control records, test results and summaries, routine testing procedures, observations, and measurements shall be available for inspection by the Contracting Officer's Representative at any time. Final acceptance of the slurry wall is based on the results of field measurements and bulk samples collected and tested as described in subparagraph 3.10.5 "Cutoff Wall Measurements", subparagraph 3.10.6, "Backfill Sampling Procedure" and subparagraph 3.10.7, "Backfill Testing". The laboratory shall be an independent commercial laboratory and shall comply with requirements of Section 01451 "CONTRACTOR QUALITY CONTROL".

#### 3.10.1 Bentonite

Each truckload of bentonite delivered to the site shall be sampled in accordance with Section 4 of API Spec 13A. The samples shall be tested in accordance with the procedures of Section 4 of API Spec 13A.

#### 3.10.2 Water

Water for construction shall be the responsibility of the Contractor. Prior to the start of construction, the source of water to be mixed with the bentonite shall be tested for pH, hardness, oil, and organics, etc. Subsequent to the start of construction, testing shall be conducted once a month. Tests shall conform to the requirements of API RP 13B-1 and these specifications. Test results shall conform to the requirements listed in paragraph 2.4 "WATER".

### 3.10.3 Wash Water

Any wash water pumped from the slurry plant to the cutoff wall shall be monitored. The wash water shall be properly disposed of. The wash water shall not be allowed to dilute the cutoff wall backfill nor shall it be allowed to spill off the levee crown onto the levee slopes.

### 3.10.4 Slurry Properties

All tests specified in this paragraph shall be conducted in accordance with API RP 13B-1. The initial bentonite slurry shall be tested prior to placing the slurry in the trench a minimum of 2 times each 8 or 10 hour shift per heading. The following tests shall be performed: viscosity, filtration, pH level, sand content and density. At the time of placing backfill into the slurry-filled trench, the bentonite slurry within the trench shall be tested for viscosity, filtration, and density. The bentonite slurry in the trench shall be sampled a minimum of 2 times each shift, near the beginning and near the end of each shift, one (1) each at a depth within 1.5 meters (5 feet) below the slurry surface, within 1.5 meters (5 feet) above the bottom of the trench and at mid-depth of the trench, all within 1.5 meters (5 feet) of the advancing toe of the backfill. The slurry tests and specification range shall be as specified in subparagraph 2.5.2 "Trench Bentonite Slurry Mixture". The sampling devices used to collect samples will be subject to approval of the Contracting Officer. The Contractor shall be required to obtain additional samples for the Contracting Officer at any time or location requested. Personnel shall be provided by the Contractor for conducting the tests and they must have a working knowledge of test procedures for drilling fluids in accordance with applicable API standard procedures. Equipment for bentonite slurry testing shall be furnished and maintained by the Contractor.

### 3.10.5 Cutoff Wall Measurements

#### 3.10.5.1 Cutoff Wall Trench Measurements

After soundings have been taken and demonstrate compliance stated in subparagraph 3.4.8 "Sounding of Excavation Prior to Backfill Placement", and prior to backfill operations, cutoff trench depth measurements shall be taken for every 3.1 m (10 feet) along the cutoff wall centerline. Cutoff trench width measurements shall be taken as follows:

- 1.5 m (5 feet) vertical increments for the entire trench depth using a mechanical or sonic (e.g. Koden) set of calipers, as approved by the Contracting Officer.
- 15 meters (50 feet) horizontally along the wall length just prior to backfilling.

The Contractor shall develop a profile for the entire depth of trench excavation using devices approved by the Contracting Officer to ensure the minimum depth and width of wall is placed during the backfilling operation.

#### 3.10.5.2 Backfill Slope Measurements

The backfill slope shall be sounded at the beginning and end of each shift per heading and at additional times upon request of the Contracting Officer. The soundings of the backfill slope shall be taken at horizontal intervals of 3 meters (10 feet) and extend a minimum of 12 meters (40 feet) beyond the toe of the backfill slope along the trench bottom.

### 3.10.5.3 Measurement Records

An as-built profile shall be continuously maintained of the trench bottom and backfill slopes in digital format and also hardcopy output. This profile shall indicate extent of excavation and the backfill profile at beginning and end of each workday.

### 3.10.6 Backfill Sampling Procedure

Two (2) bulk samples of the slurry cutoff wall shall each be taken randomly from different batches (morning, afternoon, evening, etc.) for at least once for every 8 or 10 hour shift of work per heading. The bulk samples shall be taken at the trench location just prior to placement and used for permeability and strength testing. Plastic molds used to cast the samples shall be 76.5 mm-diameter by 153 mm-long (3 inch by 6 inch) cylindrical test specimens. From each bulk sample, the Contractor shall cast six (6) test specimens for Quality Control purposes and six (6) test specimens for the Government. Gravel or/and any other particle sizes greater than 1/6 (one-sixth) of the inside diameter of the mold and any clumps not passing a 6 mm (1/4-inch) screen shall be manually removed and discarded. The wet samples shall be poured into the molds and rodded or vibrated to remove trapped air pockets and then sealed. The specimens shall be stored in a constant temperature, damp environment until tested or until otherwise directed by the Contracting Officer.

For each shift per heading in which backfill is placed, three (3) of the test specimens shall be tested for hydraulic conductivity (permeability) and three (3) shall be tested for unconfined compressive strength from a bulk sample representing a single batch. The remaining six (6) specimens from the same bulk sample shall be retained and properly stored for possible testing by the Government. Six (6) specimens from the other bulk sample shall be retained by the Contractor, for possible future testing. The other six (6) specimens shall be retained and properly stored for possible testing by the Government. The Contractor shall store Government specimens until they are transported to the Government Quality Assurance laboratory. In the event that the Contractor forms additional specimens to the minimum specified number, the Contractor shall fabricate a duplicate set of specimens for the Government and store the specimens as previously specified.

#### 3.10.6.1 Protocol for Custody of Samples

The Contractor shall develop an approved chain of custody protocol for exchanging samples among the various parties used by the Contractor for the Quality Control program. At a minimum, the sample identification, location, heading, depth, backfill ID number, date, and person taking custody of the sample shall be entered into the chain of custody sampling form. Wherever the samples are exchanged between responsible parties, the transfer shall be noted by each party accepting and transferring the samples. The type of test, date and result of measurement shall be entered on the form once samples are used for laboratory testing. All samples stored for archive purposes shall be duly noted as to the location of the archive. The chain of custody form shall be available for inspection by the contracting officer at any time. Copies of the chain of custody form shall be given to the contracting officer on a weekly basis.

#### 3.10.7 Backfill Testing

Backfill bulk samples for testing shall be screened before being molded, so as to remove potential undesirable large size particles not meeting the gradation requirements.

#### 3.10.7.1 Compressive Strength Testing

Three (3) sample test specimens from the randomly chosen bulk sample per shift per heading, one after curing for seven (7) days, one after curing for fourteen (14) days, and one after curing for twenty-eight (28) days shall be subjected to an unconfined compressive testing in accordance with ASTM D 4832. Additional testing may be required, as directed by the Contracting Officer. The need for such additional testing will be determined based, at least in part, on the results of the bulk sample testing. It is the intent of these tests to relate unconfined compression strength to permeability, therefore tests shall be performed on specimens from the same bulk sample.

#### 3.10.7.2 Permeability Testing

Three (3) sample test specimens from the randomly chosen bulk sample per shift per heading, one after curing for seven (7) days, one after curing for fourteen (14) days, and one after curing for twenty-eight (28) days shall be subjected to permeability testing in a triaxial type permeability cell. Additional testing may be required, as directed by the Contracting Officer. The need for such additional testing will be determined based, at least in part, on the results of the bulk sample testing. The permeability test parameters are as follows:

- Average Effective Confining Stress: 69 kPa (10 psi)
- Hydraulic Gradient: 4.6 meters (15 feet) divided by the average cutoff wall thickness in meters.
- Permeate: American River water adjacent to the construction site
- Backpressure: Sufficient to ensure a Skempton's pore pressure "B" parameter greater than or equal to 0.95.

The permeability tests will be performed in accordance with ASTM D 5084 and shall be continued until inflow-outflow measurements or flow rates demonstrate that steady state seepage conditions are evident. The independent Quality Control testing laboratory selected by the Contractor shall submit a detailed testing program followed with information relating to equipment used for testing.

#### 3.10.7.3 Water Content, pH, and Density Tests

For backfill bulk sample taken, the Contractor shall perform water content, pH, and density tests in the field within one (1) hour of sampling. Minimum cement content shall consist of that used for the selected and approved mix design. This test is performed to aid in the evaluation of backfill material homogeneity.

#### 3.10.7.4 Slurry Cutoff Wall Cap

Testing, frequency and type of tests shall be in accordance with Section 02332 LEVEE RESTORATION AND EARTHWORK

-- END OF SECTION --

### 1.5.3 Soil Classification

Materials shall be classified in accordance with ASTM D 2487. Preparation and testing for classification purposes shall be by the wet method. Gradation tests shall be performed in accordance with ASTM C 117 and ASTM C 136. Atterberg limit tests shall be performed in accordance with ASTM D 4318.

### 1.5.4 Moisture Content

Moisture content is the ratio of the weight of water to the weight of solid matter in the soil expressed as a percentage and determined by ASTM D 2216.

### 1.5.5 Unstable Material

Unstable material is that material that cannot be properly compacted or will not support construction equipment or fill material, due to excess moisture. Potentially unstable materials are fine grained soils with in-place moisture contents near or above the plastic limit as determined by ASTM D 4318, Method A, or 3 or more percent greater than the optimum moisture content as determined by ASTM D 698.

## 1.6 DISPOSAL OF UNSATISFACTORY MATERIALS

Unsatisfactory material generated during the course of work is the responsibility of the contractor, and all unsatisfactory material shall be disposed of off site. Disposal shall be in accordance with all local, State and Federal laws. Unsatisfactory materials ~~which are free of petroleum products, chemical contamination, or trash can be disposed of at the disposal site indicated in this specification SECTION 01505.~~

## 1.7 MEASUREMENT AND PAYMENT

Payment for the subgrade preparation, impervious blanket and cover soil placement and geomembrane seal shall be made at the contract price per square meter under bid item "Impervious Blanket". ***This bid item also will include the cost of hazardous materials testing.*** Payment for clearing, grubbing and stripping associated with this work shall be included in the contract price for the bid item "Clearing, Grubbing and Stripping".

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Impervious Blanket Material

Impervious blanket material shall consist of satisfactory material that contains not less than 40 percent by weight of material passing the No. 200 mesh sieve and not more than 20 percent by weight retained on the No. 4 mesh sieve. Maximum particle size for impervious blanket material is 25 millimeters (1 inch). Impervious blanket material shall have a plasticity index of not less than 10 and not more than 30, and a liquid limit greater than 20 and lower than 45. Additionally, plot on the plasticity chart should be above the A-line, defined as  $PI=0.73(LL-20)$ .

#### 2.1.2 Fill (for Impervious Blanket Covering) Material

Fill material, used to cover the impervious blanket, shall consist of satisfactory material.

### 2.1.3 Geomembrane

Geomembrane shall consist of smooth high density polyethylene (HDPE) material with a nominal thickness of 40 mil, as specified by ASTM D 5199 and physical properties conforming to the National Sanitation Foundation Standard No. 54, "Flexible Membrane Liners". Roll width and length shall be selected to minimize field seaming.

The geomembrane sheets shall be resistant to fungal or bacterial attack and they shall have a uniform surface with no visible defects, cuts, abrasions, holes, blisters, contaminants and other imperfections. The edge shall be straight and free of nicks and cuts.

### 2.2 SOURCE FOR IMPERVIOUS BLANKET

~~Impervious~~**The Contractor shall obtain impervious** blanket material ~~may be obtained from the designated borrow area (see Section 1505 GENERAL REQUIREMENTS for borrow area location). Material obtained from the borrow area will require selective removal, processing and stockpiling. At the Contractor's option a commercial source may be used. If a commercial site is used, the~~**from a commercial source. The** Contractor shall perform the following **geotechnical** tests: gradation, liquid and plastic limits, moisture-density relationship, and permeability test at the density that corresponds to 95% of ASTM 698 and at the specified moisture content (see paragraph 3.6 for test details). The number of tests shall include a minimum of four series of tests at random locations from the material source. **In addition, the Contractor shall be responsible to conduct hazardous materials testing as specified in SECTION 02335.** The Contractor shall submit results of these tests showing that materials from the selected borrow source site meets the specification requirements for impervious blanket material. The test report shall be submitted not later than 25 days after the notice to proceed.

## PART 3 EXECUTION

### 3.1 EQUIPMENT

#### 3.1.1 General

The Contractor shall furnish all necessary plant and equipment used in the performance of work. Such plant and equipment shall be subject to approval before work is started and shall be maintained in a safe and satisfactory working conditions at all times. Equipment safety requirements can be found in EM 385-1-1. The equipment shall have adequate capability for hauling, spreading, and compacting the impervious blanket material.

#### 3.1.2 Spreading Equipment

Spreading equipment shall consist of motorized graders or other approved equipment that have adequate capability for meeting specified thickness control and grade control.

#### 3.1.3 Compaction Equipment

Compaction equipment shall consist of tamping rollers that are pulled or self-propelled, hand powered tampers, and/or walk-behind compactors. Self-propelled compaction equipment shall not be operated at speeds greater than 5.6 kph (3.5 mph). Compaction equipment shall be selected based on material characteristics and space restrictions.

## 1.6 DISPOSAL OF UNSATISFACTORY MATERIALS

Unsatisfactory material generated during the course of work is the responsibility of the contractor, and all unsatisfactory material shall be disposed of off site. Disposal shall be in accordance with all Local, State and Federal laws.

## 1.7 PRE-CONSTRUCTION AND POST-CONSTRUCTION SURVEYS

Prior to any construction called for in these specifications, the Contractor shall survey the levee as necessary to serve as a basis for restoring the levee to its original grade, width, and alignment. When levee restoration is complete but prior to road surface placement, the Contractor shall again survey the levee to verify restoration of the levee to its original grade, width and alignment. The surveys shall consist of cross sections taken in sufficient numbers with increments being no greater than 30 meters (100 feet). The surveyed cross sections shall include the entire levee embankment and be extended a minimum of 3 meters (10 feet) from the waterside and landside levee toes.

## 1.8 MEASUREMENT AND PAYMENT

Payment for the levee fill work and impervious cap work, shown on the drawings, shall be made at the contract price per cubic meters under bid item "Levee Restoration and Earthwork", which shall also include work associated with levee degradation as shown on the drawings. **The cost for the hazardous materials testing will also be included.**

Payment for the temporary fill earthwork at Site R4 shown on drawings shall be made at the contract price per cubic meters under bid item "Temporary Fill". Any geomembrane required, as shown on the drawings, and for dewatering of any accumulated water behind the temporary fill shall be included in the contract price under "Temporary Fill". Wearing surface work shall be compensated under specification Section 02722 AGGREGATE BASE COURSE. Bike trail work at Sites R1A and R4 shall be compensated under bid items "Aggregate Base Course", "Bituminous Course" and "Crushed Stone Paving".

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Levee Fill and Temporary Fill Material

Imported levee and temporary fill shall consist of satisfactory material that contains not less than 15 percent by weight of material passing the No. 200 mesh sieve, and shall have a plasticity index of not less than 7, a liquid limit not greater than 45 and a maximum particle size of 76 millimeters (3 inches). If the contractor elects to separately stockpile satisfactory excavated project levee embankment material, this material shall be considered as suitable fill material provided that it is free of levee crown wearing surface material, organics and other deleterious material. Locations for stockpiling material shall be submitted for approval to the Contracting Officer prior to excavation. Materials excavated from the levee and borrow areas can be expected to undergo a decrease in volume (shrinkage) upon compaction. This condition is normal and shrinkage values ranging from 10% to 20% are not unusual. Any change in volume due to shrinkage, no matter how much, shall not constitute a basis for a claim.

### 2.1.2 Impervious Fill Material

Impervious fill material used for impervious cap shall consist of satisfactory material that contains not less than 30 percent by weight of material passing the No. 200 mesh sieve and shall have a plasticity index of not less than 14 and a liquid limit not greater than 45. Maximum particle size for impervious fill material is 25 millimeters (1 inch).

### 2.1.3 Aggregate Base Course

Aggregate base material shall consist of material conforming to Section 02722 AGGREGATE BASE COURSE.

## 2.2 SOURCE FOR EARTH MATERIALS

~~Levee~~ **The Contractor shall obtain material for levee fill, temporary fill, and impervious fill materials shall be obtained from the a commercial source.** The Contractor shall submit test data showing that the material from the proposed source meets the specification requirements. **The fill shall be tested for hazardous materials as specified in SECTION 02335.**  
~~Refer to SECTION 02020 SUBSURFACE DATA for subsurface information.~~

## PART 3 EXECUTION

### 3.1 EQUIPMENT

#### 3.1.1 General

The Contractor shall furnish all necessary plant and equipment used in the performance of work. Such plant and equipment shall be subject to approval before work is started and shall be maintained in a safe and satisfactory working conditions at all times. Equipment safety requirements can be found in EM 385-1-1. The equipment shall have adequate capability for hauling, spreading, and compacting earth material.

#### 3.1.2 Spreading Equipment

Spreading equipment shall consist of motorized graders or other approved equipment that have adequate capability for meeting specified thickness control and grade control.

#### 3.1.3 Compaction Equipment

Compaction equipment shall consist of tamping rollers that are pulled or self-propelled, hand power tampers, and/or walk-behind compactors. Self-propelled compaction equipment shall not be operated at speeds greater than 5.6 kph (3.5 mph). Compaction equipment shall be selected based on material characteristics and space restrictions.

#### 3.1.4 Sprinkling Equipment

Sprinkling equipment best suited for moisture conditioning or dust control shall be selected. Sprinkling equipment shall include tank trucks, pressure distributors, or other equipment designated to apply water uniformly and in controlled quantities to variable surface widths.

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## SECTION 02335

## HAZARDOUS MATERIALS TESTING

## PART 1 GENERAL

## 1.1 SCOPE

This section consists of performing hazardous materials testing on all fill materials to obtain certification from the government that all fill materials used at the site do not exceed criteria for chemicals of concern. Crushed rock or aggregate will not require testing and certification.

## 1.2 REFERENCES

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

## U.S. ENVIRONMENTAL PROTECTION AGENCY (USEPA)

SW-847 (2003) Test Methods for Evaluating Solid Waste-Physical Chemical Methods. Available on the Internet at:  
["http://www.epa.gov/epaoswer/hazwaste/test/main.htm"](http://www.epa.gov/epaoswer/hazwaste/test/main.htm)

## U.S. GEOLOGICAL SURVEY

Professional Paper 1270 (1984) "Elemental Concentrations in Soils and Other Surficial Materials of Conterminous United States."

## 1.3 SUBMITTALS

Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

## SD-01 PRECONSTRUCTION SUBMITTALS

Sampling Work Plan; GA

The Work Plan shall provide details of all the sampling methods, equipment decontamination procedures, analytical methods, the quality control/quality assurance program (including proposed statistical methods for analysis of the results), and reporting requirements. In the Work Plan all proposed procedures and methods shall conform to U.S. Environmental Protection Agency regulations and technical guidelines for sampling and analysis.

## SD-07 CERTIFICATES

Certification Report; GA

The Certification Report will briefly detail the work plan, the analytical results, and based on the analytical results a determination of the suitability of each material. If the upper 95% confidence level of

background concentrations for arsenic and/or total chromium is used, the Certification Report shall also provide the data, source of the data, and statistical method used to determine this level.

#### 1.4 SAMPLING WORK PLAN

##### 1.4.1 Work Plan

All sampling and reporting shall be conducted by an independent subcontractor retained by the Contractor. The Contractor shall submit (which may be prepared by the independent subcontractor) a Sampling Work Plan for all borrow sites from which construction soils will be obtained to the Contracting Officer within 15 days of awarding of the contract. The Contracting Officer will provide a letter of acceptance of or detail required revisions to the Work Plan within 10 working days of submission of the Work Plan. If revisions are required to the Work Plan, the Contractor will have 10 working days to revise the Work Plan and resubmit it to the Contracting Officer.

The Work Plan shall provide details of all the sampling methods, equipment decontamination procedures, analytical methods, the quality control/quality assurance program (including proposed statistical methods for analysis of the results), reporting requirements, and the name and address of the owner(s) and operator(s) borrow sites. All proposed procedures and methods shall conform to U.S. Environmental Protection Agency regulations and technical guidelines for sampling and analysis. Specifically, the sampling shall be done in accordance with SW-846.

##### 1.4.2 Qualification

A California Registered Geologist, Registered Professional Engineer (Civil), or Registered Environmental Assessor who is competent in environmental sampling and is in good standing with the California Department of Consumer Affairs shall sign and stamp the Work Plan certifying that all proposed methods and procedures are in accordance with applicable laws and regulations, and within the current professional standard of care.

##### 1.4.3 Sampling Procedures

The Contractor shall be responsible to complete all sampling work within 7 days of the receipt of the letter accepting the Work Plan from the Contracting Officer.

A minimum of four composite samples shall be submitted (for each material type) with one additional sample being submitted for each 3,000 cubic yard (or fraction thereof) in excess of 6,000 cubic yard. Each sample shall be composited from aliquots of soil taken from 1,000 cubic yard fractions. All composite samples shall be analyzed for all materials specified in Table 1 (Attachment 1). In the initial sampling event sufficient sample will be collected to analyzed the total concentration, and complete the STLC and DI-WET extractions if the later two are necessary. The portion of sample for STLC and DI-WET will be held by the laboratory and only analyzed if the criteria in Section 1.3 are met.

The location and elevation of each sampling location shall be determined to the nearest 0.1 foot by a California licensed Surveyor Contractor using either traditional surveying or GPS methods. Either State Plane or local coordinates may be used.

### 1.5 ACTION REQUIRED

The Contractor shall be responsible for certifying that the all fill materials used at the site do not exceed criteria for chemicals of concern as listed in Table 1, paragraph 3.2. Crushed rock or aggregate will not require testing and certification, but must be obtained from a quarry site and may not contain any recycled material. Prior to purchasing or shipping any particular material to the site the Contractor shall ensure the soils do not exceed maximum concentration criteria set forth in this specification by completing a Work Plan, sampling, and providing a Certification report acceptable to the Contracting Officer. A certification from the seller of the suitability of any particular fill material will not be acceptable and the Contractor shall still be responsible for obtaining the certificate from the government.

### 1.6 ANALYTICAL METHODS

The list of required analytes and analytical methods is provided in Table 1 (Attachment 1). The Contractor will request the analytical laboratory run the tests on the quickest possible turnaround (5 days or less preferred). All samples will be submitted to a California certified analytical laboratory.

All soil samples will be analyzed for total concentrations of all required analytes. A STLC extraction and analysis (see Table 1 and Title 22 CCR §66261.24 Tables II and III) will be run if the total concentration of any constituent in milligrams per kilogram (mg/kg) (wet weight) is 10 times greater than the STLC criteria listed in milligrams per liter (mg/L). STLC extract will not be analyzed for any constituent where the total concentrations is not 10 times greater than the STLC criteria. If based on total concentrations an STLC extraction is done, a DI-WET extraction will be completed at the same time and analyzed for metals listed in Table 1.

If the STLC and DI-WET extraction and analyses are run, the Contractor will request the laboratory provide the shortest possible turnaround.

### 1.7 MEASUREMENT AND PAYMENT

Payment for the hazardous materials testing shall be included in the contract price for fill bid items.

PART 2 NOT USED

PART 3 EXECUTION

### 3.1 DETERMINATION OF SUITABILITY OF SOILS BASED ON CONTAMINANT CONCENTRATIONS

Any soil that exceeds "Maximum Concentration of Solids Analysis" for any constituent, other than arsenic and total chromium, will be deemed unacceptable (see Table 1). If the STLC and DI-WET extractions are required (See Section 1.3) and the reporting limits for any specific constituent exceeds the "Maximum Concentration for STLC Extractable Analysis" or "Maximum Concentration of Soluble Constituent (DI-WET)" criteria for any particular construction material (soil), the material shall be deemed unacceptable (see Table 1).

The arsenic and total chromium concentration in soil may exceed the "Maximum Concentration of Solids Analysis" if the Contractor can demonstrate that the arsenic concentration does not exceed the upper 95% confidence level for local or regional background concentrations for similar soils. Approved statistical methods from Title 27 CCR shall be used to determine the upper 95% confidence level if the Contractor chooses to use soils that exceed the "Maximum Concentration of Solids Analysis" criteria for arsenic and/or total chromium. The Contractor may only (but is not required to) conduct a statistical analysis of the background concentrations of arsenic or chromium exceeds the "Maximum Concentration of Solids Analysis." If the contractor determines the upper 95% confidence level for background concentrations of arsenic and/or total chromium, it is preferred that available literature values be used. The use of appropriate data and methodology for determination of the upper 95% confidence level for background concentrations is subject to acceptance or request for revision from the Contracting Office.

Soils marginally over the Maximum Concentration limits or the upper 95% confidence limit for arsenic and/or total chromium may, at the discretion of the Contracting Office be granted a variance. If the Contractor expects to seek a variance and propose use of materials marginally exceeding acceptance criteria, the Contractor should begin discussions with the Contracting Office as soon as possible and before submission of the Certification Report.

### 3.2 CERTIFICATION REPORT

The independent subcontractor that conducted the sampling shall prepare ONE Certification Report evaluating the chemical suitability of the each fill material from each borrow site proposed for use at the site. The Certification Report shall be submitted to the Contracting Officer within 15 days after the receipt of the analytical results.

The Certification Report shall briefly detail the sampling methods, equipment decontamination procedures, analytical methods, the quality control/quality assurance program, the analytical results, and based on the analytical results a determination of the suitability of each material. If the upper 95% confidence level of background concentrations for arsenic and/or total chromium is used, the Certification Report shall also provide the data, source of the data, and statistical method used to determine this level.

The Certification Report will provide the name and contact information for the owner(s) and operator(s) of the borrow site(s).

A California Registered Geologist, Registered Professional Engineer (Civil), or Registered Environmental Assessor who is competent in environmental sampling and is in good standing with the California Department of Consumer Affairs shall sign and stamp the Certification Report. The above profession shall certify that the work will be and has been done under their direct supervision, and to the best of their knowledge that (except where specifically noted) all work was done in accordance with the these specifications, the Work Plan (for the Certification Report), in accordance with all applicable laws and regulations, and to the acceptable standard of care.

The Contracting Officer will provide an acceptance or require revision letter to the Contractor within 7 days of receipt of the report. No particular fill material may be purchased or shipped to the site until accepted in writing by the Contracting Officer. The Contractor will have 7

days to make the required revisions if requested by the Contracting Officer. The Contracting Officer reserves the right to accept or reject specific materials from specific sites with or without acceptance of the entire Certification Report.

-END OF SECTION -

ATTACHMENT 1

TABLE 1: Fill Material Maximum Concentration Criteria

**Table 1. FILL MATERIAL MAXIMUM CONCENTRATION CRITERIA**

Constituent	USEPA <sup>a</sup> Method No.	Maximum Concentration for Solids Analysis <sup>b</sup> (mg/kg)	Maximum Concentration for STLC Extractable Analysis <sup>c</sup> (mg/L)	Maximum Concentration of soluble constituent (DI-WET) <sup>c,d</sup> (µg/L)
<b>Metals</b>				
Arsenic	6010	22.0 <sup>e,f</sup>	5	10.0 (filtered)
Cadmium	6010	9.06 <sup>g</sup>	1	5 (filtered)
Total Chromium	6010	210 <sup>f</sup>	5	50
Copper	6010	2,900	25	10 (filtered)
Lead	6010	400	5	2.5 (filtered)
Mercury	6010	20.0 <sup>h</sup>	0.2	0.05
Nickel	6010	150 <sup>k</sup>	20	52 (filtered)
Selenium	6010	100 <sup>m</sup>	1	5
Zinc	6010	5,000 <sup>m</sup>	250	100 (filtered)
pH				6.5 to 8.5
Chromium (VI)	7196	0.2 <sup>g</sup>	5	11 (filtered)
<b>Petroleum Hydrocarbons</b>				
TPH-gasoline	8015-p	100 <sup>o</sup>		
TPH-diesel (with SGC) <sup>n</sup>	8015-e	100 <sup>o</sup>		
TPH-motor oil (with SGC) <sup>n</sup>	8015-e	500 <sup>o</sup>		
<b>Polyaromatic hydrocarbons (PAHs)</b>				
Acenaphthene	8270 or 8310	3,700		
Anthracene	8270 or 8310	22,000		
Benzo(a)anthracene	8270 or 8310	0.62		
Benzo(b)fluoranthene	8270 or 8310	0.62		
Benzo(k)fluoranthene	8270 or 8310	0.61		
Benzo(a)pyrene	8270 or 8310	0.062		
Chrysene	8270 or 8310	6.1		
Dibenz(a,h)anthracene	8270 or 8310	0.062		
Fluoranthene	8270 or 8310	2,300		
Fluorene	8270 or 8310	2,600		
Indeno (1,2,3-cd)pyrene	8270 or 8310	0.62		
Naphthalene	8270 or 8310	56		
Pyrene	8270 or 8310	2300		
<b>Polychlorinated Biphenyls (PCBs)</b>				
Aroclor 1016	8082	3.9	0.1 for sum of all listed PCBs	
Aroclor 1221	8082	0.22 for sum of all listed PCBs not including Aroclor 1016		
Aroclor 1232	8082			
Aroclor 1242	8082			
Aroclor 1248	8082			
Aroclor 1254	8082			
Aroclor 1260	8082			
<b>Organochlorine Pesticides</b>				
Aldrin	8081	0.029	0.14	
Alpha BHC	8081	0.09		
Beta BHC	8081	0.32		

**Table 1. FILL MATERIAL MAXIMUM CONCENTRATION CRITERIA**

Constituent	USEPA <sup>a</sup> Method No.	Maximum Concentration for Solids Analysis <sup>b</sup> (mg/kg)	Maximum Concentration for STLC Extractable Analysis <sup>c</sup> (mg/L)	Maximum Concentration of soluble constituent (DI-WET) <sup>c,d</sup> (µg/L)
<b>Organochlorine Pesticides (continued)</b>				
Gamma BHC (Lindane)	8081	0.44	0.4	
Chlordane	8081	1.6	0.25	
4,4-DDD	8081	1.0 Sum of DDD+DDE+DDT <sup>m</sup>	0.1 Sum of DDD+DDE+DDT	
4,4-DDE	8081			
4,4-DDT	8081			
Dieldrin	8081	0.03	0.8	
Endosulfan	8081	370		
Endrin	8081	0.2	0.02	
Heptachlor	8081	0.11	0.47	
Heptachlor epoxide	8081	0.053		
Hexachlorocyclopentadiene	8081	420		
Toxaphene	8081	0.44	0.5	
<b>Chlorinated Herbicides</b>				
2,4-D (2,4-Dichlorophenoxyacetic acid)	8151	100 <sup>m</sup>	10	
Dalaphon	8151	1,800		
2,4-DB (4-[2,4-Dichlorophenoxy]butyric Acid)	8151	490		
Dicamba	8151	NE		
Dinoseb	8151	61		
2,4,5-T (2,4,5-Trichloropheoxyacetic Acid) (Slivex)	8151	610		
<b>Selected Volatile Organic Compounds (VOCs) including BTEX and MTBE</b>				
Acetone	8260	1,600		
Benzene	8260	0.65		
Bromodichloromethane	8260	1		
Bromoform	8260	62		
Carbon Tetrachloride	8260	0.24		
Chlorobenzene	8260	150		
Chloroethane	8260	3		
Chloroform	8260	0.24		
Dibromochlormethane	8260	1.1		
1,2-Dibromo-3-chloropropane	8260	0.062 <sup>g</sup>		
1,2-Dichlorobenzene	8260	370		
1,3-Dichlorobenzene	8260	13		
1,4-Dichlorobenzene	8260	3.4		
1,1-Dichloroethane	8260	3.3 <sup>g</sup>		
1,2-Dichloroethane	8260	0.35		
cis-1,2-Dichloroethene	8260	4.3		
trans-1,2-Dichloroethene	8260	63		
1,2-Dichloropropane	8260	0.35		
1,3-Dichloropropene (total)	8260	0.7		
Ethyl benzene	8260	230		
Methyl tert-butyl alcohol (MTBE)	8260	17		
Tetrachloroethene (PCE)	8260	5.7		

**Table 1. FILL MATERIAL MAXIMUM CONCENTRATION CRITERIA**

Constituent	USEPA <sup>a</sup> Method No.	Maximum Concentration for Solids Analysis <sup>b</sup> (mg/kg)	Maximum Concentration for STLC Extractable Analysis <sup>c</sup> (mg/L)	Maximum Concentration of Soluble Constituent (DI-WET) <sup>c,d</sup> (µg/L)
<b>Selected Volatile Organic Compounds (VOCs) including BTEX and MTBE (continued)</b>				
Toluene	8260	520		
Trichloroethene (TCE)	8260	2.8	204	
1,1-Dichloroethene	8260	0.054		
Vinyl Chloride	8260	0.15		
Xylenes (total)	8260	210		

<sup>a</sup> From EPA SW-846

<sup>b</sup> From USEPA Region IX "Preliminary Remediation Goals (PRGs) for Residential Soils" (December 2001, revised 2003), except where specifically noted.

<sup>c</sup> From STLC Hazardous Waste Criteria from Title 22 CCR §66261.24 Tables II & III. STLC and DI-WET will only be run if the total constituent concentration in mg/kg is 10 times greater than the STLC regulatory criteria in mg/L.

<sup>d</sup> From Central Valley RWQCB values for similar bank discharge of soil in WDR Order 01-05-115.

<sup>e</sup> Value assigned based on available background information and available Caltrans criteria. Background estimates obtained from "Element Concentrations in Soils and Other Surficial Materials for the Conterminous United States", U.S. Geological Survey Professional Paper 1270 (1984). Arsenic PRG for cancer risk and non cancer risk end point are 0.39 and 2.7 mg/kg, respectively.

<sup>f</sup> Because frequently background concentrations of arsenic and total chromium exceed risk based and remedial goals, material will be acceptable (with the approval of the Contracting Officer) if the Contractor demonstrates that the imported material does not exceed the upper 95% confidence interval for background concentrations in local or regional soils. Data for background concentrations may be obtained from the literature.

<sup>g</sup> Modified California PRG (1994)

<sup>h</sup> For all mercury compounds

<sup>k</sup> As soluble salts.

<sup>m</sup> Cal-hazardous criteria used because PRG is higher.

<sup>n</sup> With silica gel clean up (SGC). SGC removes naturally occurring soluble soil organic matter (fats and oils) that can result in incorrectly high estimates of the TPH-diesel and TPH-motor oil concentrations.

<sup>o</sup> Based on RBSLs and LUST clean up guidelines. No PRGs available.

Note: Footnotes i, j, and l intentionally omitted to avoid potential confusion.

not be removed until deployment. If quality assurance samples are collected, rolls shall be immediately rewrapped with the plastic wrapping. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Each roll shall be labeled with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

#### 1.8.2 Storage

Rolls of geotextile shall be protected from construction equipment, chemicals, sparks and flames, temperatures in excess of 71 degrees C 160 degrees F, or any other environmental condition that may damage the physical properties of the geotextile. To protect geotextile from becoming saturated, rolls shall either be elevated off the ground or placed on a sacrificial sheet of plastic in an area where water will not accumulate.

#### 1.8.3 Handling

Geotextile rolls shall be handled and unloaded with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

### 1.9 MEASUREMENT AND PAYMENT

Clearing, Grubbing and Stripping: Payment will be made at the contract price per square meter for bid item "Clearing, Grubbing, and Stripping" and this price shall constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the work specified herein.

Seepage Berm Construction: The cost associated with constructing a seepage berm that consists of bottom sand filter, drain rock, geotextile, and earth fill, protecting the existing drainage pipe and grading the site shall be paid at the contract lump sum price for the payment item "Seepage Berm Construction". **The cost for the hazardous material testing of fills will also be included.** This price shall constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the work specified herein.

## PART 2 PRODUCTS

### 2.1 DRAIN ROCK

Drain rock material shall consist of washed concrete coarse aggregate and shall be free from lumps of clay, organic matter, silt or clay coatings, and other foreign material and meet the following gradation requirement:

<u>Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
37.5 mm (1 1/2-inch)	100
25.0 mm (1-inch)	95-100
12.5 mm (1/2-inch)	25-60
4.75 mm (No.4)	0-8

### 2.2 EARTH FILL MATERIAL

Earth fill materials shall be imported by the Contractor. Earth fill material shall be any satisfactory material with a liquid limit of less than

45 and a plasticity index of greater than 5 and less than 20. Earth fill materials shall be free of roots and other organic matter, biodegradable material, rubble, debris, frozen materials, and contaminated soil. **Earthfill shall also be tested for hazardous materials as specified in SECTION 02335.** Materials defined as Unsatisfactory Materials will be not be permitted in any portion of the seepage berm.

### 2.3 GEOTEXTILE FOR SEPARATION BETWEEN DRAIN LAYER AND EARTH FILL MATERIAL

Geotextile shall be a woven pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Stabilizers and/or inhibitors shall be added to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Re grind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material shall not be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall have a maximum apparent opening size of 0.15 mm and shall meet the requirements specified in Table 1. Where applicable, Table 1 property values represent minimum average roll values (MARV) in the weakest principal direction.

PROPERTY	UNITS	ACCEPTABLE VALUES	TEST METHOD
GRAB STRENGTH	N	1420	ASTM D 4632
PUNCTURE	N	930	ASTM D 4833
TRAP TEAR	N	555	ASTM D 4533
APPARENT OPENING SIZE	mm	0.1-0.15 mm	ASTM D 4751
PERMITIVITY	1/s	0.10	ASTM D 4491
MASS/ UNIT AREA	G/SQ M	350	ASTM D 5261
UV DEGRADATION	PERCENT	50 AT 500 HRS	ASTM D 4355

### 2.4 CONCRETE SAND FOR BOTTOM FILTER

Bottom filter layer (6-inch thick) shall consist of washed concrete sand. This material shall be free from clay, organic matter, silt, and other foreign material and meet gradational requirements of ASTM C 33 for fine aggregate as follows:

Standard Sieve Size	Percent by Weight Passing
9.5 mm (3/8 -in.)	100
4.75 mm (No.4)	95-100
2.36 mm (No.8)	80-100
1.18 mm (No.16)	50-85
600 μm (No.32)	25-60
300 μm (No.50)	5-30
150 μm (No.100)	0-10

## SECTION 02371

## EROSION CONTROL SEEDING

## PART 1 GENERAL

## 1.1 SCOPE

The work shall consist of furnishing erosion control seeding and revegetation of all disturbed areas including, but not limited to staging areas, ~~borrow areas~~, and reconstructed levee slopes, of the project as designated on the plans and as specified herein. All necessary labor, materials, equipment, and services shall be provided for the site preparation and application.

## 1.2 REFERENCES

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

## AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01 (Amended thru: Aug 1988) Federal Seed Act Regulations (Part 201-202)

## FEDERAL SPECIFICATIONS (FS)

FS O-F-241 (Rev D) Fertilizers, Mixed, Commercial

FS JJJ-S-181 (Rev B) Seeds, Agricultural

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-01 PRECONSTRUCTION SUBMITTALS

## Contractor's Qualifications; GA

Provide reference information on three successfully completed projects of similar scope completed within the past year. Include owners' names, project addresses, size and type of seed.

## Computed Area; GA

A tabulation of computed area will be submitted for approval by the contracting officer prior to seed application.

## Implementation Schedule; GA

A detailed GANT chart schedule indicating all tasks to be performed under this Specification and their start date and duration.