EXHIBIT B

TECHNICAL SPECIFICATIONS FOR CLOSURE CONSTRUCTION

TECHNICAL SPECIFICATIONS
FOR CLOSURE CONSTRUCTION
SESI PROPERTY
OTAY MESA, SAN DIEGO
CALIFORNIA

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1.0 DEFINITIONS AND SCOPE OF WORK

1.1 Definitions

In these Technical Specifications, "Owner" is defined as the Coordinating Committee for the United States District Court, 940 Front Street, San Diego, California 92189, on the behalf of Mr. & Mrs. Salim D. Sesi.

The "Engineer" is a duly authorized agent of the Owner who is the onsite representative during the construction phase of the project. The Engineer may also be an independent firm (and its representatives) that is contracted to the Owner to provide construction observation and monitoring during closure.

The "Plans" are the construction drawings for all construction activities associated with the final closure of the Sesi Property, Otay Mesa, San Diego, California.

The "Contractor" is the organization or its representative responsible for the construction activities so that the landfill closure construction is in accordance with the Plans and with these Technical Specifications.

1.2 Scope of Work

The work to be done by the Contractor under this contract consists of furnishing all plant, labor, equipment, and supervision to complete the construction of a multilayered landfill final cover, surface water drainage control facilities, and other improvements for the closure of landfilled waste at the Sesi property. The items of work shall include, but not limited to:

- Clearing surface vegetation and preparation of landfill surface including excavation and redisposal of waste and construction debris in designated areas within the landfill;

- Excavation of keys along the designated sections of the periphery of the landfill cover;

- Excavation and backfill of a buttress at the toe of the front slope, including installation of a leachate collection system;

- Stripping of existing topsoil from the onsite borrow area and stockpiling for use in vegetative layer construction;

- Grading of an onsite borrow for soil to be used in formation layer and engineered fill construction;

- Importation of clay materials for low permeability layer construction;

- Construction of the landfill final cover including foundation layer, low permeability layer, and vegetative cover layer;

- Installation of a geomembrane lining above the low-permeability layer in the area of the main drainage channel;

- Construction of drainage channels including riprap lined main drainage channel, asphalt-concrete v-ditches, and the concrete v-ditches and associated features such as riprap protection of landfill slopes and grading of the native ground around the landfill cover to prevent ponding;

- Miscellaneous construction including approach ramps to landfill, access road, installation of survey monuments and protection barriers, in-place protection and extension of existing landfill gas and groundwater monitoring wells, installation of a leachate storage system, and installation of a perimeter security fence; and,

- Revegetation of Site.

1.3 General Specifications

a. Contractor shall maintain fill reference stakes as directed by the Engineer.

b. Contractor shall provide adequate notice of intent to the Engineer. No work shall proceed without prior approval from the Engineer.

c. Contractor shall only use such equipment as meets the approval of the Engineer. Any equipment deemed inadequate or unsuitable by the Engineer shall be replaced with approved equipment.

d. Contractor shall stockpile material only in designated areas and not at random. All stockpiles shall be limited in number and areal extent. The Contractor shall notify the Engineer sufficiently in advance of building a stockpile so as to allow the Engineer to survey or approve the subgrade. The Contractor shall obtain approval in writing from the Engineer before stockpiling any material.

2.0 SITE CLEARING, SITE PREPARATION, AND TOPSOIL STRIPPING

2.1 General

The work covered by this section consists of furnishing all plant, labor, equipment and supervision, and performing all operations for relocation of soil drums and waste storage tank, clearing shrubs and bushes, site preparation in landfill areas, and topsoil stripping from borrow areas as shown on the Plans or as directed by the Engineer, prior to engineered fill placement or construction of the landfill final cover. Specifications for details, not covered explicitly in this document, shall be referred to the Standard Specifications for Public Works Construction, 1994 ("Greenbook").

2.2 Construction

2.2.1 Relocation of Soil Drums and Water Storage Tank

A number of drums filled with soil excavated during construction of the onsite monitoring wells are stockpiled onsite. The soil drums shall be hauled to the onsite disposal area shown on the Plans, opened and the soil placed in the disposal area in accordance with Section 3.0 of the Specifications. The drums shall be shipped offsite to a drum recycler as part of this work.

The 7,500-gallon water storage tank shall be relocated onsite by the Contractor as directed by the Engineer prior to the start of grading.

2.2.2 Plant Salvage

The Contractor shall salvage desirable native plants within the limit of disturbance as directed by the Engineer. Plant salvage shall commence prior to clearing and grubbing. Native succulents, woody perennials and trees, shall be salvaged, including but not limited to Willow (*Salix sp.*), Mexican Elderberry (*Sambucus Mexicana*), Mule Fat (*Baccharis Glutmosa*), and San Diego Barrel Cactus (*Ferocactus Viridescens*).

Prior to salvage operations, the Contractor shall submit a plan detailing the proposed methods and maintenance procedures. Plants tagged for salvage shall be pruned, as appropriate, by a qualified arborist. Plants and sufficient root materials shall be excavated and placed in a container 150% larger than the rootball dimensions. Care shall be exercised so as to not disturb and retain the native soil surrounding the roots. The salvaged plants shall be stored and maintained in an onsite nursery until replanted during Site revegetation activities. The lost, damaged or dying salvaged plants shall be replaced at the Contractor's sole expense.

2.2.3 Clearing of Surface Vegetation in Landfill Area

The Contractor shall remove the vegetation from the areas to receive landfill final cover, by mowing or other methods approved by the Engineer. Grubbing shall not be performed to remove roots. Removed organic materials may be blended with stockpiled vegetative cover soil, or placed in identified disposal areas as the Engineer may direct.

2.2.4 Surface Preparation for Final Cover Construction

In areas where engineered fill is required to reach foundation layer subgrade, the Contractor shall moisture condition and compact the upper 8 inches of the existing soil cover to 85 percent relative compaction as determined by ASTM D1557. The Contractor shall delineate the areas requiring compaction and grading and shall obtain the Engineer's approval prior to grading or compacting. The grading and compaction of any material containing refuse shall be performed under a site-specific health and safety plan approved by the Engineer.

The extent of grading of the surface areas shall be sufficient to control storm runoff and to provide stable slopes and surfaces to receive fill materials. During the subsurface preparation operation, care shall be taken to minimize the exposure of waste fill material present below the existing soil cover. Any waste material, if exposed, shall be covered by the end of the day with a minimum 6-inch-thick layer of cover soil specified in Section 4.2 of the Specifications.

2.2.5 Topsoil Stripping in Borrow Area

The Contractor shall strip existing topsoil including vegetation from within the limits of the borrow area shown on the Plans. The average excavation in that area shall be 2 feet to obtain a sufficient quantity of soil for construction of the upper 6 inches of the vegetation layer. The stripped topsoil shall be placed in the location of the temporary stockpile show on the Plans. Vegetation and other organic materials removed from the landfill may be placed and blended with stockpiled topsoil provided the material is free of waste and is approved by the Engineer prior to placement.

2.3 Measurement and Payment

a. Payment for relocating soil drums and water tank shall be made on a lump-sum basis. The price shall include all costs; including drum moving, opening, hauling and recycling and tank relocation. No separate payments will be made.

b. Payment for clearing surface vegetation and surface preparation shall be made at the unit price bid per acre of the prepared landfill surface area. Price shall include all costs: mowing or cutting, hauling, dust control, compliance with all regulations for health and safety and environmental quality. No separate payment will be made for clearing or surface preparation in designated areas.

c. Payment for topsoil stripping shall be made at the unit price per cubic yard for the quantity of excavation determined by survey in the borrow area. The price shall include all costs: staking, excavation, hauling, stockpiling, blending of cleared vegetation and dust control.

3.0 WASTE EXCAVATION AND RELOCATION

3.1 General

The work covered by this section consists of furnishing all plant, labor, equipment, and supervision for: excavation of existing soil cover or waste in the area of landfilled waste to reach foundation layer subgrade; excavation of keys along the periphery of the landfill for the final cover; and excavation for drainage channels and any other features required for the cover construction. Excavation shall include excavation, hauling, stockpiling (if needed), placement and compaction of material in identified disposal areas. Specifications for details, not covered explicitly in this document, shall be referred to the Standard Specifications for Public Works Construction, 1994 ("Greenbook").

3.2 Construction

a. All excavation shall be performed to the lines and grades shown on the Plans.

b. Contractor's excavation methods shall conform to the California Division of Occupational Safety and Health (Cal OSHA) requirements for excavations.

c. The Contractor shall take all necessary precautions to minimize disturbance of the material below and beyond the lines of excavations. Any damage to the work due to the Contractor's operations, shall be repaired by the Contractor at its own expense. Overexcavations in drainage or shear key areas shall be backfilled with material compacted to minimum of 90 percent relative compaction as determined by ASTM D1557.

d. All excavations for construction of drainage channels and ditches shall be performed in dry conditions.

e. Existing cover soil excavated from the landfill area may be directly used as fill for foundation layer of the final cover or may be temporarily stockpiled onsite prior to their use in the landfill final cover construction provided the soil is free of waste. Stockpiles shall be located such that they will not interfere with the site drainage nor impact the access to the site. Stockpile areas shall be subject to the approved by the Engineer. Locations of the stockpiles should be such as to prevent mixing of soil with waste. The Contractor shall place and maintain the stockpiles in a stable condition as determined by the Engineer.

f. The Contractor may encounter waste during the excavation within the boundary of the landfill. The waste shall be removed to the lines and grades shown on the Plans, or as directed by the Engineer. The extent of removals may be determined at the site by the Engineer during construction of the final cover.

g. The excavated waste shall be relocated to the identified disposal area within the landfill as shown on the Plans and placed to grades that are below the base of the foundation layer shown on the Plans.

h. Relocated waste placed within the disposal area shall be compacted using a self-powered sheepsfoot compactor such as a CAT 815B or by a fully loaded 5 × 5 sheepsfoot compactor towed by an appropriate dozer. The wastes shall be placed in lifts not exceeding 1-foot and compacted by no less than four passes of the compactor prior to placing the next lift.

i. At the end of each work day or prior to anticipated precipitation exposed waste in the excavation and disposal areas shall be covered by a minimum of 6 inches of clean soil as specified in Section 4.2 of the Specifications.

3.3 Measurement and Payment

a. Payment for excavation of existing cover soil and waste in the area of the landfill shall be made at the unit price bid per cubic yard of the excavated material. The quantities shall be determined by the Engineer from a comparison of surveys of the existing ground surface and to the lines and grades shown on the Plans.

b. The price should include all costs including excavation, hauling, placement and compaction in the disposal areas, daily soil cover operations, dust control, regulatory compliance, and site safety. No separate payment will be made for any construction activity required due to the size of the waste.

c. No separate payment will be made for disposal or temporary stockpiling of excavated material including waste.

4.0 ENGINEERED AND STRUCTURAL FILL

4.1 General

4.1.1 Work Included

The work covered by this section consists of furnishing all plant, labor, equipment and supervision necessary to complete the construction of engineered and structural fills on the project. These elements include; buttress keyway and backslope excavation, channel embankments, and construction of compacted fills for the buttress, and miscellaneous excavation and engineered fill, roads and drainage structures outside the limits of the final cover.

4.1.2 Quality Assurance (QA)

Prior to the start of work covered by this section of the Technical Specifications, the Construction Manager shall initiate a preconstruction meeting with the Contractor, Engineer, and QA/QC Manager. Topics for review and discussion shall include, but not be limited to, these Specifications, QA testing, safety, construction schedule, and presentation by the Contractor of the techniques, procedures, and equipment to be used during earthwork construction.

The QA testing will be conducted by the QA/QC Manager and the QA/QC Technicians. The Contractor shall cooperate with the QA/QC staff to permit monitoring and testing of all earthwork activities. The Engineer will determine in-place density and moisture content of the fill materials by the methods listed below. The location of testing shall be determined by the QA/QC Technicians.

- ASTM D1557 - Moisture-Density Relationship, one test per change in material
- ASTM D2922 - In-place Density (Nuclear), one test per 1,000 cubic yards
- ASTM D3017 - In-place Moisture (Nuclear), one test per 1,000 cubic yards
- ASTM D1556 - In-place Density (Sand Cone), one test per 10,000 cubic yards

4.2 Materials

4.2.1. Fill Soil

The Contractor shall obtain all materials necessary to complete the compacted fills from the onsite borrow area and excavations.

Rock or rock fragments less than 6 inches in the largest dimension may be utilized in the fill provided these are evenly distributed without nesting or segregation. Rock greater than 6 inches in the largest dimension shall be disposed of in the stockpile area designed by the Contraction Manager. All deleterious materials shall be removed from the work area, and disposed of at a location approved by the Construction Manager. Processing (i.e., screening, sorting, rock raking, etc.) of materials from the excavation may be necessary to meet the properties required for the fill material as specified above and in the SSPWC Section 300-4.

4.3 Construction

4.3.1 Buttress Key/Backslope Excavation

The Contractor shall request the Engineer to observe all cut slopes during grading at intervals not exceeding ten (10) feet.

All work shall comply with the requirements for Unclassified Excavation as defined in Section 300-2 of the SSPWC. Excavation shall be completed to the lines and grades shown on the Plans.

4.3.2 Miscellaneous Excavation

Excavation for miscellaneous road construction and drainage channels outside of the final cover limits shall be completed in accordance with Section 300-2 of the SSPWC. Excavation shall be completed to the lines and grades, and as required by the details, shown on the Plans.

4.3.3 Engineered and Structural Fill Construction

a. Soil, slopewash, colluvium, alluvium, or rock material which, in the opinion of the Engineer, are unsuitable for placement as compacted fill shall be removed from the work area and disposed of at a location designated by the Construction Manager. Following removal of unsuitable materials, the surface receiving fill shall be scarified to a depth not exceeding 8 inches by the Contractor until it is uniform and free from uneven features which may prevent uniform compaction.

b. The scarified ground surface shall then be moisture conditioned, mixed as required and compacted to a minimum of 90% of the maximum dry density as defined by ASTM D1557. If the scarified zone is greater than 8 inches in depth, the excess over 8 inches shall be removed and placed in loose lifts of not more than 8 inches in thickness, prior to compaction.

c. All fill keyway areas will be cleared of loose slough materials by the Contractor prior to placing fill materials. Any areas cleared of loose slough materials must be approved by the Engineer in writing prior to placement of any fill material.

d. Fills will be constructed so that each layer of fill material shall have a cross fall no steeper than 1 foot vertical in 20 feet horizontal.

e. Fill material shall be placed in uniform layers not more than 8 inches in loose thickness, prior to compaction. Each layer of engineered fill material shall be compacted to a minimum of 90% of the maximum dry density as determined by ASTM D1557. Each layer of structural fill material shall be compacted to a minimum of 95% of the maximum dry density as determined by ASTM D1557. The fill material shall be moisture conditioned to bring the moisture content between 2% below optimum and 4% above optimum, as determined by ASTM D1557. When the fill is dry, water shall be added until the moisture content is within the limits required to assure proper compaction of the fill materials. Each layer shall be moisture conditioned as required, prior to placing the next layer of fill material.

f. When the moisture content of the fill material is greater than the specified limits or when the moisture content interferes with the compaction of soil, the fill material shall be aerated by plowing, discing, blading, or other satisfactory methods until the moisture content is within the acceptable range.

g. The "outer zone of fill slopes" is defined as one equipment width, measured horizontally from the surface of the slope being constructed. The outer zone of fill slopes shall be constructed with materials which are well blended without layering of dissimilar materials in the finished slope surface. Non-cohesive materials which, in the opinion of the Engineer, would create an unstable condition in the finished slope surface shall not be used to construct the outer zone of fill slopes. The Contractor shall be required to maintain the specific minimum relative compaction out to the finished slope surface.

h. A "pumping" condition exists when, in the opinion of the Engineer, shear failure of the fill is occurring. After completion of the compaction, portions of fills which are exhibiting an excessive pumping condition will be considered unacceptable and shall be removed, reprocessed, and recompacted.

i. The Contractor is responsible for protecting and properly maintaining fill areas prior to acceptance of the work. Where previous compacted fill has become wet, dried out, or cracked, the Contractor shall remove or process the materials, as determined by the Engineer. The Contractor shall obtain written approval from the Engineer prior to resuming placement of fill material.

j. Where the slope receiving the fill is steeper than 4-horizontal to 1-vertical, the fill shall be keyed and benched into undisturbed bedrock or firm material, in accordance with subsection 300-4.4 of the SSPWC, and as approved by the Engineer.

4.4 Measurement and Payment

4.4.1 Buttress Key/Backslope Excavation

All excavation for the buttress key and backslopes shall be compensated for in accordance with the unit price reflected in the Bid Schedule. The quantity of excavation will be based on comparison of pre-grading contours shown on the Plans and survey topo of the completed excavation. All costs associated with this work shall be reflected in the unit prices, and no additional payment shall be made for the work required to complete the excavation in accordance with these Special Provisions.

4.4.2 Miscellaneous Excavation

Miscellaneous excavation for roads and drainage structures shall not be measured for payment, and all costs for such work shall be absorbed in the unit price in the Bid Schedule for Foundation Layer construction.

4.4.3 Buttress Fill

All engineered and structural fill associated with the buttress shall be compensated for in accordance with the unit price reflected in the Bid Schedule. The quantity shall be based on comparison of the field survey of the buttress key excavation and design grades for the buttress. All costs associated with this work shall be reflected in the unit price, and no additional payment shall be made for the work required to complete the compacted fills in accordance with these Special Provisions.

4.4.4 Miscellaneous Engineered Fills

Engineered fills for the roads, drainage structures, and benches, shall not be measured for payment, and the Contractor shall prepare his own quantity estimate on which to base his bid. All material shall be compensated for in accordance with the lump sum price reflected in the Bid Schedule. All costs associated with this work shall be reflected in the lump sum price, and no additional payment shall be made for the work required to complete the compacted fills in accordance with these Special Provisions.

5.0 LIQUID COLLECTION SYSTEM

5.1 General

5.1.1 Work Included

The work covered by this section consists of furnishing all plant, labor, equipment, and supervision necessary to complete construction of the liquid collection system. Specifications for details not covered explicitly in this document shall be referred to the Standard Specifications for Public Works Construction, 1994.

5.1.2 Submittals

The Contractor shall submit three copies of the following items for the liquid collection system:

- Certificates of compliance, and a 6-inch sample of slotted and solid 8-inch diameter SCH 80 PVC pipe
- Gradation and material quality certificate of compliance for gravel filter material
- Manufacturer's data and certificate of compliance for 8 oz. geotextile

5.2 Materials

5.2.1 PVC Pipe

Eight (8)-inch diameter, slotted and solid Schedule 80 PVC pipe, and all appurtenances for caps, etc., shall be in conformance with Section 217-17 of the SSPWC.

5.2.2 Gravel Drainage Material

The gravel drainage material shall conform to the quality and gradation requirement for ¾-inch crushed rock as defined in Section 200-1.2 of the SSPWC.

5.2.3 Geotextile

The geotextile material shall consist of nonwoven polypropylene or polyester conforming to Section 9.0 of these specifications.

5.2.4 Well Cover

The well covers shall be a CAP COP II, Model TC-73, locking well vault as distributed by Longyear (800-241-9408) or approved equivalent. The covers shall be traffic-rated, and flush mounted. The covers shall have a minimum inside opening of 21 inches and skirt length of 22 inches.

5.2.5 Concrete

Concrete shall have a minimum compressive strength of 2,500 psi after 28 days and shall conform to concrete Class 560-6-2500P of Section 201-1 of the SSPWC. Masonry units shall conform to Section 202-2.1, and rebar shall be Grade 60 billet steel conforming to Section 201-2 of the SSPWC.

5.3 Construction

a. The Contractor shall construct the liquid collection system to conform to the details as shown on the Plans, and as directed by the Engineer. The PVC drainage pipes shall be constructed to the minimum slopes and general horizontal alignment as called for on the Plans. Locations and installation shall be approved by the Engineer.

b. Geotextile panels shall be overlapped a minimum of 18 inches. Horizontal seams in slopes shall not be allowed unless otherwise approved by the Engineer.

c. Pipes must be installed with appropriate SCH 80 PVC fittings. All joints shall be glued with appropriate primer and SCH 80 PVC cement or constructed with threaded joints.

d. Backfill around pipes shall be performed in a careful manner. Soil around the riser pipes shall be placed by hand and compacted by hand-operated, motorized plate compactors. Damage to the piping shall be repaired by the Contract at no cost.

5.4 Measurement and Payment

Payment for supply and installation of the liquid collection system shall be made on a lump sum basis in accordance with the price on the Bid Sheet. The lump sum price shall include all labor, materials, equipment, and supervision involved in construction of the liquid collection system and no separate payment shall be made.

6.0 FINAL COVER CONSTRUCTION

6.1 General

6.1.1 Work Included

The work covered by this section consists of furnishing all plant, labor, materials, equipment and supervision, and performing all operations to construct the landfill final cover, consisting of a foundation layer, a low-permeability soil layer, and a vegetative layer, as shown on the Plans.

The specifications provided herein for the construction of final cover shall be followed in conjunction with the approved QA/QC plan. Specifications for details, not covered explicitly in this document, shall be referred to the Standard Specifications for Public Works Construction, 1994 ("Greenbook").

6.1.2 Quality Assurance/Quality Control (QA/QC)

Work performed for construction of the final cover is subject to the QA/QC methods, procedures, and documentation requirements contained in the attached QA/QC Plan. The QA/QC testing will be conducted by the QA/QC Manager and QA/QC Technicians. The Contractor shall familiarize himself with the contents and scope of the QA/QC Plan and permit monitoring and testing of all final cover construction.

6.2 Foundation Layer

6.2.1 General

The Work consists of excavation of suitable material at the onsite borrow area, hauling to the placement area, temporary stockpiling (if needed) of the material, processing for moisture conditioning, spreading and compacting of soil the design grades of the foundation layer shown on the Plans. In accordance with QA/QC plan, Contractor shall make allowances for testing by the Engineer including the excavation of test pits. The Contractor shall provide the Engineer with unrestricted access to the site for purposes of inspection and testing. Contractor shall provide labor, materials, equipment and supervision for excavation and backfilling of any test holes and/or pits.

6.2.2 Materials

The foundation material shall be free of organic and other deleterious matter and shall not contain rocks or cobbles larger than 8 inches in the greatest dimension. The foundation soil shall be obtained from the onsite borrow area shown on the Plans.

6.2.3 Construction

a. Immediately prior to placing foundation layer material, the existing soil cover shall be reworked (moisture conditions, rolled with a sheepsfoot roller or scarified) to a depth of 6 inches in order to provide a bond between the soil cover and the foundation material to be placed. The Contractor shall obtain Engineer's approval of the prepared surface, prior to placement of any foundation material.

b. Fill materials shall be moisture conditioned to 0 to 5 percent above optimum and placed in approximately horizontal, evenly distributed layers ("lifts") not exceeding 8 inches in loose thickness. Each lift shall be compacted to a minimum of 90 percent relative compaction as determined by ASTM D1557. The moisture content of the placed material shall be uniform throughout the lift. The Contractor shall use approved tamping or sheepsfoot rollers of sufficient dimensions and weight to achieve the specified relative compaction. The rollers shall be subject to the approval of the Engineer. Approval must be obtained before any equipment is used onsite.

c. The surface of each lift shall be sufficiently scarified after compaction, to provide a bond with the succeeding lift, prior to placement of the next lift. Scarification may be eliminated where a sheepsfoot compactor has been used to compact the surface of the lift and with the approval of the Engineer. The foundation layer on side slopes flatter than 2.5:1 (horizontal:vertical) shall be placed and compacted on the slope. For slopes steeper than 2.5:1, the foundation layer shall be placed in horizontal lifts for a minimum one equipment width. The overbuilt portions of the slope shall be cut back to design lines and grades. Grader and dozer slope boards shall be serrated and not smooth.

d. The Engineer shall perform in-situ moisture, density, and other required laboratory tests at the frequency specified in the QA/QC plan. The Contractor shall make the area safe for such work to be performed and provide equipment necessary to excavate test holes.

e. Any portion of the compacted lift which does not meet the moisture content and/or compaction requirements shall be reworked until it meets the Specifications.

f. The finished surface of the foundation layer shall be graded as shown on the Plans.

6.3 Low-Permeability Soil Layer

6.3.1 General

The work consists of excavation of suitable material at the offsite borrow area, hauling to the site, temporary stockpiling of the material, processing for moisture conditioning, placement of processed material, and compaction to achieve a minimum 1-foot-thick low-permeability soil layer on top of the foundation layer.

6.3.2 Materials

a. The low-permeability soil shall consist of imported clayey material classified as SC, CL or CH according to the Unified Soil Classification System with a minimum of 30 percent by weight passing No. 200 U.S. standard sieve and shall be free of waste or leachate. The maximum clod size shall be less than 1 inch, and the total gravel content (particles retained on U.S. standard sieve No. 4) shall be no more than 10 percent of the total weight of the material. Clay determined by the Engineer as commingled with unsuitable soil or debris shall not be used and shall be removed from the site. The compacted material shall have a coefficient of permeability no greater than 1.0×10^{-6} cm/sec.

b. A source of low permeability soil has been identified at the Otay Annex Sanitary Landfill in Chula Vista, California. The selection of the source was based on a limited amount of laboratory testing on representative samples. The Engineer shall perform additional geotechnical and analytical tests on the identified borrow material, prior to use in low permeability layer. All borrow operations at the landfill shall conform with the Agreement with the Landfill Owner, Allied Waste Industries, Inc. The Agreement is provided as Exhibit A to these specifications.

c. The Contractor may propose alternative source(s) for the low permeability layer. The Contractor shall submit the details of the source and data on quantified properties of materials to the Engineer for approval. The Contractor shall perform geotechnical and analytical tests on the material from alternative source(s). The geotechnical testing shall consist of gradation analyses (ASTM D422), Atterberg limits (ASTM D4318), USCS soil classification (ASTM D2487), visual soil classification (ASTM D2488), specific gravity (ASTM D845/C127), compaction testing (ASTM D1557), and saturated hydraulic conductivity (ASTM D5084). Engineer's approval of the source shall not relieve the Contractor of its responsibility to meet the Specification requirements as placed.

6.3.3 Otay Annex Landfill Borrow Operations

The following measure shall apply regarding the Contractor's activities at the Otay Annex Landfill (OAL) site:

a. All activities shall be conducted in such a manner as to not create hazards and to avoid injury or damage to any persons or property;

b. Clay shall be removed from the designated borrow site only;

c. All work shall be conducted during daylight hours on weekdays;

d. Unless otherwise permitted by the Landfill Owner, the number of loads leaving the borrow site shall be limited to ten (10) per hour.

e. Vehicles shall be limited to traveling on the designated access route indicated on the borrow site Agreement. The Landfill Owner shall have the right to cause the relocating of the access route within OAL property. Any additional costs are to be borne by the Contractor.

f. The Contractor shall at all times control the generation of dust from its activities on the borrow site. A sufficient number of water trucks shall be operated to ensure the control of dust to the satisfaction of the San Diego Air Pollution Control District. Further, the Contractor shall remove all dust, dirt, clay and other debris which may collect on Maxwell Road adjacent to the OAL property on a daily basis.

g. The Contractor shall be solely responsible for obtaining water for construction and dust control operations at the OAL site. The Contractor should be aware that water may be available at the OAL site in accordance with the Owner's agreement with the Landfill Owner.

h. Contractor's operations shall not adversely affect OAL operations. When necessary to facilitate OAL's operations, the Landfill Owner is entitled to, upon proper notification of a least seven (7) days in advance, to suspend Contractor's operations for a period not to exceed seven (7) days each month, but not more than once each month, during the life of the contract.

i. On completion of the work, the Contractor shall restore the entire site to a condition satisfactory to the Landfill Owner.

j. Grading shall be performed on the OAL site in accordance with the grading plans provided in Exhibit ___. A Geotechnical Engineer or Geologist under the direction of the Engineer shall determine and approve the suitability of materials at the borrow site to be transported to the site for use as low-permeability soil layer construction.

k. The Contractor shall use the freeway and local streets along the haul route as stipulated in the Agreement with the Landfill Owner (see Exhibit ___).

l. The Contractor shall be responsible for ensuring that clay-hauling trucks travel at safe and legal speeds. At the OAL site and Sesi property, speeds shall not exceed 15 mph.

6.3.4 Construction

a. Prior to construction of the low permeability layer, the Contractor shall construct a production pad using equipment and methods that would be used in the low permeability layer construction. The methods and equipment used in production pad construction shall be approved by the Engineer. The pad should be constructed to the minimum dimensions of 100 feet long × 50 feet wide × 2 feet thick, at a location approved by the Engineer. The Engineer shall conduct field and laboratory permeability tests, and in-situ moisture and density tests at the frequency specified in the QA/QC plan. Based on the test results, the Contractor, with the approval of the Engineer, shall duplicate for low permeability layer construction the type of equipment and construction methods used in test pad construction.

b. The low-permeability soil shall be placed and blended in stockpiles at the site. The stockpile area shall be located so as to avoid contamination of this material with other onsite materials. All stockpiles shall be limited in number and areal extent. The Contractor shall notify the Engineer sufficiently in advance of building a stockpile so as to allow the Engineer to survey or approve the subgrade. The Contractor shall obtain approval in writing from the Engineer before stockpiling any material.

c. The material in the stockpile shall be moisture conditioned and each 12-inch (maximum) lift processed by a minimum of two passes of a BOMAG MPH 100 or approved equivalent to provide a uniform moisture content. The moisture content shall be brought to within 3 to 6 percent over the optimum moisture content as determined by ASTM D1557. If the moisture content in the stockpile area or borrow area is higher or lower than permissible limits it is the sole responsibility of the Contractor to achieve the required moisture content by additional processing or adding moisture prior to transporting to the fill area. The moisture conditioned material shall be allowed to cure for a minimum of 48 hours within the stockpile prior to removal and hauling to the placement area. No new material will be added to a stockpile once the curing period has begun nor while material is being removed from placement on the fill. Any removal of oversize material greater than 1 inch size shall be performed on the stockpile by approved rock rakes.

d. The processed and cured soil shall be uniformly spread on the prepared foundation surface to provide a loose lift thickness not exceeding 8 inches. Any clay clods greater than 1 inch in size shall be broken down by suitable equipment. Moisture content of the soil shall be maintained at within 3 to 6 percent above optimum moisture content.

e. Following placement, each lift shall be compacted by a minimum of four (4) passes of an approved sheepsfoot (tamping foot) roller, to at least the minimum required relative compaction as determined by the Engineer from test pad results. The relative compaction shall be determined as per ASTM D1557. The number of passes of the compactor shall be increased if the minimum required density is not achieved within the moisture content range specified above. The Contractor shall take all steps necessary to obtain the required compaction. It is the sole responsibility of the Contractor to provide sufficient compactive effort and adjustments to the moisture, within specified limits, as required to meet the specified relative compaction. If necessary, the Contractor shall adjust the size or ballasting of the sheepsfoot compactor in order to obtain the required compaction.

f. The Engineer will perform gradation and Atterberg limits analyses, in-situ density and moisture tests, and will recover relatively undisturbed Shelby tube samples for laboratory permeability tests. Should the laboratory permeability values exceed the specified value of 1.0×10^{-6} cm/sec on properly compacted samples meeting the specified moisture and density criteria, the Contractor shall rework and recompact the lift as directed by the Engineer. The cost of reworking and recompacting shall be paid by the Owner at the specified contract rate for excavation and compaction of the low permeability layer. The cost of excavating test pits and any reworking and recompaction, if required, to correct the moisture content and/or compaction deficiency shall be borne by the Contractor. The Contractor shall provide all labor, material and equipment for testing and backfilling. All holes in the clay layer shall be backfilled with a bentonite/soil admixture developed by the Engineer.

g. The successive lifts of the low permeability layer shall be bonded by scarifying a portion of the lower lift to minimize lamination of fill. The total compacted thickness of the low permeability layer shall be a minimum one (1) foot as shown on the Plans.

h. The compaction of the material against side slopes and other confined areas where the specified compactors cannot be used, shall be performed by hand-held motorized plate compactors as approved by the Engineer. The requirements of density, moisture content and permeability shall be the same as specified above.

i. On side slopes flatter than 2.5:1 slope, the low permeability layer will be compacted on slope. For slopes steeper than 2.5:1, the material shall be placed in horizontal lifts as specified above for an equipment width and the over built portion trimmed back to the design lines and grades.

j. The finished surface of the low-permeability layer shall be graded as shown on the Plans. The low-permeability layer shall be protected to minimize development of shrinkage cracks. Any cracking observed prior to covering with the vegetative layer shall be inspected by the Engineer, and if the Engineer determines that repairs are needed, shall be repaired to the satisfaction of the Engineer.

k. Placement of vegetative soil cover shall begin only after all tests have been completed by the Engineer and the required relative density is achieved. The Engineer's written approval must be obtained prior to placement of vegetative soil cover on any area.

l. Contractor shall not puncture the finished clay layer. Any punctures must be filled (and sealed) with bentonite to the satisfaction of the Engineer.

6.4 Vegetative Layer

6.4.1 General

The work consists of excavation from the onsite borrow or stockpile, placing and compacting a minimum 18-inch-thick vegetative layer on top of the low-permeability soil layer, as shown on the Plans and as directed by the Engineer.

6.4.2 Materials

a. The lower 1 foot of vegetative layer material shall be free of waste, leachate or other contaminations and shall consist of sand, with silt or clay (SP-SM or SP-SC), clayey sand (SC), silty sand (SM), silt (ML), and clay (CL) that will sustain vegetation growth. The material shall not contain cobbles or rocks larger than 8 inches in the greatest dimension.

b. The upper 6 inches of vegetation layer shall consist of stockpiled topsoil obtained from stripping of the borrow area. The material shall not contain cobbles or rocks larger than 6 inches in the greatest dimension.

c. The borrow area shown on the Plans has been identified as the source of vegetative soil cover material. The Engineer shall perform analytical tests on the identified borrow material prior to use in the vegetative layer.

6.4.3 Construction

In general, construction of the vegetative layer shall follow Section 6.2.3 of the Specifications. The vegetative soil cover layer shall be placed in three lifts, which each lift not exceeding a compacted thickness of 6 inches. Moisture content shall be brought to between 0 and 5 percent above optimum moisture content as determined by ASTM D1557, prior to compaction. The first and second lifts shall be compacted to a minimum of 90 percent and upper third lift shall be compacted at 85 percent of the maximum dry density (as per ASTM D1557), respectively. The graded surface of the soil cover shall conform to the final grading Plans.

6.5 Measurement and Payment

a. Payment for loading, hauling, stockpiling and processing low permeability layer soil from the Otay Annex Landfill shall be compensated for in accordance with the unit price reflected in the Bid Schedule. The quantity shall be based on load counts of vehicles arriving at the site. Random weighing of trucks leaving Otay Annex Landfill shall be performed daily to provide an average weight of soil per truck for calculating payment. All costs associated with this work shall be reflected in the unit rate and no additional payment shall be made.

b. Payment for foundation layer, low permeability soil layer and vegetative layer shall be made at the unit price bid per cubic yard of the respective material placed.

c. The quantities for payment for foundation layer shall be determined by the Engineer on the basis of surveys taken of the prepared landfill surface following excavation and relocation of waste, and following placement and compaction of foundation layer to design grades.

d. The quantities for payment for low permeability soil layer and vegetative layer shall be determined by the surveyed as-built area multiplied by the design thickness of each layer.

The Contractor should be aware that consolidation of landfill subsurface material may occur during the Contractor's operation. The Engineer shall determine if consolidation has occurred and if necessary, make adjustments to the fill grades. Any corrections of fill volume placed by the Contractor as a result of these adjustments shall be compensated at the contract unit price for "Excavate, Place, Compact, and Finish Foundation Layer."

7.0 DRAINAGE STRUCTURES

7.1 General

7.1.1 Work Included

The work covered by this section consists of specifications for construction of concrete v-ditches, asphalt concrete drainage swale, concrete and riprap lined (stone revetment) channels and storm drain lines. The work shall include subgrade preparation and construction of channels to the lines and grades at the locations shown on the Plans. The work shall include but is not limited to furnishing all labor, materials, tools, equipment and services, and furnishing and installing all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete and compatible installation.

These specifications shall be used in conjunction with QA/QC plan. Specifications of the "Greenbook," 1994, shall be applicable to all details not provided explicitly in this document or on the Plans.

7.1.2 Submittals

The Contractor shall submit (3) three copies of the following items:

- Asphalt concrete mix design and certificate of compliance
- Concrete mix design(s)
- Certificates of compliance, material source data on concrete components
- Certificate of compliance, material data sheet for curing compound
- Certification of compliance, material data sheet for welded wire mesh
- Mill certificates for rebar

- Gradation, and quality certifications on riprap

- Certificate of compliance and material data sheets for HDPE pipe.

Other submittals required for PVC geomembrane, geotextile, and gabion, shall be submitted in accordance with those sections of the Specifications herein.

7.2 Materials

7.2.1 Asphalt Concrete

a. Asphalt concrete shall conform to Section 203-6 of the SSPWC, 1994

b. The grade of asphalt concrete shall be C2-AR-4000

c. Coarse aggregate shall be crushed rock or slag conforming to Section 200-1.2 of the SSPWC. Fine aggregate shall be sand, rockdust, slag, mineral filler or a blend of these materials. Sand shall conform to the requirements of Section 200-1.5.2, while rockdust and slag shall conform to the requirements of Section 200-1.2. The asphalt binder to be mixed with the aggregate shall be paving on liquid asphalt conforming to Sections 203-1 or 203-2. The grading of the combined aggregate and percentage of asphalt binder shall conform to the following requirements:

U.S. Standard Sieve No.	Percentage by Weight Passing Sieve
3/4"	100
½"	95 - 100
3/8"	72 - 88
No. 4	46 - 60
No. 8	28 - 42
No. 30	15 - 27
No. 50	10 - 20
No. 200	2 - 7
Asphalt Binder (%)	4.6 - 6.0

7.2.2 Riprap

a. Stone for riprap shall be approved durable broken stone quarry run, hard, resistant to abrasion and free from structural fractures, laminations and defects, and shall not contain shale, unsound sandstone, or other materials which will readily disintegrate. It shall be of such character that it will not disintegrate from the action of air, water, or the conditions to be met in handling and placing.

b. The riprap shall be composed of a well-graded mixture of stone. Where not shown on the Plans, the gradation of stone for riprap shall conform to the following:

Mean Size, d_{50} (inches)	Intermediate Dimension (inches)	Percentage Smaller than Given Size by Weight
9	15 12 9 3	100 50 - 70 30 - 50 2 - 10
12	21 18 12 4	100 50 - 70 35 - 50 2 - 10

Unless otherwise indicated, the minimum thickness of the riprap layer shall be 1.75 times the mean rock size. Flat or elongated shapes will not be accepted unless the thickness of the individual pieces is at least one-third of the length. At the time of placement the riprap shall be free of dirt and fines. The rock shall be sized so as to permit its interlocking.

Suitable tests as listed in Table 200-1.6(A) of the SSPWC, 1994, may be used to determine the acceptability of the stone.

7.2.3 Granular Bedding

Riprap shall be placed directly on a granular bedding spread over the approved subgrade or PVC geomembrane, as shown on the Plans. Grading of the granular bedding material shall conform to 3/8-inch crushed rock specification in Section 200-1.2 of the SSPWC.

7.2.4 Geotextile

Geotextile to be incorporated with drainage structures shall conform with Section 9.0 of these specifications.

7.2.5 PVC Geomembrane

PVC geomembrane shall conform with Section 8.0 of these specifications.

7.2.6 Concrete for Miscellaneous Drainage Structures

Concrete for miscellaneous drainage structures shall have a minimum compressive strength of 2,500 psi after 28 days, and shall conform to concrete Class 560-C-2500P of Section 201-1 of the SSPWC. All admixtures and additives shall also conform with Section 201-1.

7.2.7 Reinforcing Steel

Rebar shall be Grade 60 billet steel and conform with Section 201-2 of the SSPWC.

7.2.8 Curing Compound

Curing compound shall be nontoxic Type 1, conforming to Section 201-4 of the SSPWC.

7.2.9 Gabion

Gibions shall conform with Section 10.0 of these specifications.

7.2.10 HDPE Pipe

HDPE pipe to be incorporated with drainage structures shall consist of high density corrugated pipe with an integrally formed smooth interior, as manufactured by Advanced Drainage Systems, Columbus, Ohio, or approved equivalent. The pipe shall be the nominal inside diameter as indicated on the Plans. Pipe and fittings shall be made of polyethylene compounds.

The pipe and fittings shall be free of foreign inclusions, visible defects, or perforations. Fittings including couplers and neoprene gaskets shall be utilized to provide a water-tight joint. Couplers shall engage the pipe at least 2 corrugations on each side of the joint.

7.3 Construction

7.3.1 Asphalt Concrete Lined Drainage Channels

7.3.1.1 Subgrade Preparation

a. The subgrade for drainage channel construction either by excavating or filling shall conform to lines, grades, and cross-sections as shown on the Plans. The upper 12 inches of subgrade shall be compacted to a minimum relative density of 90 percent, determined as per ASTM D1557. The finished subgrade shall be firm and suitable for placement of asphalt concrete lining.

b. The finished drainage channel subgrade shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the asphalt concrete is placed. Asphalt concrete shall not be placed on subgrade that is considered too wet to support construction equipment.

7.3.1.2 Spreading and Compacting of Aggregate

Spreading and compacting shall conform to Standard Specifications for Public Works Construction, Section 301-2.

7.3.1.3 Quality Control

Quality Control of asphaltic concrete lining will include measuring temperature and thickness of placed material. The temperature of the mixture prior to placement shall be between 200 and 250 degrees Fahrenheit. The thickness shall be within ± 0.25 inches of the specified thickness of 3 inches and shall be measured every 25 feet along the drainage channel.

7.3.2 Riprap (Stone Revetment) Channel

7.3.2.1 Subgrade Preparation

The subgrade for riprap channel shall be prepared by either cutting or filling to the lines, grades and cross-sections shown on the Plans. The subgrade prepared to the specified grades should not contain loose materials and shall be approved by the Engineer prior to placing PVC geomembrane or granular bedding material. Subgrade for PVC geomembrane lined sections shall also be smooth, free of abrupt breaks and rocks or debris that may puncture the geomembrane.

7.3.2.2 Placing PVC Geomembrane

Placement of PVC geomembrane shall conform with Section 8.0 of these specifications.

7.3.2.3 Placing of Riprap

Riprap shall be placed on a 6-inch thick granular bedding spread over the approved subgrade or PVC geomembrane. The rocks in riprap shall be placed to the full thickness of the lining shown on the Plans in a single operation. In placing the riprap, the Contractor shall take adequate precautions to avoid displacement of underlying bedding material or damage to the PVC geomembrane. The Contractor may carry out hand placing of individual stones as necessary to obtain a reasonably well graded distribution. The finished riprap lining shall be free of pockets of small stones or clusters of larger rocks and shall be subject to approval by the Engineer.

7.3.3 HDPE Pipe

The installation of the HDPE pipe shall conform with relevant portions of Section 306 of the SSPWC. Trench excavation shall conform with Section 306-1.1. The dimensions of the trench including width shall conform with the Plans. Pipe bedding and laying shall conform to Section 306-1.2.1 and 306-1.2.2, respectively. Field jointing of the HDPE pipe shall conform with the manufacturer's recommendations and as approved by the Engineer. Backfill and compaction shall conform to Section 306-1.3.1 and Section 306-1.3.2. The backfill compaction requirements outside or below the limits of the final cover shall conform with Section 306-1.3.4. Where trench backfill is within the zone of final cover layers, the compaction and construction methods shall conform with Section 6.0 of these specifications.

7.4 Measurement and Payment

a. Payment for the geomembrane/riprap lined section of Channel A shall be compensated for in accordance with the unit price reflected in the Bid Schedule. Quantities for payment shall be determined by the Engineer based on the field measurements of the channels and length of drains constructed. Waste relocation, excavation, and final cover construction along this section of the channel shall be compensated in accordance with those sections of the Specifications. No separate payment will be made for completion of the geomembrane/riprap lined section of Channel A.

b. Payment for the riprap/geotextile lined section of Channel A shall be compensated for in accordance with the unit price reflected in the Bid Schedule. Quantities for payment shall be determined by the Engineer based on the field measurements of the channels and length of drains constructed. Excavation for the Channel along this section of the channel shall be absorbed in the unit price in the Bid Schedule for Foundation Layer construction. No separate payment will be made for completion of the riprap/geotextile lined section of Channel A.

c. Payment for the concrete lined section of Channel A shall be compensated for in accordance with the unit price reflected in the Bid Schedule. Quantities for payment shall be determined by the Engineer based on the field measurements of the channels and length of drains constructed. Excavation for the channel along this section of the Channel shall be absorbed in the unit price in the Bid Schedule for Foundation Layer construction. No separate payment will be made for completion of the concrete lined section of Channel A.

d. Payment for rip-rap lined channels along Line A-2 shall be compensated for in accordance with their respective unit prices reflected in the Bid Schedule. Quantities for payment shall be determined by the Engineer based on the field measurements of the channels and length of drains constructed. The unit prices shall include all incidental excavation, grading and materials including geotextile. No separate payment will be made for completion of the riprap lined channels.

e. Payment for HDPE storm drains along Line A-1 and Line B shall be compensated in accordance with their respective unit prices reflected in the Bid Schedule. Quantities for payment shall be determined by the Engineer based on the field measurements of the channels and length of drains constructed. The unit prices shall include staking, excavation, pipe, bedding, backfill, headwall/outlet structures, inlets, and other incidental work or materials required to complete the work. No separate payment will be made for completion of the HDPE storm drains.

f. Payment for concrete v-ditch and concrete v-ditch/block wall structures along Line A-1, Line B, brow ditches, terrace drains and terrace down drains shall be compensated in accordance with their respective unit prices reflected in the Bid Schedule. Quantities for payment shall be determined by the Engineer based on the field measurements of the channels and length of drains constructed. The unit prices shall include staking, excavation, and other incidental work or materials required to complete the work. No separate payment will be made for completion of the v-ditches.

g. Payment for the gabion stilling basin shall be compensated in accordance with the lump sum price shown on the Bid Schedule. Measurements shall be performed by the Engineer to confirm the structure was build in accordance with the Plans, not for a basis of payment. The lump sum price shall include all excavation, grading, gabion, geotextile, riprap, and other incidental labor and materials required to complete the stilling basin.

h. Payment for the asphalt/gabion swale shall be compensated in accordance with the unit price reflected in the Bid Schedule. Quantities for payment shall be determined by the Engineer based on the field measurements of the channels and length of drains constructed. The unit price shall include staking, grading, and other incidental materials and labor required to complete the work. No separate payment will be made for completion of the asphalt/gabion swale.

i. No separate payment will be made for completion of the drainage improvements as shown on the Plans. Incidental structures such as down drains, or miscellaneous grading shall be absorbed in the unit or lump sum prices identified above.

8.0 PVC GEOMEMBRANE

8.1 General

8.1.1 Work Included

The work includes furnishing all labor, materials, tools, equipment and services for installation of a 30-mil PVC geomembrane lining for Channel A.

8.1.2 Submittals

The Contractor shall provide three (3) copies of the following:

a. Shop plans with a proposed panel layout to cover the lined area shown on the project Plans. Shop plans shall indicate the direction of factor seams and shall show panel sizes.

b. Details shall be included to show the termination of the panels at the perimeter of lined areas and the methods of sealing around penetrations.

c. Certificate of compliance and material data sheets.

d. Manufacturers Quality Control (MQC) and Fabricators Quality Control documents for material supplied for this project.

8.1.3 Quality Assurance (QA)

8.1.3.1 The fabricator of PVC panels shall take samples from every 10,000 pounds of roll goods received from the PVC manufacturer. The fabricator shall pay for a qualified independent laboratory to perform the following tests in accordance with Table 8-1.

1) Thickness
2) Minimum tensile properties
3) Tear resistance

In addition, nondestructive seam samples taken before each fabrication shift shall be tested in accordance with Table 8-1.

8.1.3.2 All MQC and Fabrication QC testing data shall be provided to the QA/QC Manager for approval prior to installation of the PVC geomembrane.

8.1.3.3 The fabricator of the PVC synthetic membrane liner shall provide the Engineer with a list of not less than 10 projects and not less than 10 million square feet of successfully installed PVC synthetic lining. The project list shall show the name, address, and telephone number of an appropriate party to contact in each case.

The installer of the PVC lining shall be experienced in the installation of flexible membrane lining and shall provide the Engineer with a list of not less than 10 projects and not less than 10 million square feet of successfully installed PVC synthetic lining. The project list shall show the name, address, and telephone number of an appropriate party to contact in each case.

8.2 Materials

The lining material shall be polyvinyl chloride (PVC) membrane and shall be manufactured by the calendering process. The lining material shall be uniform in color, thickness, size and surface texture. The finished liner shall be free from pinholes, blisters, and contaminants.

The PVC liner shall have a smooth or matte finish on both sides and shall not be embossed.

The membrane shall be manufactured from a composition of high quality ingredients specifically compounded for use in hydraulic structures. Only domestic materials shall be used. Reprocessed or reground materials will not be acceptable. The PVC lining shall be as furnished by CMS Industries, LLC, of Stanton, California, or Engineer approved equal.

The lining material must have the minimum property values shown in Table 8-1.

TABLE 8-1
MINIMUM MATERIAL PROPERTIES
SESI PROPERTY CLOSURE PROJECT
OTAY MESA, SAN DIEGO

PROPERTY	TEST METHOD	TEST VALUE
Gauge (nominal)		30 mils
Thickness, minimum	ASTM D1593, Par. 9.1.3	28.5 mils
Specific Gravity (minimum)	ASTM D792; Method A	1.20 to 1.30
Minimum Tensile Properties (each direction)	ASTM D882	
1. Breaking Factor (lbs/inch width)	Method A or B (1-inch wide)	69 lbs/in width (2,300 psi)
2. Elongation at Break (percent)	Method A or B	300%
3. Modulus (Force) @ 100% Elongation (lbs/inch width)	Method A or B	27 lbs/in width (900 psi)
Tear Resistance (minimum average pounds)	ASTM D1004, Die C	8 lbs (267 lbs/in)
Low Temperature Impact (50% pass)	ASTM D1790	-20°F
Dimensional Stability (each direction, percent change maximum)	ASTM D1204; 212°F; 15 min	±5%
Water Extraction (maximum % weight loss)	ASTM D3083 (as modified by NSF)	0.35%
Volatile Loss (maximum % weight loss)	ASTM D1203; Method A	0.7%
Resistance to Soil Burial (percent change maximum in original value)	ASTM D3083 (as modified by NSF)	
1. Breaking Factor		5%
2. Elongation at Break		20%
3. Modulus @ 100% Elongation		20%
Hydrostatic Resistance (lbs/inch minimum)	ASTM D751; Method A	82 psi

SEAM REQUIREMENTS

FACTORY SEAM TEST	TEST METHOD	TEST VALUE
Bonded Seam Strength (factory seam breaking factor, ppi width)	ASTM D3083 (as modified by NSF)	55.2 lbs/in width, FTB
Peel Adhesion (lbs/inch minimum)	ASTM D413 (as modified by NSF)	10 lbs/in, FTB
Resistance to Soil Burial (percent change maximum in original value)	ASTM D3083 (as modified by NSF)	
Bonded Seam Strength		-20%
Peel Adhesion		-20%
FIELD SEAM TEST	**TEST METHOD**	**TEST VALUE**
Bonded Seam Strength	ASTM D3083 (as modified by NSF)	55.2 lbs/in, FTB

Note:
FTB = Film Tearing Bond

8.3 Construction

8.3.1 Fabrication

The individual widths of calendered PVC shall be factory fabricated into large sheets custom designed for this project so as to minimize field seaming. All factory seams shall provide a bond between the sheets sufficiently strong to meet the test requirements of these specifications. The factory seaming shall be accomplished by the use of dielectric fusion welding. The dielectric weld shall be a nominal 1-inch wide (½-inch minimum) continuous bond.

8.3.2 Panel Packaging and Storage

Factory fabricated PVC panels shall be accordion-folded onto a sturdy wooden pallet designed to be moved by a forklift or similar equipment. Each factory fabricated panel shall be prominently and indelibly marked with the panel size. Panels shall be fully enclosed in heavy, water-resistant cardboard and protected to prevent damage to the panel during shipment. The outside of each container shall also be prominently marked with the panel size.

Panels which have been delivered to the project site shall be stored in their original, unopened containers in a dry area and protected from the direct heat of the sun, especially when stored for a long period of time. Pallets shall not be stacked.

8.3.3 Subgrade Preparation

Lining installation shall not begin until a proper base has been prepared to accept the membrane lining. Base material shall be free from angular rocks, roots, grass and vegetation. Foreign materials and protrusions shall be removed and all cracks and voids shall be filled and the surface made level or uniformly sloping as indicated on the Plans. The prepared surface shall be free from loose earth, rocks, rubble and other foreign matter. The subgrade shall be uniformly compacted to ensure against settlement and shall be steel wheel rolled prior to liner installation. All ruts, areas of saturation or other disturbances to the subgrade shall be repaired prior to anchoring and seaming of the panels.

The surface on which the lining is to be placed shall be maintained in a firm, clean, dry and smooth conditions during lining installation.

8.3.4 Lining Installation

The PVC lining shall be placed over the prepared surface in such a manner as to assure minimum handling. Anchor trench excavation and any structure seal preparation should be completed before lining installation begins. The sheets shall be of such lengths and widths and shall be placed in such a manner as to minimize field seaming. Horizontal field seams on the slopes shall not be allowed. Only those sheets of lining material which can be anchored and sealed together that same day shall be unpackaged and placed in position.

The lining installation should be started at Cactus Road, Channel "A," Station 20+21, and proceed down channel. The leading edge of the liner shall be secured at all times with sandbags or other means sufficient to hold it down during high winds. Both fabrication and field seams shall be shingled so that the upper leading edge faces down channel.

Sandbags shall be used as required to hold the lining in position during installation. The sand bags shall not be filled with rock or debris with sharp edges which may snag or cut the lining. Materials, equipment or other items shall not be dragged across the surface of the liner or be allowed to slide down slopes on the lining. All parties walking or working upon the lining material shall wear soft-sole shoes without cleated treads.

Lining sheets shall be closely fit and sealed around inlets, outlets and other projections through the lining. Lining to concrete seals shall be made with a mechanical anchor as shown on the Engineer approved, installer shop plans. All piping, structures and other projections thorough the lining shall be sealed with approved sealing methods.

The liner shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation. Stretching of the liner to fit will not be allowed.

8.4.5 Field Seams

All seaming adhesives, caulking and mastics shall be of a type or types recommended and supplied by the manufacturer or fabricator of the PVC panels and shall be delivered in original 1 gallon containers each with an indelible label bearing the brand name and complete directions as to proper storage and use.

Field lap joints shall be formed by lapping the edges of panels a minimum of 6 inches. The contact surfaces of panels to be seamed shall be wiped clean to remove all dirt, dust, moisture and other foreign materials. Sufficient liner to liner bonding adhesive shall be applied to the joint area so as to form a continuous solvent weld approximately 2 to 3 inches wide. In applying adhesive, care must be taken to tie-in to the end of the previously completed seamed area so that leak paths or weak points in the seam do not occur. The surfaces should be pressed together immediately and a roller or flat wooden paddle used to squeeze the adhesive toward the leading edge of the panel. Any wrinkles shall be smoothed out. A small amount of adhesive should extrude and appear at the edge of the seam to indicate that sufficient adhesive has been applied. Excess adhesive should be wiped off with a clean rag. Seams shall be inspected after the initial seal and any loose edges shall be resealed, using the same procedure, to eliminate all free edges.

Extreme care shall be taken to avoid fishmouths in the field seams. Where fishmouths do occur, they shall be slit out far enough from the seam to dissipate them, lapped, seamed together in the lapped area and patched. Any portion of the lining damaged during installation, by any cause, shall be removed or repaired by using an additional piece of PVC lining as specified hereinafter.

8.3.6 Patching

Any repairs to the PVC lining shall be patched with the lining material and liner-to-liner bonding adhesive. The patch material shall have rounded corners and shall extend a minimum of 8 inches in each direction from the damaged area.

8.3.7 Cover Operations

The granular bedding material shall be placed over the lining as soon after liner placement as possible. The cover soil shall be placed over the lining in such a manner and with such equipment as the Contractor may choose, provided it is satisfactorily demonstrated to the Engineer that such manner and such equipment do not damage the lining. Only low ground pressure (LGP) equipment or hand methods shall be used to spread the earth cover. No equipment shall work directly over the PVC geomembrane.

8.4 Measurement and Payment

Payment for PVC geomembrane shall be reflected in the unit price identified in Section 7.4.a. of these specifications. No separate payment for PVC geomembrane shall be made.

9.0 GEOTEXTILE

9.1 General

9.1.1 Work Included

The work includes furnishing all labor, materials, tools and equipment for the installation of geotextile beneath the bottom and along the back of all riprap and gabion structures, in accordance with the provisions of the Contract Documents.

9.1.2 Submittals

The contractor shall submit three (3) copies of the following for the Engineer's approval:

1. Sample and manufacturer's specifications for geotextile
2. Certificate of compliance for geotextile
3. Manufacturer's installation instructions

9.1.3 References

9.1.3.1 Reference Standard and Specifications

The following standards and specifications form part of this section to the extent designated herein.

9.1.3.2 American Society for Testing and Materials (ASTM)

D-3786-80a	Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method
D-435584	Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Zenon-Arc Type Apparatus)

D-4491-85	Standard Test Methods for Water Permeability of Geotextiles by permittivity
D-4533-85	Standard Test Method for Trapezoid Testing Strength of Geotextiles
D-4632-86	Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
D-4751-87	Standard Test Method for Determining Apparent Opening Size of a Geotextile
D-4833-88	Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

9.2 Materials

9.2.1 Geotextiles

The geotextile shall consist of a nonwoven material composed of polyester or polypropylene, as manufactured by Synthetic Industries, or approved equal. The geotextile shall be resistant to chemical attack, rot, and mildew, and shall have no tears or defects which adversely alter its physical properties. The fabric shall meet physical requirements below:

PHYSICAL REQUIREMENTS FOR GEOTEXTILES

Property	Test Method	Value
Tensile strength, lb	ASTM D4632	150
Elongation, %	ASTM D4632	50
Puncture strength, lb	ASTM D4833	90
Burst strength, psi	ASTM D3786	350
Trapezoid tear, lb	ASTM D4533	65
Permittivity, sec-1	ASTM D4491	1.7
Ultraviolet degradation (500 HR), %	ASTM D4355	70
Apparent Opening Size (AOS)	ASTM D4751	70 min
Note: All numerical values represent minimum average roll values.		

9.3 Construction

9.3.1 Shipment and Storage

Shipment and storage of geotextile shall follow manufacturer's recommendations and these specifications. The geotextile shall be kept dry and wrapped such that it is protected from the weathering elements during shipping and storage. At no time shall the geotextile be exposed to ultraviolet light for a period exceeding 14 days. The fabric shall be labeled as per ASTM D4873.

9.3.2 Placement of Geotextile

Unless otherwise specified, the geotextile shall be overlapped a minimum of 1 foot at all longitudinal and transverse joints, and the geotextile shall be placed such that upstream sheet overlaps the downstream sheet. For placement on slopes horizontal seams shall not be allowed. The geotextile shall be anchored using key trenches or aprons at the crest and toe of the slope. Pins, usually 18 inches in length, should be used in securing the geotextile during installation except in areas underlain by the final cover or geomembrane.

9.4 Measurement and Payment

Payment for geotextile shall be based on unit price or lump sum items identified in other sections of the Specifications. No separate payment for geotextile shall be made.

10.0 GABION

10.1 General

10.1.1 Work Included

The work includes furnishing all labor, materials, tools, equipment and services for the installation of all gabions with appurtenant items in accordance with the provisions of the Contract Documents.

10.1.2 Submittals

The Contractor shall provide three (3) copies of the following submittals:

1. Manufacturer's product specifications and installation procedures for gabions and erosion control mats.

2. Name of source and certificate of compliance for gabion stone.

10.2 Materials

10.2.1 Gabions

Gabions shall be heavily galvanized steel wire mesh baskets of approved sizes intended for filling with stones as manufactured by MacCaferri Gabions, Inc., or approved equal.

a. Mesh: Mesh openings shall be hexagonal in shape, measuring approximately three and one-quarter inches (3-¼) by four and one half inches (4-½) uniform in size.

b. Mesh joints: All joints shall be flexible and triple twisted to prevent unraveling.

c. Galvanizing: All steel wire used shall be galvanized having a minimum amount of zinc coating of 0.80 OZ/SQ FT of wire, and complying with Federal Specification (QQ-W-461 g., Class 3).

d. Mesh wire: The steel wire mesh shall be U.S. Gauge No. 11 after galvanization.

e. Selvedge wire: The selvedge wire, running through all the edges (perimeter wire), shall be U.S. Gauge No. 9 after galvanization.

f. Lacing wire: The wire, necessary for assembling and lacing the gabion units, shall be U.S. Gauge No. 13 after galvanization.

g. Tensile strength of all wire used for manufacturing the gabions and lacing wire shall range from 60,000 to 80,000 psi in accordance with Federal Specifications (QQ-W-461 g, Class 3).

h. Load test shall be conducted in accordance with Federal Specifications (QQ-4-41 g, Class 3).

i. Elongation test shall be conducted in accordance with Federal Specifications (QQ-W-461 g, Class 3)

10.2.2 Stone

The gabions shall be filled with hard, durable, clean angular stone which shall be of an effective size of four (4) to eight (8) inches. The stones shall be rough, uneven quarry stones of approximately rectangular shape.

10.3 Construction

10.3.1 Subgrade Preparation

The subgrade for gabion structures shall be prepared by either cutting or filling to the lines and grades as shown on the Plans. The subgrade prepared to the specified grades should not contain loose materials and shall be approved by the Engineer. Prior to placement of gabion or erosion control cells, the subgrade shall be covered with geotextile.

10.3.2 Gabion Installation

a. The Contractor shall install, assemble and fill gabions with approved materials specified in Section 10.3.2, in accordance with the specifications to the grades and lines shown on the Plans.

b. The Contractor shall assemble the gabions in accordance with the procedures recommended by the manufacturer.

c. Gabions shall be manufactured in such a manner that their sides, ends, lid and diaphragm(s) can be assembled to form rectangular units of specified dimensions.

d. Gibions shall be of a single unit construction. The font, base, back and lid shall be woven into a single unit. The ends and diaphragm(s) shall be factory connected to the base.

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

f. The gabion dimensions shall be in accordance with the Plans. However, all gabions furnished by the manufacturer shall be of uniform width. Where the gabion length exceeds 1-½ times its horizontal width, the gabion shall be equally divided into cells by diaphragm(s) of the same mesh and gauge as the gabion body.

g. The individual gabion units, when properly located, shall be assembled into monolithic structure by lacing together adjacent units, along the perimeter of their contact surfaces. Where the gabion structures require more than one tier, the upper empty gabion tier shall also be laced to the top of the lower one.

h. The gabions shall be filled with stones specified in Section 10.2.2, and shall be approved by the Engineer prior to placement. Gabions shall be filled one at a time. Two connecting wires shall be placed between each layer along all exposed faces of the gabion structures. All connecting wires shall be looped around two mesh openings and the wire terminals shall be securely twisted to prevent their loosening. Where shown on the Plans or otherwise directed by the Engineer, the gabion mesh shall be cut, folded and wired together to suit existing site conditions. The mesh must be cleanly cut and the surplus mesh cut out completely, or folded back and neatly wired to an adjacent gabion face.

i. Finish surfaces of gabion structures shall be constructed within a vertical tolerance of 0.1 foot except where dimensions or grades are shown or specified as minimum. Finish grades of drop structure shown on the project Plans are approximate. The grade of the top of the drop structure shall be determined by the channel slope of 0.001 ft/ft from the as-built, downstream end of the stilling basin.

10.4 Measurement and Payment

Payment for gabions shall be based on the unit price or lump sum items identified in other sections of the Specifications. No separate payments for gabions shall be made.

11.0 MISCELLANEOUS CONSTRUCTION

11.1 General

The work described in this section includes installation of survey monuments, abandonment of groundwater monitoring Well WS3 and lysimeters, extension and protection of other groundwater monitoring wells, and fencing.

11.2 Survey Monuments

The Contractor shall furnish and install survey monuments at the locations and in accordance with the details shown on the Plans or as directed by the Engineer.

The monuments shall be cast-in-place in neat holes without the use of forms. The finished surface of the concrete shall be uniform of even texture and shall be free of holes, cracks and chipped edges.

Marker plates for the monuments shall be furnished by the Owner. The Contractor shall place the marker plates in the monument before the concrete has acquired its initial set and shall firmly bed it in the concrete. The concrete shall be so located that, when the plate is inserted, the desired reference point shall fall within a 1-inch circle in the center of the plate. Monuments shall be set firmly and vertically in the ground to depths shown on the Plans. The tops of the monuments shall be set flush with the ground surface.

The Contractor shall install suitable barricades/protection, approved by the Engineer, around the monument to prevent damage during construction and post-closure maintenance activities.

11.3 Groundwater Monitoring Wells and Lysimeters

11.3.1 General

Thirteen groundwater monitoring wells and two lysimeters have been previously installed by others at the locations shown on the Plans. Ten of the wells must be extended to accommodate the final cover grades and 2 wells and 2 lysimeters must be abandoned. Prior to abandonment or removal of the wells/lysimeters, well abandonment permits must be obtained by the Engineer. All methods and procedures shall be submitted in writing by the Contractor and discussed at a preconstruction meeting and approved by the Engineer before the work begins. The Contractor shall notify the Engineer 48 hours prior to the start of any work covered by this section and the Engineering Geologist shall be present during all such work.

11.3.2 Materials

a. Well casing shall be threaded, Schedule 40 PVC specially designed and packaged for use in construction of groundwater monitoring wells.

b. Disposable concrete column form shall be minimum 24-inch inside diameter as manufactured by Burke or Engineer approved equivalent.

c. Bentonite grout shall be Volclay grout as manufactured by the America Colloid Company or Engineer approved equivalent.

d. Well covers shall be CAP COPII, Model TC-73, locking well vaults as distributed by Longyear (800-241-9408) or approved equivalent. The covers shall be traffic rated and flush mounted. The covers shall have a minimum inside opening of 21 inches and skirt length of 22 inches.

11.3.3 Construction

a. Prior to construction of the final cover, Monitoring Well WS3 and the two lysimeters shall be abandoned by the Contractor in accordance with California Well Standards Department of Water Resources Bulletin 74-81 as revised by Bulletin 74-90. The work shall include removal of surface covers and concrete pads, overdrilling the PVC casing to the depth of the well/lysimeter, and grouting to the existing ground surface using Volclay grout or approved equivalent. Monitoring Well WS5 is shallow and will be abandoned by removal during excavation for the buttress fill.

b. The Contractor shall construct extensions for ten (10) of the remaining wells (all except MW-8) to accommodate the grade changes with construction of the final cover. It is the essence of this work that no foreign matter or debris fall into the well. Prior to initiating this work the Contractor shall submit and receive approvals from the Engineer of a plan for well extension procedures including methods for preventing contamination. At all times the Contractor is working on the well extensions, the Engineer's representative must be present, with no exceptions.

   Demolition of existing concrete pads, well covers and guard posts shall be performed in a manner as to not damage the existing PVC well casing. Casing extensions shall match the existing construction. Connections by threaded coupling shall be performed wherever possible, slip couplings can be used where threads on existing casing are damaged or missing. Both concrete form and well extension shall be guyed during grout placement. Volclay grout shall be added in lifts of no more than 2 feet. Final cover soil layers around the concrete form shall be placed and compacted by hand methods. New concrete pads and locking well covers shall be constructed in accordance with the details. The top of the concrete pad shall be finished at a minimum of 10 percent to divert water away from the well vault. Concrete steel guard posts of given normal diameter measuring 4-feet above grade and 3 feet below grade shall also be installed.

11.4 Fencing

The Contractor shall construct a 6-foot high, chain-link fence around the landfill as shown on the Plans and/or as directed by the Engineer. The chain-link fence and gates shall conform to Section 206.6 of the SSPWC, 1994. The chain-link fabric posts and fittings shall be galvanized. The gates shall be installed in the fence at the locations shown on the Plans or as directed by the Engineer.

11.5 Measurement and Payment

a. Payment for supply and installation of surface monuments and fencing shall be made in accordance with the lump sum price for "miscellaneous" in the Bid Schedule. The lump sum price shall include all labor, materials, equipment and supervision involved in construction of the survey monuments and fencing, complete in-place, including excavation and backfill as shown on the Plans and as directed by the Engineer.

b. Payment for the abandonment of Well WS-3 and lysimeters shall be made in accordance with the unit price bid per foot, in accordance with the Bid Schedule. The unit price shall include all materials, labor, equipment and supervision involved in the abandonment. No separate payment for the abandonment of well WS-5 will be made.

c. Payment for the extension of the monitoring wells shall be made in accordance with the lump sum price in the Bid Schedule. The unit price shall include all materials, labor, equipment and supervision involved to complete the wells to the new grades.

12.0 REVEGETATION

12.1 General

12.1.1 Work Included

The work described in this section consists of furnishing all plant, materials, equipment, labor and supervision, and performing all operations in connection with revegetation of the Site. The work shall include salvage of existing native plants, preparation of the seed bed including furnishing and placing inoculum on all areas to be seeded, furnishing and sowing seed, furnishing and applying mulch materials on all areas specified (or directed by the Engineer) to be seeded, planting container plants, and maintaining and tending the seeded and planted areas until a satisfactory stand of vegetation, relatively free of barren spots, is obtained.

Site revegetation shall be made in the Fall, after October 15, and prior to December 15.

12.1.2 Submittals

The Contractor shall submit three (3) copies of the following items for review by the Engineer. Approved submittals are required prior to construction of these items:

a Seed mix, slurry mix, and seeding application procedures including equipment.

b. Germination test results

12.2 Materials

12.2.1 Seed Mixture

The seed mixture furnished by the Contractor shall consist of the following plant species and additives:

Scientific Name	Common Name	Approximate Pounds of Seed/Acre
Native Grassland Seed Mix		
Bloomeria crocea	Common Goldenstar	1.0
Bromus carinatus	California Brome	6.0
Dichelostemma capitatum	Blue Dicks	1.0
Encelia californica	California Encelia	2.0
Eschscholzia californica	California Poppy	3.0
Hordeum californicum	California Barley	5.0
Lotus scoparius	Deerweed	3.0
Lupinus bicolor	Miniature Lupine	3.0
Nassella cernua	Nodding Stipa	1.0
Nassella lepida	Foothill Needlegrass	1.0
Nassella pulchra	Purple Needlegrass	3.0
Poa secunda ssp. secunda	Bluegrass	3.0
Sisyrinchium bellum	Blue-Eyed Grass	1.0
Viguiera laciniata	San Diego Sun Flower	3.0
Vulpia microstacys	Zorro Grass	2.0
Sage Scrub Seed Mix		
Artemisia californica	California Sagebrush	2.0
Artemisia palmeri	Tall Sagebrush	2.0
Baccharis pilularis	Coyote Brush	0.5
Bromus carinatus	Brome Grass	2.0
Dichelostemma capitatum	Blue Dicks	0.5
Encelia californica	California Encelia	1.0
Ericameria palmeri	Palmers Goldenbush	0.5
Eriogonum fasciculatum	California Buckwheat	3.0
Eriophyllum confertiflorum	Golden Yarrow	1.0
Eschscholzia californica	California Poppy	1.0
Gnaphalium bicolor	Bicolored Everlasting	0.5

Scientific Name	Common Name	Approximate Pounds of Seed/Acre
Sage Scrub Seed Mix **(Continued)**		
Gnaphalium californicum	California Everlasting	0.5
Helianthemun scoparium	California Rush Rose	1.0
Hordeum californicum	California Barley	1.0
Isocoma menziesii	Coast Goldenbush	2.0
Iva hayesiana	San Diego Poverty Weed	3.0
Lasthenia californica	Goldfields	1.0
Layia platyglossa	Tidy Tips	1.0
Leymus condensatus	Giant Wild Rye	1.0
Lotus scoparium	Deerweed	2.0
Lupinus bicolor	Miniature Lupine	2.0
Lupinus succulentus	Arroyo Lupine	2.0
Malocothamnus fasciculatius	Mesa Bushmallow	1.0
Melica imperfecta	Coast Range Melic	1.0
Muhlenbergia rigens	Deergrass	1.0
Nassella cernua	Nodding Stipa	1.0
Nassella lepida	Foothill Needlegrass	1.0
Nassella pulchra	Purple Needlegrass	3.0
Plantago insularis	Plantain	10.0
Salvia apiana	White Sage	2.0
Salvia mellifera	Black Sage	1.5

The seed shall be less than two years old. Seed with Inoculum is preferred to aid establishment of vegetation. Germination tests of the seed shall be made less than four months prior to seeding operations and a certificate of such tests shall be furnished to the Engineer. The germination tests, for an acceptable seed, shall indicate the minimum germination shown on the table. When directed by the Engineer, the above mixture may be varied to suit any special condition of soil peculiar to the areas to be seeded. Seed which has become wet, moldy, or otherwise damaged in transit or storage shall not be acceptable.

12.2.2 Container Plants

Container plants furnished by the Contractor shall consist of the following plant species:

Botanical Name	Common Name	Container Size
Baccharis glotinosa	Mule Fat	1 gal
Salix gooddingii	Black Willow	1 gal
Sambucus mexicana	Mexican Elderberry	5 gal

Plants shall be obtained from Tree of Life Nursery (San Juan Capistrano) or other nurseries approved by the Engineer. Plants shall be vigorous, undamaged, and not diseased or root-bound in containers. Plants delivered to the Site shall be property stored, maintained and watered prior to planting. Diseased, dead or otherwise damaged plants shall be removed promptly from the Site and replaced by the Contractor.

12.3 Construction

12.3.1 Soil Preparation

Prior to installation of the temporary irrigation system and weed abatement, planting areas less than 3:1 in slope or where recommended in the field by the Engineer, should be thoroughly cross-ripped or scarified to a maximum depth of six inches (6") to alleviate the surface compaction. Scarification or cross-ripping shall be performed by 2 passes, perpendicular to each other, with the final pass parallel to the slope contour.

In areas that are not scheduled for imprint seeding, an inoculum of vesicular-arbuscular mycorrhizal fungi (*Glomus intraradices*) consisting of spores, colonized root fragments and other propagules in a clay-based carrier should be spread at thirty (30) liters per acre between cross-rips.

Areas greater than 3:1 in slope should be scarified to a depth of two to six inches (2" - 6") before weed abatement to enhance weed seed germination and to provide optimal surface texture for application of seed. As part of the post weed abatement scarification an inoculum of vesicular-arbuscular mycorrhizal fungi (*Glomus intraradices*) should be spread at thirty (30) liters per acre.

12.3.2 Irrigation Systems

Irrigation systems should be above grade, temporary overhead sprinklers. Sprinkler heads should be placed a minimum of twenty-four inches (24") above grade in order to dissipate water being delivered to the planting areas. Radii for sprinkler head should not exceed fifty (50) feet. Spacing of sprinkler heads should be based on fifth (50%) percent diameter of throw. Sprinkler systems should conform to contours and large grade differences valved separately. Check valves should be installed for every ten feet (10") of grade difference. Upon completion of successful plant establishment, irrigation systems should be removed.

12.3.3 Weed Abatement

Upon completion of soil preparation and irrigation systems, all areas should be watered four (4) times daily for twenty-one (21) consecutive days or until weed seeds have germinated. Watering should then be ceased for three (3) days. A non-selective contact herbicide (Roundup Pro or Rodeo) should be sprayed to eradicate the germinated weeks except areas within 20 feet of drainage channels. For those areas weed abatement shall be performed by manual methods.

Allow the herbicide to kill all weeks. A waiting period prior to clearing weeds should be seven (7) to ten (10) days. Rake or hoe off all dead weeks to a minimum depth of one-quarter (¼) inch below the surface of the soil. Remove all cleared weeds and dispose.

Re-water cleared planting areas four (4) times daily for fourteen (14) consecutive days, until new growth appears. Re-apply herbicide. Clear weeds after seven (7) to ten (10) days. Remove all cleared weeds and dispose.

12.3.4 Seeding

Seeding should be performed by a combination of three methods: seed imprinting; hydroseeding; and hand broadcast seeding. Seeding should be conducted between October 15 and December 15 to achieve maximum success. Application of each seed mix should minimally overlap the adjacent seeded area to create an even transition area.

12.3.5 Seed Imprinting

Seed imprinting should be used in areas to receive the Native Grassland seed mix where slopes are 3:1 or less. On grade temporary irrigation installed for weed abatement should be removed prior to the seed imprinting and reinstalled after. Seed imprinting should be conducted when there is sufficient moisture in the soil to form the imprints and make the seed stick to the surfaces of the impression. Imprints should be V-shaped and four to six (4 - 6) inches in depth. Faces of imprints should join to make an angle between sixty (60) and (90) degrees. The length of each imprint should be ten (10) inches. Imprinting teeth should be arranged in alternating patterns with ends of the teeth separated by two (2) inches to discourage water channeling. The seed imprinter should be maneuvered through the Site with a small crawler tractor (John Deere JD450, Caterpillar D-4, D-5, or equivalent), and should have a drum of sufficient size to roll freely over any soil types. The long dimension of the imprint should be parallel with steep slope contours.

Imprinting should provide a raised soil ridge that prevents continuous movement of water between impressions. Seventy-five (75) percent of all imprinted surfaces should bear quality impressions, apart from areas deemed unimprintable due to shallow soils, rocks, or other natural features as approved by the Engineer. A minimum of seventy-five (75) percent of all impressions should reach full tooth depth (4" - 6"), and should have smooth and firm soil on the impression surface area. Imprinter should operate at a speed that allows full tooth penetration and dispersal of seed at the required rates (typically between 2 ane 5 miles per hour). Where Site conditions (fences, sign posts, rocks and other at grade features, etc.) prevent the seed imprinting machine from reaching complete coverage, the Contractor should hand seed and hand rake in the seed mix to achieve one hundred (100%) percent seed coverage. Mycorrhizal inoculum as described previously, should be imprinted simultaneously with seed at a rate of thirty (30) liters per acre.

12.3.6 Hydroseeding

Where planting areas are in slope conditions greater than 3:1 and as directed by the Engineer, seed should be broadcast by hydroseeding.

All hydroseed mixing should be performed in a tank, with a built-in, continuous agitation and recirculation system of sufficient operating capacity to produce a homogeneous slurry, and a discharge system that will apply the slurry to designated areas at a continuous and uniform rate. Water should be free of impurities, excess chlorine, and salts. The tank and all hoses should have been rinsed thoroughly of all seed and chemicals before entering the project Site. The tank and its hoses should also be rinsed thoroughly upon completion of hydroseeding each seed mix prior to proceeding to another seed mix. The slurry preparation should take place at the project Site and should begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft and good recirculation has been established, the seed should be added. The wood cellulose fiber and organic stabilizer should be added when the tank is at least one-third (1/3) filled with water. Spraying should commence immediately when the tank is full.

The hydroseed slurry should be sprayed in designated areas with a sweeping motion, in an arched stream, until a uniform coat is achieved and the material is spread at the required rate per acre. A slurry mixture that is not applied within four (4) hours after mixing should be considered non viable and replaced.

Standard hydroseeding technique should be employed, using a two (2) stage application as follows:

a. First Application

500 lbs/acre of weed fiber mulch
Specified seed

b. Second Application

2,000 lbs/acre of wood fiber mulch
150 lbs/acre of Ecology Control binder (or approved equal)

12.3.7 Hand Broadcast Seeding

Areas that are inaccessible to either seed imprinting or hydroseeding equipment, areas disturbed by container planting and other areas determined by the Engineer should be seeded by hand. In all hand seeding areas, the first one-quarter (¼") inch of the soil surface should contain residual moisture. If not the area should be watered thoroughly for three (3) consecutive days to saturate upper layers of soil and then the soil surface should be allowed to dry out for one day only prior to the seeding. If the soil has developed a hard crust, the surface must be scratched prior to hand seeding with a metal rock rake to make the surface of the mineral soil conducive to seeding.

Seed should be installed dry. Seeding application should be by hand or mechanical broadcasting, followed immediately by raking. Seed should be broadcast evenly on the soil around each plant outside of watering basins, not directly on or under container plantings. Seed should be broadcast to achieve an even, complete coverage for each species. Calibration of the mechanical broadcaster should be necessary for each type or similar type of seed, and may require several passes to complete the seeding. The mechanical broadcaster should be clean and free of contaminants before the initiation of the seeding operation. The seed should be thoroughly mixed onsite just before the start of seeding and each time seeding halts to move to a new location. Following the installation of seed over each area, the seed should be incorporated into the soil to a maximum depth of one-quarter (¼") inch by raking with a bamboo rake or equivalent, and tamped with the back of a rake, hoe, or similar tool to ensure good seed to soil contact.

12.3.8 Container Planting

Container plantings should be spaced in natural looking patterns to approximate the character of the natural riparian communities extant onsite. Plant locations should be marked with wire pin flags for approval before excavating pits.

All planting holes should be excavated by augur or shovel at least three (3) times as deep as the container plant's rootball and two (2) times as wide; all planting holes will have vertical sides with roughened surfaces. Each planting hole should be partially filled with the excavated backfill. Two (2) slow-release fertilizer tablets should be included for large shrub species only.

The planting hole should be filled with water, and the water allowed to be absorbed into the surrounding ground. Once the water has completely drained, the settled soil in the bottom of the planting hole should not be disturbed.

Remove the plant from the container and scarify the sides of the rootball to promote development of new roots. Any roots wrapped around the sides of the container should be pulled loose from the rootball. Each plant should be placed in the center of the pit with roots untangled. Roots should be laid out in the planting hole to promote optimal root distribution. Set the plant in the planting hole so that the crown of the rootball is one-half to one (½" - 1") inch above finished grade and backfill with Site soil excluding rocks greater than two (2") inch average diameter. Do not fill around trunks or stems.

Lightly tamp the finely broken up backfill around the rootball, making certain not to depress the crown of the plant. The top of the root collar should be exposed rather than covered with soil. A three (3") inch high earthen watering basin twenty-four to thirty (24" - 30") inches in diameter should be provided around each container plant.

Immediately following installation, each container plant should be deep soaked with sufficient water to reach the lower roots. Apply water in a moderate stream in the planting hole until the material about the roots is completely saturated from the bottom of the hole to the top of the ground.

A one (1") inch deep layer of mulch should be spread in the watering basin of each container plant. No mulch should be spread against the trunk of the plant.

12.3.9 Watering

Artificial irrigation should be supplied to the plantings and seeded areas as needed and recommended by the Engineer during the one year plant establishment period.

The amount and frequency of irrigation of each area should be determined through monitoring soil conditions during the initial irrigation period. During watering, the soil should be irrigated until the soil is saturated to below the root zone. Duration of waterings should require repeat limited applications over a short period of time to achieve the required watering depth and minimize runoff. Irrigation should then be withheld until soils near the surface start to dry.

After the first watering, the soil moisture in the root zones should be monitored to determine the proper irrigation frequency. Twice a month, a probe or other acceptable tool should be used to check the rootball moisture of representative plants as well as the surrounding soil. At no time should the revegetated areas be watered excessively or more frequently than needed to sustain the plants in a natural condition as adapted.

The following are general guidelines for irrigation frequency and duration. These guidelines may change depending on weather, and vigor of the plantings:

a. During the first winter and spring after planting, all plantings should be irrigated to supplement natural precipitation.

b. In the absence of natural precipitation for more than a seven (7) day period, approximately two (2) hours of irrigation should be provided or as long as necessary to penetrate the soil as sufficient to saturate the root zones of the containers and cuttings and to six (6") inches deep for the seeded areas.

12.3.10 Weed Controls

Weed species determined to be inconsistent with the revegetation goals should be removed manually, or by another approved method, on a continuing basis during the one (1) year pant establishment period. In no case should weedy species exceed an average height of twelve (12") inches nor should flowering weeds be allowed to set seed. Weeds and their roots systems should be completely removed.

Invasive, weedy plant species including, but not limited to, myoporum (*Myoporum laetum*) Hottentot fig (*Carpobrotus edulis*), caster bean (*Ricinus communis*), fountain grass (*Pennisetum setaceum*), sweet fennel (*Foeniculum vulgare*), pampas grass (*Cortaderia selloana*), tree tobacco (*Nicotiana glauca*), bull thistle (*Cirsium vulgare*), and cardoon (*Cynara cardunculus*) should be removed from any part of the revegetation areas.

Weeds should be removed by hand or using hand tools, and/or mechanical measures. Herbicides should be used only when determined to be necessary to eliminate a severe weed infestation and should require submitting a written request to the Engineer. The areas to be sprayed should be carefully marked, and no spraying should be allowed outside the designated area. The herbicide solution should contain an agricultural dye (turf dye) and the Engineer should oversee all spraying operations.

13.3.11 Supplemental Planting

Should supplemental planting and seeding be required to achieve project revegetation goals, to correct faults, bare spots, etc., these operations should take place between October 15 and December 15 of the second year.

12.4 Measurement and Payment

a. Payment for revegetation shall be made at the unit price bid per acre of the work area. The payment shall include the cost of materials, application of seed and mulching, planting of container plants, and maintenance of the area until a stand of vegetation to the satisfaction of the Engineer has been developed on the surface of closed landfill and slopes.

b. The quantities for payment shall be determined by the Engineer based on the surveys of the area.