SECTION C.3

PROPOSED DISPOSAL SITE DESIGN FEATURES
(27 CCR, SECTION 21600(b)(4)(A))

C.3 PROPOSED DISPOSAL SITE DESIGN FEATURES (27 CCR, SECTION 21600(b)(4)(A))

C.3.1 INTRODUCTION

A description of SCL's proposed disposal site design features is included in the following sections. The long-term development of SCL includes a 375379-acre landfill footprint (Figure 13) increased from the currently permitted 246 acres, which is comprised of 84 acres in SCL City and 162 acres in SCL County (Figure 2). As indicated in Section C.2.2, portions of the disposal footprint are outside of the refuse disposal limit set by the CUP Exhibit A (Alternate) issued by the County of Los Angeles. Although these areas are lined, only dirt fill may be placed within them. The maximum final elevation of SCL is proposed to be increased from 1,830 to 2,004 feet MSL on the SCL City side (which would account for approximately 4 feet of final cover including one foot of in-place intermediate cover). The SCL County side will remain at a maximum elevation of 1,904 feet MSL including final cover.

The groundwater protection system for the lateral expansion refuse areas will include a LCRS and a double composite liner system, underlain by subdrains as necessary. SCL will be constructed with interim and final drainage and erosion control systems, as well as environmental control/monitoring systems. SCL will also be capped with a final cover system designed in accordance with applicable regulatory requirements and permits. The proposed final closure design features and post-closure maintenance activities were developed in accordance with 27 CCR and are included in the PCPMP included as Section E of this JTD.

All of the engineering plans reflecting the proposed landfill are conceptual in nature and subject to change. The proposed composite liner system design, which is a component of the overall waste containment system, meets the standard design criteria specified in 40 CFR, Section 258.40. As required by 27 CCR, Section 21760, a Design Report detailing the construction plans and specifications for each lined waste management phase or subphase will be prepared and submitted to the RWQCB prior to construction. A Construction Certification report detailing as-built plans and quality assurance reports of the containment system will also be prepared and submitted to the RWQCB, upon completion of containment system construction for each area of development.

C.3.2 EXCAVATION PLANS (27 CCR, SECTION 21600(b)(4)(D))

C.3.2.1 GENERAL DESCRIPTION

The Base Grading Plan for the SCL expansion is presented in Figure 9 and incorporates the grades at top of liner for expansion Phases CC-I through CC-V. Excavation will occur approximately five to eight feet below the grades depicted to account for containment systems and subdrains where needed. Excavation volumes and phasing of operations are discussed in Section C.3.10 for each development phase.

The master floor bottom grades for the expansion range between 2.5 percent and 5 percent and the slope bottom grades range from 2:1 to 3:1 (horizontal:vertical). The overall bottom grading of Phase CC-I is sloped to drain to the existing sump in the easternmost portion of Cell A. The bottom grading of Phases CC-II through CC-V are sloped to drain all leachate directly into a future permanent sump at the southeastern end of Phase CC-III which will gravity drain to storage tanks (Figure 15). Further discussion of the master subdrain/leachate collection system is included in Sections C.3.3 and C.3.5, respectively.

Conventional construction equipment, such as excavators, haul trucks, wheeled loaders, dozers, and scrapers, will be used for excavation and grading activities. Hard-rock excavation is not anticipated to occur, except in localized areas. Hard rock excavation is defined as excavation that cannot be performed by a CAT D-10 or D-11 dozer with standard rippers. SCL will be excavated in general accordance with the lines and grades delineated in the base grading plan (Figure 9). Excavated soils will be used as daily and interim cover material or stockpiled for later use.

Unsuitable materials encountered below the base grade for the landfill, including alluvium, organic material, and landslide debris, will be removed. Engineered fill will be placed in those areas, as necessary, to restore the base grade for containment system construction and/or to provide adequate stability for slopes constructed for development of future phases. The unsuitable material will be excavated, in a number of construction stages as the working area of the landfill progresses to avoid opening large sections of potentially unstable material. A buffer area, typically on the order of 50-100 horizontal feet (15-30 m), or as deemed appropriate to maintain safe working conditions, will be maintained between the active cells receiving waste and areas under excavation. In accordance with 27 CCR 20240(d), a registered professional engineer or certified engineering geologist will delineate the limits of the unsuitable material to be removed and associated "backcuts" to facilitate its removal. Excavation will be conducted along the canyon axis for constructing subdrain systems (Section C.3.3 of this JTD).

In recognition of the existence of previously abandoned oil and gas wells within Sunshine Canyon, it is anticipated that grading activities have the potential to encounter such facilities. Abandoned oil and gas wells encountered during construction will be identified, tested, and if necessary re-abandoned in accordance with standards and procedures set forth by the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (CDC) (e.g., plug the perforated intervals with cement, install a cement surface plug, and weld a steel plate over the top of the casing). Section 3208.1 of the Public Resources Code (PRC) authorizes the CDC engineers to order the re-abandonment of any previously abandoned oil and gas well when construction of any structure over or in the proximity of the well could result in a hazard. BFI will undertake re-abandonment procedures if directed by the CDC as part of landfill development activities. Abandoned or unrecorded wells uncovered or damaged during excavation or grading activities may require remedial cementing operations. If this occurs, BFI will contact the CDC's district office to obtain information on the current requirements, and obtain their approval to abandon or re-abandon the excavated well(s). The well will be identified, excavated, tested, and re-abandoned, if necessary, in accordance with the CDC's Construction Project Site Review and Well Abandonment Procedures.

C.3.2.2 STABILITY OF EXCAVATION SLOPES

Stability analyses of the excavation slopes in the existing SCL County design are presented in the "Geologic Report and Slope Stability Analyses, Sunshine Canyon County Extension Landfill Phases V-VII" (A-Mehr, 2006) (see excerpts in Appendix R) and stability analyses of the excavation slopes in the existing SCL City design are presented in Appendix S. PortionsThe majority of Phase CC-I for the consolidated landfill overlap with is included in the existing SCL City and SCL County footprints and so the analyses in Appendices R and S have been included for informational purposes. The stability analysis for the entire consolidated SCL is included in Appendix N. Additional stability analyses for excavated slopes will be completed as required as individual phases and sub-phases are designed and submitted to the RWQCB for review and approval in the form of a design report. Further information on stability analysis is provided in section D.4.5.

C.3.2.3 MATERIAL AVAILABILITY/STOCKPILES

There are several existing soil stockpile locations for the SCL City and SCL County including the 500 foot setback area on the northeast side of City Unit 2 landfill (see Figure 2). As landfill development progresses, future stockpile locations for the proposed SCL will include existing locations as well as additional suitable areas on top of fill within the new phases that are not to final grades (see Figure 6). As of May 2007, approximately 5.76 mcy of soil was stockpiled at the SCL City and SCL County facilities. Over the life of the landfill expansion, excavation of phases CC-I through CC-V will result in approximately 16.81 mcy of soil for a total of 22.521.7 mcy available for cover and various landfill construction activities. Soils are available for final cover on-site. In the event that an entity other than SCL implements closure, at any time throughout the life of the landfill, they would have access to those on-site soils for final cover construction. See section C.4.2 for complete calculations of soil availability and soil needs throughout the life of the facility.

C.3.3 SUBDRAIN SYSTEM

As described in section C.2.3.1, shallow seasonal springs and seeps occur in the alluvial sediments and weathered bedrock underlying the landfill. Consistent with existing lined units of the landfill, a subdrain system will be installed as needed below the liner system for future phases. The purpose of the subdrain system is to protect against potential hydrostatic pressure against the liner system. A groundwater subdrain cross-section is shown on Figure 24. The subdrain consists of a 12 inch layer of gravel underlain by a 6-inch slotted or perforated HDPE pipe placed within a gravel trench underneath 3 feet of compacted native soil and the liner system. The subdrain system has been designed to withstand overburden, is oversized in regard to anticipated flows and includes a geotextile wrap to prevent clogging. This system has been designed to be maintenance free.

Figure 25 shows the existing subdrain system for the SCL County and the SCL City as well as proposed additions and modifications anticipated during construction of the expansion areas of the landfill. The proposed changes are conceptual in nature, with the actual configuration of new subdrains to be dictated by conditions as determined by a qualified geologist or professional engineer during excavation and grading of each new phase of the landfill. All groundwater seeps in the expansion areas will be intercepted by the subdrain system.

As Phase CC-I of the landfill expansion is developed, the existing SCL County subdrains which currently outfall at the temporary County sedimentation basin will be connected with a perforated HDPE pipe (for clean water) and a solid HDPE pipe (for impacted water - see section C.2.3.2). The former will connect with existing subdrains in SCL City Unit 2 which will continue to outfall into the terminal retention basin. The latter will be directed to the relocated landfill liquids treatment facility near the entrance of the landfill. Phase CC-II through CC-V subdrains will all be interconnected to flow down the main subdrain in the lower portion of the canyon in Phase CC-III where it will be joined with Phase CC-I subdrains and continue to outfall into the terminal retention basin.

C.3.3.1 LFG/SEEP COLLECTORS IN SLOPE LINER INTERFACE OVER EXISTING WASTE

Various sideslope areas of the proposed expansion overlap the existing unlined SCL City Unit 1 landfill. In order to address potential impacts from landfill gas and/or seeps from the unlined landfill on the subdrain system underlying the liner in the bottom of the expansion areas, two sets of collector trenches are proposed to be installed (Figures 26, 27 and 28). The upper trench will collect landfill gas from the sideslopes of the existing landfill units and convey it to the gas collection and control system for destruction. Lateral collectors arrayed up and down the slope of the existing landfill may also be installed as needed and connected to the collection system. The lower trench will collect any seep water from the unlined landfill units that may be impacted by leachate or landfill gas. Any seep water collected will be tested periodically and either discharged to the terminal retention basin or conveyed to the leachate treatment plant as necessary. Bearing capacity calculations were performed for the pipes in this area and are included in Appendix V. The calculations indicate that the anticipated loads from the waste placed on top of the pipes will not adversely affect their integrity.

C.3.4 LINER SYSTEM DESIGN

The liner system design for the future phases at SCL will be lined with a double composite liner as previously set forth in requirements specified in WDR Order No. R4-2007-0023 for SCL County, WDR Order No. R4-2003-0155 for SCL City and the Code of Federal Regulations (40 CFR), Parts 257 and 258 (Subtitle D).

Subtitle D contains design requirements for a prescriptive liner system and also allows an operator to develop and submit for approval, an alternative liner design in accordance with 40 CFR 258.40 (a)(1). For SCL, Phases CC-I through CC-V of the expansion consist of the following for the sideslopes and bottom areas:

For side slope areas (areas with gradients greater than 5:1), the liner system consists of (from bottom to top), as shown on Figure 23:

- a minimum 30-mil (.75-mm) thick textured HDPE geomembrane;
- geosynthetic clay liner (GCL) with a thickness of 0.25 in. (6 mm) and a saturated hydraulic conductivity less than or equal to 5×10^{-9} cm/s;
- a minimum 60-mil (1.5-mm) thick textured HDPE geomembrane;
- geotextile leak detection / drainage layer placed below a 60-mil HDPE separation layer on the lower 10 feet of the slope;
- geosynthetic clay liner (GCL) with a thickness of 0.25 in. (6 mm) and a saturated hydraulic conductivity less than or equal to 5×10^{-9} cm/s;

- a minimum 60-mil (1.5-mm) thick (smooth top textured bottom) HDPE geomembrane;
- geotextile filter fabric to serve as a cushion and drainage layer; and
- a minimum 24-in. (600-mm) thick protective (operations) soil layer.

For bottom areas (areas with gradients less than 5:1), the liner system consists of (from bottom to top), as shown on Figures 23:

- prepared native ground to provide foundation support for the overlying containment system components.
- in stream bed/seep areas only - a minimum 12-in. (300 mm) thick granular underdrain layer, with a hydraulic conductivity of 1 cm/s or more, and with centrally located subdrains along the canyon floors; a perforated pipe within a trench will be placed along the centerline of the canyon to collect and convey groundwater beneath the composite liner system (Figure 25);
- a minimum 24-in. (600-mm) thick low-permeability soil barrier layer, with an average saturated hydraulic conductivity of 1 x 10^{-7} cm/s;
- a minimum 60-mil (1.5-mm) thick textured high density polyethylene (HDPE) geomembrane;
- a drainage and leak detection layer consisting of a 12-inch layer of sand;
- geotextile cushion placed beneath the low-permeability soil barrier layer (not needed if GCL is used instead of clay);
- a minimum 24-in. (600-mm) thick low-permeability soil barrier layer, with an average saturated hydraulic conductivity of 1 x 10^{-7} cm/s, or approved equivalent (e.g., geosynthetic clay liner (GCL);
- a minimum 60-mil (1.5-mm) thick textured high density polyethylene (HDPE) geomembrane;
- geotextile cushion placed beneath the LCRS granular drainage layer;
- a minimum 12-in. (300-mm) thick leachate granular drainage layer, with a hydraulic conductivity of 1 cm/s or more, or equivalent geocomposite, with a perforated pipe along low points to collect and convey liquids to leachate sumps;
- geotextile filter fabric placed above the LCRS granular drainage layer; and
- a minimum 24-in. (600- mm) thick protective (operations) soil layer.

The specific liner design for each future phase of development will be documented in a Design Report to be approved by the RWQCB prior to construction.

Upon installation of the above described systems, any leachate percolating through the landfill would collect and flow by gravity through a system of laterals and mainlines to sumps which will be pumped to LCRS storage and treatment facilities to be relocated near the entrance to the landfill (Figure 13).

C.3.5 LEACHATE COLLECTION AND REMOVAL SYSTEM

C.3.5.1 GENERAL DESCRIPTION

The containment system design for SCL expansion areas include a LCRS above the liner to collect and convey leachate that may be generated within the refuse prism. The LCRS System layout for both existing and proposed areas is shown on Figure 15 and is comprised of a series of perforated header and lateral collectors and leachate sumps/outfalls (see details on Figure 24). The proposed system is conceptual in nature and will be designed in detail as part of the design report for each phase or subphase for review and approval by the RWQCB prior to construction. Leachate will be conveyed to collection sumps installed at low points at the base of the landfill. The leachate will either gravity drain or pumps will be installed in each sump as needed for removal of liquids for treatment in the leachate treatment facility or for reintroduction.

Design criteria for the LCRS will meet State (27 CCR) and Federal (40 CFR) regulations for municipal solid waste landfills. These criteria include:

- Maintaining liquid levels to one foot (30 cm) or less at all points on the liner system.
- System capable of collecting/removing twice the anticipated maximum daily liquid volume.
- A minimum base slope of 0.5 percent.
- Adequate performance in the anticipated leachate environment and under the expected maximum landfill loading conditions.

In the floor areas, the LCRS will consist of a 12-inch thick granular drainage blanket containing a network of perforated and solid-wall HDPE leachate collection pipes to convey accumulated fluids to the designated collection point. The drainage material will be covered with a geotextile to filter out fines from the overlying protective soil and reduce clogging of the LCRS. Clean-out risers will extend from the lateral collectors up the sideslopes.

C.3.5.2 LEACHATE GENERATION

For calendar year 2006, the site managed a total of 2.6 million gallons of leachate from a lined area of approximately 150 acres in the SCL City and County. This is equivalent to approximately 6.4 cubic feet per acre per day of leachate. The peak period, April 2006, generated a total of approximately 790,000 gallons, equivalent to 24 cubic feet per day per acre. Based on this information it is estimated that for the additional lined area (213 acres) of the expansion would generate an average of approximately 3.7 million additional gallons of leachate per year. This is a conservative calculation since there will likely be a decrease in leachate produced per acre from the existing due to increased thickness of waste and greater overall moisture holding capacity.

C.3.5.3 LCRS DESIGN

In general, the LCRS will consist of 6-inch diameter SDR 9 HDPE slotted pipe located in a V-shaped pipe trench. To minimize the potential for clogging, bio-fouling and piping, 85 percent of the gravel will be larger than the slot width of the pipe. The bottom area LCRS gravel pack will be overlain by a geotextile fabric to prevent clogging of the gravel from piping of the operations layer soil material. Due to the relatively flat grade along the base liner system, a 1-foot thick gravel layer will be provided over the majority of the bottom liner areas to keep the leachate head to less than 12 inches. In addition, the bottom gravel layer will host perforated LCRS lateral collectors that feed to the mainline pipes.

Regulations require that the LCRS layer extend up the side slopes of the landfill, as feasible. Any leachate contacting the slopes will flow along the operations layer/geotextile to the bottom LCRS collection system or bench collectors as necessary. Solid HDPE pipe LCRS down drains will be placed strategically along the bench down the slope to allow for liquids collection from bench collectors for conveyance downgradient to the LCRS mainline.

C.3.5.3.1 ACCESS RISERS AND LEACHATE EXTRACTION

Sideslope risers with dedicated leachate pumps for extraction will be installed as part of the construction of the leachate sumps which do not gravity drain. Permanent sump risers will ultimately daylight at the top of the refuse column and can also be used as access ports for testing of the LCRS pipes.

C.3.5.4 LEACHATE TREATMENT/DISPOSAL

Collected leachate and landfill gas condensate, and impacted subdrain water will continue to be conveyed to the leachate treatment facility currently located in the southern portion of the SCL County. The landfill liquids will be recirculated or are treated as described in section B.3.7.9. As the landfill is developed the leachate treatment facility will be relocated near the landfill entrance as depicted on Figure 13.

C.3.5.5 OPERATIONS LAYER

An operations layer (or protective soil cover) will be placed over the LCRS in bottom liner areas and over all slope liner areas. The operations layer provides protection from waste materials which may damage or puncture the HDPE liner component. The operations layer will consist of a minimum 2-foot thick soil layer. A geotextile fabric layer will be placed over the LCRS on bottom areas and over the liner system on sideslope areas prior to placement of the operations layer.

C.3.5.6 REINTRODUCTION OF LEACHATE/GAS CONDENSATE TO LANDFILL

The return of leachate and gas condensate is an acceptable practice at landfills under 40 CFR 258.28 and 27 CCR, Sections 20090(b) and (e), 20200(d), and 20340(g). The procedures outlined below will be implemented upon approval by the California Regional Water Quality Control Board, Los Angeles Region.

Reintroduction Methods and Procedures

In order to provide a flexible liquids management program, four different methods of leachate and condensate reintroduction may be employed:

- Vertical injection wells
- Vertical infiltration galleries;
- Horizontal infiltration trenches; and
- Spraying liquids on the working face of the landfill.

Each of these methods is described below:

<u>Vertical Infiltration Wells</u>

Vertical infiltration wells are constructed similarly to gas injection wells. A typical well would be a 36-inch borehole with an overall depth of approximately 60 feet. A 4-inch HDPE pipe is placed in the borehole, with ½-inch perforations in the lower 15 to 20 feet. The perforated pipe section is backfilled with gravel, and the upper section with native soil. Clayey soil and/or bentonite plugs are placed above the gravel pack and near the surface to prevent the well from becoming a landfill gas conduit to the surface.

Criteria for locating and constructing the infiltration wells include the following:

- The bottom of the well should be a minimum of 50 feet above the elevation of the liner in order to prevent short-circuiting of leachate to the LCRS, and provides a large volume of refuse below the bottom of the well for downward migration of the reintroduced liquid.
- A minimum of at least 30 feet of undisturbed refuse should remain above the top of the gravel pack in order to minimize the potential for increased gas migration to the surface.
- The infiltration wells are constructed in such a manner that in the future they may be converted to gas extraction wells, in the event the waste mass within the zone of influence of the well reaches its maximum moisture holding capacity, experiences a significant decrease in permeability, or otherwise becomes unusable for liquid reintroduction.

Wells may be filled by gravity discharge from a tank truck or by a pump distributing liquids to several wells from a storage tank. Each well will hold from 500 to over 1,000 gallons of liquid each time it is charged. Wells are filled in rotation, allowing several days for the liquid to infiltrate into the waste mass. Additional wells are constructed when the rate of infiltration becomes insufficient to keep up with the daily requirements. This can be expected to occur as the waste mass decomposes and settles, decreasing the hydraulic conductivity and ability of liquid to migrate through the waste.

Use of an infiltration well is terminated either when it becomes ineffective, or when it is estimated that the waste mass within its area of influence has reached its field capacity. This can be calculated from generally known information about waste moisture and the depth of waste in the landfill. Typically, refuse goes into the landfill with a moisture content about 50% of its field capacity of 4 inches of water per foot of refuse, allowing it to absorb an additional 2 inches of moisture per foot of depth.[Kmet, 1975]. Thus, a 2-acre area can absorb about 14,500 cubic feet of water, or 100,000 gallons, per foot of refuse depth brought to field capacity. At 3,000 gallons per day, a two-acre area of infiltration galleries will bring approximately 10 feet of waste per year to its field capacity.

When it becomes necessary to place additional waste over an area covered by an infiltration well, the vertical fill pipes are extended in the same manner that gas well pipes are extended as the landfill increases its vertical height.

<u>Vertical Infiltration Galleries</u>

Vertical infiltration galleries function as shallow, large-diameter injection wells. They are constructed by excavating a pit approximately 6 feet deep, with a diameter of 10 to 20 feet. The excavation is backfilled with a permeable material consisting of gravel, concrete or asphalt debris, or shredded tires, and a vertical perforated pipe is embedded in the backfill for delivery of liquids. About 40 cubic yards of material will be required to backfill each gallery. The permeable matrix is covered with soil to eliminate odors.

Depending upon the particle size and porosity of the backfill material, each infiltration gallery will hold from 1,500 to 3,000 gallons of liquid. Infiltration rates are expected to range from 500 to 1,500 gallons per day per gallery, depending on the permeability of waste, which will vary over time depending upon the degree of saturation, decomposition and settlement of waste in the area of influence of each gallery.

Although the large diameter galleries behave somewhat differently from vertical injection wells of smaller diameter but greater operating pressure, the areas of influence are expected to be similar. Accordingly, a typical well spacing of from 100 to 300 feet can be used for design purposes, based on the literature.[1] Infiltration galleries are located to avoid interference with landfill gas extraction wells that may be in the area. After some months of operation of the initial array of galleries, test holes may be drilled between adjacent galleries to determine the lateral spread of liquids as a basis for reducing the spacing in subsequent installations.

Operation of the vertical infiltration gallery system is straightforward. Each day, leachate and landfill gas condensate is collected by tanker truck and transferred by gravity to one or more of the galleries using the perforated fill pipe. Galleries are filled in rotation, allowing three to four days for the liquid to infiltrate into the waste mass at a nominal rate of 1000 gallons per day. Additional galleries are constructed when the rate of infiltration becomes insufficient to keep up with the daily requirements. This occurs as the waste mass decomposes and settles, decreasing the hydraulic conductivity and ability of liquid to migrate through the waste.

Use of an infiltration gallery is terminated either when it becomes ineffective, or when it is estimated that the waste mass within its area of influence has reached its field capacity. This can be calculated from generally known information about waste moisture and the depth of waste in the landfill. Typically, refuse goes into the landfill with a moisture content about 50% of its field capacity of 4 inches of water per foot of refuse, allowing it to absorb an additional 2 inches of moisture per foot of depth.[2] Thus, a 2-acre area can absorb about 14,500 cubic

---

[1] Reinhart, Debra and Timothy G. Townsend. Landfill Bioreactor Design and Operation. Lewis Publishers, 1998.

[2] Kmet, Peter. "EPA's 1975 Water Balance Method – Its Use and Limitations. Wisconsin Department of Natural Resources Guidance Report, 1982.

feet of water, or 109,000 gallons, per foot of refuse depth brought to field capacity. At 3,000 gallons per day, a two-acre area of infiltration galleries will bring approximately 10 feet of waste per year to its field capacity.

When it becomes necessary to place additional waste over an area covered by an infiltration gallery, the vertical fill pipes are extended in the same manner that gas well pipes are extended as the landfill increases its vertical height. Additional galleries may be constructed after an additional 40 feet of waste have been placed.

Horizontal Trench System

In the future it may become advantageous for BFI to install a system of leachate collection pumps and piping to eliminate the manual pumping of collection sumps and trucking of leachate to the reintroduction system. At such time the site may benefit from installation of a system of horizontal trenches to reintroduce liquids under pressure to the landfill. Such systems are well documented in the literature, and consist of:

- A horizontal trench 50 to 200 feet long, 2 to 3 feet wide and at least 3 feet deep, excavated into the surface of the waste;
- A 2-inch to 4-inch perforated pipe imbedded in a backfill of gravel, crushed concrete or asphalt, shredded tires, or other porous, free-draining material;
- At least one foot of cover soil placed over the trench; and
- A pumping means to deliver leachate and condensate to the perforated pipe and trench.

Trenches are placed parallel to each other with a typical spacing of 75 feet between them, based on the performance of similar installations reported in the literature. Liquid reintroduction rates on the order of 100 gallons per day per foot of trench can be achieved. [Reinhart and Townsend, 1998] As with the vertical infiltration galleries, the fill pipes of the trench system are extended upward as additional lifts of waste are added, with new trenches constructed at vertical intervals of approximately 40 ft. Trenches are set back a minimum of 75 feet from perimeter side slopes to avoid the potential for surface outbreaks of leachate or condensate.

Also similar to the vertical well, the useful life of a trench is limited by the eventual decrease in hydraulic conductivity and consumption of the liquid absorbing capacity of the underlying refuse column. Assuming a 75-foot wide area of influence, a 100-foot long trench can distribute approximately 450,000 gallons of liquid to bring a refuse mass 50 feet deep to its field capacity. Cumulative volumes of reintroduced liquids will be monitored to assure that this quantity is not exceeded.

Spraying Liquids at the Working Face

The fourth potential method of leachate and condensate reintroduction is direct application of liquids to waste deposited at the active working face. Guidelines for this method include the following:

- Only liquids without significant odors are reintroduced by this method.
- A water truck is used to distribute liquids uniformly over previously placed refuse.
- Liquids are applied in locations and by methods to assure that landfill operations personnel and customers are not exposed to sprays.
- Liquids are applied at a rate that ensures no standing liquid is observed at the working face.
- Additional waste or cover soil are placed over refuse that has been sprayed with landfill liquids.
- No spraying of liquids at the working face is done during rain events.

The amount of liquids applied directly to waste should not exceed 40 gallons per ton of refuse in order to avoid exceeding the field capacity of the refuse. Thus, 1,000 gallons of liquids theoretically should be applied to no less than 25 tons of waste. At an initial compaction rate of 1,000 lb./cubic yard, this would be 50 cubic yards of refuse. If the spraying is applied to affect only the top 12 inches of waste, 50 cubic yards would cover 150 square yards, or 1,350 square feet of active face area. As an operating guideline, the site will spread 1,000 gallons over a minimum area of 2,000 square feet of area. This will produce an average distribution of less than one inch of liquid over the refuse surface, sufficient to wet it without creating standing water conditions. Typical dimensions of the

Sunshine Canyon working face are 200 ft. by 400 ft., resulting in an area of about 80,000 square feet; thus a relatively small portion of the daily working face will be affected by surface spreading of landfill liquids.

Monitoring

Existing permit conditions related to leachate monitoring will be implemented. In addition, the following records will be maintained and reported to the RWQCB in the annual monitoring report:

- Leachate heads over the liner in the sump(s)
- Leachate volumes removed from each sump
- Volumes of leachate and condensate reintroduction, by location

C.3.6 ACCESS ROADS

A new main access road from the facility entrance to the proposed administration and scale complex will be built as shown on Figures 13 and 14. This will be built during Phase CC-I of the expansion. Access roads will be developed from the scales to expansion phases CC-II through CC-V as the various phases are constructed.

C.3.7 LANDFILL GAS EXTRACTION/RECOVERY

C.3.7.1 GENERAL DESCRIPTION

The landfill gas (LFG) extraction/recovery system consists of a series of horizontal and vertical extraction wells and collection laterals, which will be connected to a main header pipe leading to the various flare stations. The entire system can be divided into three main subsystems: the LFG extraction wells and collection laterals; the main LFG conveyance lines or headers, and the LFG treatment facility (flare station). A complete description of the existing LFG extraction system is included in Section B.7.2.

As of September 20, 2007 new regulations for Gas Monitoring and Control at Active and Closed Disposal Sites became effective. For disposal sites which receive greater than 20 tons of waste per day compliance is required within one year from the effective date. Section B.7.2.5 includes a discussion of the SCL's compliance with these new regulations.~~BFI acknowledges the new gas monitoring and control regulations which recently became effective. In accordance with the regulations, BFI has one year from the effective date of the new regulations to come into compliance. BFI anticipates a future submittal which will amend this JTD to include a gas management plan in compliance with the new regulations.~~

C.3.7.2 PROPOSED LANDFILL GAS SYSTEM FACILITIES AND OPERATION

During active operations, horizontal collection pipes will be installed incrementally to provide ongoing environmental control. As the expansion areas are developed additional vertical extraction wells will be installed as needed. A conceptual plan for vertical wells at final build-out is shown on Figure 18. The extracted gas will be transported to the flare stations through gas headers. Landfill gas generation calculations were prepared and peak production is projected to occur in 2039 at approximately 13,990 standard cubic feet per minute (scfm) (see Appendix B). Based on this anticipated peak gas generation, additional flares will be required. The number of additional flares required will depend on the amount of LFG the site generates and the amount of gas used for a LFG to energy, LNG or other conversion technology facility that may be installed at SCL. At this time, approximately two additional flares are estimated to be required as SCL is developed. The two potential locations for the future flare stations have been identified as shown on Figure 18. The ultimate location(s) for the new flare facilities will depend on air dispersion modelling and SCAQMD approvals.

Condensate which forms in the gas system piping will gravity drain to storage tanks or sumps placed at low-points in the system around the landfill. The collected condensate will be removed from the sumps manually or will be pumped automatically to a central holding tank.

BFI is continuing to consider the potential for energy recovery from landfill gas at the SCL. Potential energy recovery options include off-site industrial use of landfill gas, electricity generation and sales and conversion of landfill gas into liquefied natural gas (LNG) for use by refuse trucks or other end users. To date an economically viable program has not been identified. Should a viable program be identified, BFI will inform the appropriate agencies (e.g., CIWMB, LEA, and SCAQMD) of their intent and obtain necessary permits and approvals.

It is anticipated that the entire gas control/recovery system will be installed prior to closure and that minimal additions/modifications to the system will be necessary at closure. During closure construction, the system will be taken off-line in phases (as the final cover system is placed), modified appropriately and then reconnected.

C.3.7.3 PROPOSED PERIMETER MONITORING NETWORK MODIFICATIONS

Proposed probes GP-1 through GP-~~5~~ 10 have been located to replace probes that will be removed as part of the landfill expansion and achieve the required 1,000-foot spacing (see Figure 20). Probe GP-1 will be placed immediately upon approval of the SCL City/County consolidation to maintain the required spacing between probes P-212 and P-213. Probe GP-2 and GP-3 will be installed as part of Phase I of the consolidation and will replace probes P-211 and P-212. Probes GP-4 and GP-5 will be added to the network to replace P-209 and probes GP-6 and GP-7 will be added to ensure spacing of less than 1,000 feet along the west side of the County portion of the landfill. Proposed probes GP-1, GP-2, GP-3, GP-8, GP-9 and GP-10 have been located to replace probes that will be removed as part of the landfill expansion. A complete discussion of the proposed perimeter monitoring network modifications is discussed in Section B.7.2.5~~will be placed as part of Phase IV and will replace probes P-201 and P-202 and Probe GP-5 will be placed as part of Phase V and will replace probes P-230 and P-231~~.

Both existing and proposed probe depths have been evaluated for compliance with the recently (September 2007) enacted regulations in 27 CCR, Section 20925(c) and (d) via the probe construction logs~~ (see Appendix W)~~ and the elevation of waste in the proximity of the probes (~~Figure 1 of~~ see Appendix W). ~~Table 24 summarizes the results of this evaluation and requests exclusions or modifications as applicable.~~

C.3.8 DRAINAGE CONTROL

C.3.8.1 GENERAL DESCRIPTION

The surface water drainage control systems (both interim and final) for SCL are designed to accommodate 50-year, 96-hour storm event run-off volumes with peak flows bulked to account for debris production from a burned watershed. The interim and final systems are also designed to accommodate the peak flows resulting from the 100 year frequency 24 hour storm as required by 27 CCR 20365(f). Interim drainage control features and procedures will be instituted during active disposal operations and will include fill area grading, downdrains, earthen berms and desilting basins. This will provide continuous stormwater collection and conveyance in a controlled manner and minimize erosion, ponding and the potential for excess leachate generation and surface water contamination. Some of the interim drainage control system facilities (e.g., desilting basins) will be utilized as part of the final drainage control system for the site.

The proposed final drainage control system will include exterior slope downdrains, engineered deck area gradients and drainage berms, deck inlets, bench drains and inlets, trapezoidal perimeter channels and desilting basins. The following discussion outlines the methodology that has been used to design and analyze the drainage control system for the SCL. The final drainage control system configuration is shown on Figure 29.

C.3.8.2 HYDROLOGY

A hydrology study was conducted by Questa Engineering Corporation (Questa) to evaluate future surface water drainage conditions for the SCL in accordance with 27 CCR, Section 20365, and the Los Angeles County Department of Public Works Hydrology and Sedimentation Manual (Los Angeles County, 1991). As detailed in Appendix J, the analysis included the following steps:

- Determination of the design storm, the Capital Flood as specified in the LACDPW manual, with peak flows bulked to account for debris production from a burned watershed. The Capital Flood is equivalent to a 50-year, 96-hour storm event, and has been shown to produce higher peak runoff volumes than the 100-year, 24-hour event specified as the design storm for landfill surface water management facilities under CCR Title 27.

- Computation of runoff during the design storm from the on-site and off-site areas contributing to surface water runoff from the landfill. Runoff was computed from each of 42 subareas within the watershed of the City and County areas of Sunshine Canyon.

- Analysis of inlet and discharge hydrographs from the sedimentation/detention basins on the site, including Basins A, B, D and the terminal basin near the site entrance at San Fernando Road.

- Determination of basic design requirements for the major permanent channels and drain pipes for stormwater discharges from the sedimentation basins.

Peak total storm water discharges compare favorably with pre-project flows. Peak total discharge of the Terminal Basin serving the SCL is 1,916 cubic feet per second which is significantly less than the computed pre-landfill peak flow of 2,203 cfs. Figure 30 shows the Overall Hydrology Map developed by Questa.

C.3.8.3 DRAINAGE CONTROL SYSTEM

C.3.8.3.1 EXISTING ONSITE DRAINAGE FEATURES

Figure 17 shows the major existing stormwater management structures and features at SCL. They consist of the following:

- Sedimentation Basin "D" located at the extreme northwest corner of the landfill, which currently receives and detains runoff from the undeveloped canyon areas north and west of the landfill. It has two outlets, one to the west and one to the east.

- The west perimeter maintenance corridor (PMC), a large concrete-lined trapezoidal drainage channel receiving runoff from the west side of the landfill and cut slopes to the west. It runs from the west outlet of Basin "D" to Basin "A".

- The east perimeter channel, consisting of connecting segments of concrete channels, earthen channels, and pipes collecting runoff from canyons and cut slopes north and east of the landfill as well as drainage from easterly portions of the landfill. It begins at the east discharge of Basin "D" and terminates in pipes discharging to Basin "C".

- Existing Basin "C", currently the collection point for all runoff from the County Extension Landfill and tributary canyons outside the landfill footprint. This basin also receives seep water collected in the subdrain system constructed below composite liners in the landfill. It discharges to a drainage system comprised of temporary and permanent channels and culverts which also receives runoff from the City landfill and conveys it under the City Landfill access road to the terminal basin located near the site entrance.

- Existing terminal basin was designed with a storage capacity of 36.5 acre-ft. The terminal basin is sized to accommodate the combined hydraulic and sediment volumes corresponding to the contributory watershed for build-out of the SCL. The expected sediment production to the terminal basin is 10.5 acre-ft. Discharge is performed by three 78-in. diameter outlet pipes connected to a slotted riser pipe. An emergency weir spillway, with 3-ft of depth, is positioned at the top of the berm. The outlet pipes and emergency spillway discharge into a 48-ft wide concrete spillway channel. The terminal basin discharges through a concrete box channel underneath San Fernando Road into the Weldon Canyon Flood Control Channel, which is part of the City of Los Angeles flood control system.

C.3.8.3.2 FUTURE INTERIM DRAINAGE FEATURES

The proposed development of Phase CC- I will require relocation of existing sedimentation basin C in the County side of SCL (Figure 17). The following modifications and additions to the surface water management system will be made prior to or concurrently with the development of Phases CC-I through CC-V:

- Sedimentation basin C will be relocated to an area northeast of Phase CC-I, denoted as Basin B on Figure 29. Basin B will have capacity similar to that of Basin C.

- Sedimentation Basin D will be enlarged to increase its capacity.

- Diversion berms and grading on west cut slopes and northerly landfill slopes on the county side of SCL will direct some of the flow currently going to the west PMC into Basin D. In addition, the west discharge from Basin D will be eliminated, with Basin D discharging only to the east drainage channel. These measures will reduce flow to Basin A, reducing its peak discharge and impact on downstream structures.

- The east drainage channel will be re-routed around the northern portion of the Phase CC-I disposal area to the new sedimentation Basin B to be constructed east of Phase CC-I.

- Drainage from temporary and permanent slopes on the County side of SCL will be directed, to the maximum extent possible to Basins D, A and B. Remaining areas will drain, directly or indirectly, to drainage channels and interim basins on the City side of SCL as discussed below.
Full build out of the SCL will involve five main fill phases, CC-I through CC-V. Each phase alters the drainage patterns with the landfill footprint but does not alter the basic runoff configuration. Basins A, D, B, and the terminal basin are always functional throughout the build out phases and thus design storms never exceed the existing conditions outflows for the entire watershed.

The build out phases involve large excavations, construction of appropriate waste liners and the construction of buttresses as each new cell or construction stage within the main development phases proceeds. There are temporary drainage challenges for each phase of the build out as the initial excavation must collect runoff from a certain amount of watershed area. In many instances these excavations are closed off to through conveyance and collect runoff. The basic drainage concept is to construct a series of temporary drainage features such as v ditches and the down chutes/pipes that capture as much of the upslope runoff as possible and reroute it around the active excavation area and into one or more of the permanent storm detention basins. The runoff that is captured in the excavations is retained and then pumped from the excavation bottom up and over the top into either existing or new drainage conveyance facilities. In some cases the vertical pumping heights may necessitate a temporary interim basin and step pumping systems.

The storm water facilities at the base of these excavations will be designed to hold and retain a 10-year, 24-hour storm and can be pumped dry within 48 hours. According to the NOAA weather II atlas, this design storm has a 24 hour depth of six inches. The following discussion addresses each phase of the build out and its storm water management concept and presents concept drainage layouts.

Phase CC-I: This Phase entails some excavation of the area that straddles the City/County border and is just down canyon from the upper deck of the main refuse prism within the County (Figure 51). This excavation does not enclose or retain storm water runoff. All runoff is directed towards the terminal basin. To the extent possible upslope runoff will be directed into a series of bench v ditches and down chute pipes above the excavation area so the storm water is efficiently conveyed to the terminal basin.

Phase CC-II: The Phase CC-II excavation is to the southwest of the Phase CC-I excavation and involves the excavation and construction of a bowl-like watershed. Existing bench drains constructed as part of the previous fill will divert as much of the storm water away from the excavation as possible. Channels on the slope benches will be created as shown on Figure 52. However, a certain amount storm water runoff must be retained and pumped over the excavation rim and into a storm water system which leads to the terminal basin. The watershed that will drain into the excavation is 30 acres. This watershed generates approximately 15 ac-ft of runoff during the 10-year storm and would have a peak discharge rate into the excavation of approximately 60 cfs. In order to drain the runoff from the excavation a steady pumping rate of 4 cfs will need to be maintained and a retention basin of 2- to 3-acre feet will need to be developed at the base of the excavation.

Phase CC-III: The Phase CC-III excavation entails excavating in the center of the watershed where the existing access road currently exists. This excavation will create a basin that is 80 feet deep and has a watershed that is 31 acres. A series of v ditches above the 1,460 foot elevation will intercept runoff from adjacent landfill slopes and direct to the terminal basin. The watershed and the diversion ditches are shown on Figure 53. A retention basin of approximately 2- to 3-acre feet will be constructed at or near the downstream end of the excavation at elevation 1,390. Collected storm water will be pumped approximately 70 feet up and over the excavation edge and discharged into channels that lead to the terminal basin. A pump system with a 4 cfs capacity will be needed to drain the retention basin within 48 hours.

Phase CC-IV. The Phase CC-IV excavation is immediately above the phase CC-III excavation and fill area. The same techniques of intercepting runoff above the excavation will be employed during this phase. Figure 54 shows a conceptual drainage layout for this phase. The total contributory watershed to the excavation is 83 acres. The total volume of storm water runoff during the 10-yr, 24-hour storm is 42-acre feet. This water will retain in a basin and then be pumped up and out of the excavation. The runoff will need to be pumped approximately 260 vertical feet. The base of the excavation is at el.1,480. The runoff will be pumped in two phases. The first 120 feet will be pumped to a temporary retention basin located on adjacent bench at elevation 1,600. A second pump will then take the storm water from elevation 1,600 and discharge into a lateral channel at elevation 1,740 which will convey water down the canyon and connect to existing drainage systems leading to the terminal basin. Each retention basin will need to have approximately 7 to 10 acre feet of storage depending on the pumping capacity at each temporary basin.

Phase CC-V: The phase CC-V excavation storm water management will be handled in a similar manner to Phase CC-IV. The contributory watershed to the excavation will be minimized to the greatest extent possible by capturing and diverting runoff from up slope areas. The watershed size contributing runoff to the phase excavation is 150 acres. Two retention basins will be constructed. It is estimated that the contributory watershed of the lowest basin will be 98 acres. The contributory acreage to the upper basin is 52 acres. The runoff will need to be pumped approximately 260 vertical feet from the bottom of the excavation.

The base of the excavation is at el.1,480. The runoff will be pumped in two phases. The first 120 feet will be pumped to a temporary retention basin located on an adjacent bench at elevation 1,600. A second pump will then take the storm water from elevation 1,600 and discharge into a lateral channel at elevation 1,740 which will convey water down the canyon and connect to existing drainage systems leading to the terminal basin. Each retention basin will need to have approximately 7- to 10-acre feet of storage depending on the pumping capacity at each temporary basin. We estimate that a pumping capacity of 7 to 12 cfs will be needed at each retention basin.

C.3.8.3.3 FINAL DRAINAGE PLAN

In order for the landfill to collect and efficiently convey runoff through the planned system, a series of pipes, ditches and open channels are proposed. At present Basin D has two outlets that discharge to the north and south. At final build out one of these outlets will be removed from the basin. Discharge from Basin D will only go to the north and enter the proposed Basin B. Basin B will be constructed as part of the overall landfill extension. Basin B will have the same outlet configuration as Basin D. The major features of the system are shown on Figure 29. Based on the analysis detailed in Appendix J, the following drainage features will be part of the system:

<u>Grading</u>

The final cover of the Landfill extension shall be compacted and graded with a minimum 3 percent gradient to provide positive surface water drainage to direct surface water runoff away from the waste mass and into interceptor ditches, conveyance channels, and downchutes for discharge into the planned sedimentation basins.

<u>Basins A, B, D, and Terminal Basin</u>

At final build-out the SCL will have four basins A, B, D, and the Terminal Basin. All of the basins are sized to accommodate the combined hydraulic and sediment volumes corresponding to the contributory watershed for build-out of the SCL see Appendix J.

V-Ditches

Lined and unlined drainage diversion ditches (V-ditches) installed along the benches will intercept surface runoff from native and developed landfill slopes. Diversion ditches will convey surface water runoff from native and landfilled areas to designated low points along each bench where pipe downchute inlet structures are located. Drainage will be directed from the downchutes to the permanent perimeter channels for conveyance around the footprint to the terminal S/D basin. V-ditches may be unlined or lined with erosion control fabric or concrete.

Downchute Pipes

A 60-inch pipe will be needed to convey runoff from basins A and B to the terminal basin. Sizing calculations are shown in Table 5 of Appendix J.

Channels

To provide long-term surface water drainage control, lined perimeter conveyance channels may be installed along the main access road at the Landfill. These channels will be lined with concrete and energy dissipaters will be placed at appropriate locations. Table 5 of Appendix J shows the channel sizing data.

Conveyance channels will be sized to provide adequate hydraulic capacity to accommodate peak flow resulting from the 50-year, 96-hour burned and bulked design storm event.

The perimeter drainage channels will be constructed as the landfill is developed. In general the perimeter channel sections adjacent to specific landfill phases will be developed as each phase is excavated and the associated perimeter road is constructed. This occurs during the latter stages of filling of the previous phase. Therefore the last portion of the perimeter drain system will be completed during the excavation and construction of phase CC-V which will occur during the last stages of filling in phase CC-IV. Airspace constructed in Phase CC-V will provide approximately 71 mcy, or approximately 13 years of site life. Therefore the perimeter drainage system will be completed approximately 13 years prior to site closure. Should premature closure occur during the second largest open area (Phase C at 208 acres on Table 21) a cost of approximately $551,460 will be incurred for building 5,460 linear feet of drainage channel. The costs presented in Table 18 for Phase E are $896,000 more than the costs for Phase C and will be sufficient to cover this expense. Therefore, Phase E closure is still the costliest potential closure phase at the SCL.

C.3.8.3.4 EROSION CONTROL PLAN

The SWMS is a primary means for providing erosion and sediment control. In addition, erosion control measures will be implemented by SCL to comply with all applicable waste discharge requirements. Construction materials, equipment, and vehicles will be stored or parked in areas protected by berms and drainage ditches from surface water runoff. Construction material loading and unloading will occur in designated areas to minimize erosion. Pre-construction controls to be implemented include the use of sandbagging systems, including sandbag check dams and sandbag desilting basins, to help reduce surface water runoff velocities and sediment loads prior to entering the SWMS.

Surface water released from the terminal S/D basin will be monitored in accordance with NPDES requirements. SCL will continue to monitor the effectiveness of measures designed to prevent pollution from entering the off-site storm water system by maintaining its current coverage under the SWRCB's General Construction Activities Storm Water Permit Programs for the Landfill. Debris and sediment will be periodically removed from the terminal S/D basin to maintain adequate hydraulic capacity in the basin.

Revegetation and erosion control procedures will be implemented for exposed slope areas. The erosion controls may include soil stabilization measures and revegetation (e.g., hydroseeding).

C.3.9 LANDFILL LINER PHASING

C.3.9.1 INTRODUCTION

The proposed incremental limits of future liner for SCL are shown in Figure 6. Incremental landfill liner phase configurations are based on the anticipated fill sequencing anticipated over the life of the landfill. The following sections describe the rationale for the conceptual phasing, as well as the preliminary estimates of excavation, and airspace volumes. The proposed excavation and fill volumes are based on the master excavation plan, ultimate fill plan and slope stability constraints. The excavation quantities presented in the following sections account for the most conservative scenario since any potential stability issues will likely cause most slopes to be excavated more to layback for stability purposes or to relieve burden. This would result in more overall soil available for operations and closure of the landfill..

The onsite and offsite stormwater drainage control facilities and SCL infrastructure for the ultimate configuration are intended to be constructed progressively as waste filling is completed. Interim drainage and erosion control structures will be constructed and periodically relocated as waste filling progresses until final grades are reached. This will provide continuous stormwater collection and conveyance in a controlled manner to reduce erosion, ponding and the potential for excess leachate generation and surface water contamination.

The total airspace volume estimated in each phase as of May 19, 2007 was calculated based on conceptual Sunshine Canyon Landfill Phasing Plans developed by Bryan A. Stirrat & Associates, dated June 2007. The total gross airspace volume is that contained between the base grades (representing the top of liner) and the final fill plan surface which includes the LCRS and operations layer and the final cover. The base topographic maps for the phasing plans used to calculate the remaining airspace is dated October 19, 2006, which was the latest mapping available when the design plans were initiated. The excavation volume is the total volume (in cubic yards) between the excavation plan surface and the existing ground surface (topographic map dated October 2006).

C.3.9.1.1 EXCAVATION

The proposed incremental excavation phasing limits for SCL are shown on Figure 9. These bottom grades consist of approximate contours for the undeveloped areas of expansion Phases CC-I through CC-V where the double composite liner system will be installed. The upper slopes of excavations above the active cell will remain exposed until fill operations reach these areas and then the slopes will be lined. Note that the final limits of grading may be adjusted based on the final construction design.

C.3.9.1.2 INITIAL WASTE PLACEMENT PROCEDURES

To minimize the potential for damage to the liner system resulting from initial waste disposal operations, the following procedures will be implemented:

Initial Waste Fill Placement: Initial waste fill operations will include a uniform 10-foot initial lift of waste. This lift of waste will be placed to protect the operations layer. Direct contact of landfill equipment on the operations layer shall be minimized. In addition, the first lift of waste and associated daily cover will be graded to direct clean stormwater and surface water runoff off of the cell and minimize stormwater infiltration into the LCRS system. Filling operations will then proceed with typical lifts of ±20 feet, thereafter.

Waste Inspection: Wastes will be inspected to eliminate objects that could be driven through the liner system during placement and compaction of the initial lifts of waste. Waste inspection will be conducted continuously throughout the period of waste placement against the liner. The following items will be diverted from the fill: large metal objects, construction and demolition debris, and large green wastes.

Waste Unloading, Spreading and Compacting: Transport vehicles can travel in direct contact with the operations layer. Landfill equipment should minimize direct contact on the operations layer. Any area which has had direct contact with equipment which could damage the liner system shall be inspected prior to waste placement. Transport vehicles will tip loads from the operations pad or the deck of the compacted refuse fill. After waste has been unloaded from the transport vehicles, a uniform lift thickness will be established. To minimize the potential for objects to penetrate the operations layer, refuse will not be pushed excessively. During compaction, all compaction equipment will work on the deck and slope face of the waste fill.

Liner areas on the slope and the perimeter of the cell left exposed for future liner tie-in will be monitored periodically for potential damage from erosion.

C.3.9.2 PHASE CC-I

Phase CC-I of the proposed expansion is a transitional phase that incorporates previously approved areas from existing SCL City and SCL County permits. The remainder of Cell A from SCL City and portions of Phase CC-IV and all of Phase CC-V from SCL County are included in Phase CC-I as well as a small area between these areas. The final construction level plans and specifications for each sub-phase of Phase CC-I will be included in a Design Report required in 27 CCR, Section 21760 (a)(3) – (a)(4), to be submitted to the RWQCB and LEA prior to construction.

The following Phase CC-I excavation and associated fill plan have been developed for overall site soil management/construction budgeting purposes.

C.3.9.2.1 PHASE CC-I - EXCAVATION

The proposed Phase CC-I excavation includes the remaining area depicted on Figure 31- Phase CC-I Excavation. Approximately 2,443,000 cubic yards of soil is estimated to be excavated for this phase of development with an associated 680,000 cubic yards of fill (as of October 19, 2006). Final excavation quantities will be dependent on the final design.

C.3.9.2.2 PHASE CC-I - EXCAVATION STABILITY

Most of the Phase CC-I excavation grades have previously been analyzed as indicated in section C.3.2.2 and will create cut slopes resulting in grades that achieve a factor-of-safety that meets regulatory requirements. Additional stability analyses for excavated slopes will be completed as required as individual phases and sub-phases are designed and submitted to the RWQCB for review and approval in the form of a design report.

C.3.9.2.3 PHASE CC-I - FILL PLAN

The Phase CC-I Fill includes approximately 16,770,000 cubic yards of airspace, and approximately 5 years of life are estimated for this development area (Figure 32). Final airspace quantities will be dependent on the final design. It should be noted that due to the size of Phase CC-I, the liner construction will be implemented in smaller sub-phases.

C.3.9.3 PHASE CC-II

Phase CC-II of the proposed expansion is a phase on the City/County line that encompasses portions of previously proposed SCL City Cell C and SCL County Phase CC-VII as well as the area in between. The final construction level plans and specifications for each sub-phase of Phase CC-II will be included in a Design Report required in 27 CCR, Section 21760 (a)(3) – (a)(4), to be submitted to the RWQCB and LEA prior to construction.

The following Phase CC-II excavation and associated fill plan have been developed for overall site soil management/construction budgeting purposes.

C.3.9.3.1 PHASE CC-II - EXCAVATION

The proposed Phase CC-II excavation includes the area depicted on Figure 33 - Phase CC-II Excavation. Approximately 3,330,000 cubic yards of soil is estimated to be excavated for this phase of development with no associated fill. Final excavation quantities will be dependent on the final design.

C.3.9.3.2 PHASE CC-II - EXCAVATION STABILITY

Stability analyses for excavated slopes in Phase CC-II will be completed as required as individual phases and sub-phases are designed and submitted to the RWQCB for review and approval in the form of a design report. Final excavation grades for Phase CC-II will be based on the stability analyses to create cut slopes resulting in grades that achieve a factor-of-safety that meets regulatory requirements.

C.3.9.3.3 PHASE CC-II - FILL PLAN

The Phase CC-II Fill plan includes approximately 2,040,000 cubic yards of airspace and approximately 0.6 years of life are estimated for this development area (Figure 34). Final airspace quantities will be dependent on the final design. It should be noted that due to the size of Phase CC-II, the liner construction may be implemented in smaller sub-phases.

C.3.9.4 PHASE CC-III

Phase CC-III of the proposed expansion is located at the lower end of Sunshine Canyon and consists of a small strip between existing inactive City Unit 1 landfill areas (to the northeast and south) and the active City Unit 2 landfill (to the north). The final construction level plans and specifications for each sub-phase of Phase CC-III will be included in a Design Report required in 27 CCR, Section 21760 (a)(3) – (a)(4), to be submitted to the RWQCB and LEA prior to construction.

The following Phase CC-III excavation and associated fill plan have been developed for overall site soil management/construction budgeting purposes.

C.3.9.4.1 PHASE CC-III - EXCAVATION

The proposed Phase CC-III excavation includes the area depicted on Figure 35 - Phase CC-III Excavation. Approximately 890,000 cubic yards of soil is estimated to be excavated for this phase of development with an associated 60,000 cubic yards of fill. Final excavation quantities will be dependent on the final design.

C.3.9.4.2 PHASE CC-III - EXCAVATION STABILITY

Stability analyses for excavated slopes in Phase CC-III will be completed as required as individual phases and sub-phases are designed and submitted to the RWQCB for review and approval in the form of a design report. Final excavation grades for Phase CC-III will be based on the stability analyses to create cut slopes resulting in grades that achieve a factor-of-safety that meets regulatory requirements.

C.3.9.4.3 PHASE CC-III - FILL PLAN

The Phase CC-III Fill plan includes approximately 24,250~~600~~,000 cubic yards of airspace and approximately 7.2~~3~~ years of life are estimated for this development area (Figure 36). Final airspace quantities will be dependent on the final design. It should be noted that due to the size of Phase CC-III, the liner construction may be implemented in smaller sub-phases.

C.3.9.5 PHASE CC-IV

Phase IV of the proposed expansion is located adjacent to Phase CC-II on the City/County border and encompasses portions of previously proposed SCL City Cell C, SCL County Phases CC-VI and CC-VII, as well as the area in between. The final construction level plans and specifications for each sub-phase of Phase CC-IV will be included in a Design Report required in 27 CCR, Section 21760 (a)(3) - (a)(4), to be submitted to the RWQCB and LEA prior to construction.

The following Phase CC-IV excavation and associated fill plan have been developed for overall site soil management/construction budgeting purposes.

C.3.9.5.1 PHASE CC-IV - EXCAVATION

The proposed Phase CC-IV excavation includes the area depicted on Figure 37 - Phase CC-IV Excavation. Approximately 5,600,000 cubic yards of soil is estimated to be excavated for this phase of development with no associated fill. Final excavation quantities will be dependent on the final design.

C.3.9.5.2 PHASE CC-IV - EXCAVATION STABILITY

Stability analyses for excavated slopes in Phase CC-IV will be completed as required as individual phases and sub-phases are designed and submitted to the RWQCB for review and approval in the form of a design report. Final excavation grades for Phase CC-IV will be based on the stability analyses to create cut slopes resulting in grades that achieve a factor-of-safety that meets regulatory requirements.

C.3.9.5.3 PHASE CC-IV – FILL PLAN

The Phase CC-IV Fill plan includes approximately 3,710,000 cubic yards of airspace and approximately 1.1 years of life are estimated for this development area (Figure 38). Final airspace quantities will be dependent on the final design. It should be noted that due to the size of Phase CC-IV, the liner construction may be implemented in smaller sub-phases.

C.3.9.6 PHASE CC-V

C.3.9.6.1 PHASE CC-V - EXCAVATION

The proposed Phase CC-V excavation includes the area depicted on Figure 39 - Phase CC-V Excavation. Approximately 3,930,000 cubic yards of soil is estimated to be excavated for this phase of development with an associated 120,000 cubic yards of fill. Final excavation quantities will be dependent on the final design.

C.3.9.6.2 PHASE CC-V - EXCAVATION STABILITY

Stability analyses for excavated slopes in Phase CC-V will be completed as required as individual phases and sub-phases are designed and submitted to the RWQCB for review and approval in the form of a design report. Final excavation grades for Phase CC-V will be based on the stability analyses to create cut slopes resulting in grades that achieve a factor-of-safety that meets regulatory requirements.

C.3.9.6.3 PHASE CC-V – FILL PLAN

Phase CC-V Fill includes the balance of the refuse placement for the SCL site as depicted on Figure 40. Approximately 70,700,000 cubic yards of airspace volume is provided by this development area representing approximately 21 years of landfill life. Final airspace quantities will be dependent on the final design.

SECTION C.4

DESIGN CALCULATIONS

C.4 DESIGN CALCULATIONS

C.4.1 SITE CAPACITY

The total gross design airspace for SCL is approximately 140.9141.2 mcy and the remaining total gross airspace as of OctoberJuly 31, 2007 is 115.2116.3 mcy. Calculations used to determine the site's remaining capacity are discussed in Section B.3.2 and back-up calculations are included in Appendix C.

C.4.2 SOIL/STOCKPILE AVAILABILITY

Following are the results of the soil balance analysis:

Soil stockpiled as of May 2007:	5.7 mcy
Excavation of phases CC-I through CC-V:	16.8 mcy
Total Available Soils:	**22.5 mcy**

Soil required for daily and intermediate cover: (assuming refuse-to-soil ratio of 5:1)	18.8 mcy
Soil required for construction of new access road, berm, and soil buttress:	1.2 mcy
Soil required for operations layer:	0.7 mcy
Soil required for final cover:	1.8 mcy
Total Soil Usage:	**22.5 mcy**

, approximately 5.76 mcy of soil was stockpiled at the facilities. See Figures 2 and 6 for existing and proposed stockpile locations, respectively. Over the life of the landfill expansion, excavation of phases CC-I through CC-V will result in approximately 16.8 1 mcy of soil for a total of 22.521.7 mcy available for landfill construction. For purposes of this JTD, BFI has elected to assume a refuse-to-soil ratio of 5:1 and a typical lift thickness of approximately 20 feet for all phases resulting in a projected soil volume of 18.819.1 mcy used for daily and intermediate cover over the life of the landfill. An additional 2.3.7 mcy will be needed for the construction of the new access road, berm and soil buttress (1.2 (.7 mcy), the operations layer (.74 mcy) and final cover (1.82 mcy) for a total of

~~22.5~~21.4 ~~mcy of soil.~~ See Figures 2 and 6 for existing and proposed stockpile locations, respectively. This analysis results in ~~approximately .3 mcy of excess soil resulting in~~ an overall balanced soil management scenario in the long run.

C.4.3 SETTLEMENT ANALYSIS

A settlement analysis has been conducted by Geologic and Associates and is included in Appendix K. Based on the analysis the total projected settlement of the SCL might be as much as 90 feet for the thickest fill placed. This estimate is a cumulative estimate between the various waste thicknesses (see Figure 1 of Appendix K). Regarding the closed SCL City Unit 1, by the time new waste is placed in this area Unit 1 settlement will have virtually been completed (according to work done by Huitric (1981)) as this area will have been closed for over 20 years.

At the time of closure of the landfill, permanent monuments will be installed in accordance with 27 CCR, Section 20950, to provide both horizontal and vertical control points by which to monitor settlement of the final site face during the post-closure period. In addition, an aerial photographic survey shall be made of the entire SCL at final closure to produce a map at a scale and contour interval sufficient to depict the as-closed topography of each portion of the landfill in accordance with 27 CCR, Section 21142. In accordance with 27 CCR, Section 21142, an aerial photographic survey will be made of the entire SCL every five years throughout the post-closure maintenance period in order to update the original topographic map produced at closure. From this information, an iso-settlement map will be produced showing the changes in elevation between consecutive aerial surveys of the landfill.

C.4.4 LEACHATE GENERATION

Leachate is formed when surface water infiltrates and any free liquids inherent to waste migrate through the refuse prism. SCL will be operated to inhibit leachate formation by minimizing surface water infiltration. The containment system design for the proposed landfill area includes a LCRS above the composite liner to collect and remove leachate that may be generated within the refuse prism.

In order to size and locate the LCRS components for the proposed expansion areas, historical leachate generation for the SCL City and SCL County were used. The historical leachate generation volumes are discussed in Section C.3.5.2 and are applicable to all areas of the site.

C.4.5 DRAINAGE SYSTEM CAPACITY REQUIREMENTS (27 CCR, SECTION 21090(b)-(b)(3))

The design criteria for drainage control devices are based on the location of SCL, which precludes inundation of the landfill by a 100-year tide or flood and on hydrology calculations in Appendix J conducted for the SCL by Questa Engineering Corp. (Questa). Questa applied the methodology and data of the Los Angeles County Department of Public Works Hydrology and Sedimentation Manual [Los Angeles County, 1991] to evaluate the surface water management system at SCL. Questa determined the design storm, the Capital Flood, as specified in the LACDPW manual, with peak flows bulked to account for debris production from a burned watershed. The Capital Flood is equivalent to a 50-year, 96-hour storm event, and has been shown to produce higher peak runoff volumes than the 100-year, 24-hour event specified as the design storm for landfill surface water management facilities under CCR Title 27.

C.4.6 GAS GENERATION AND AIR EMISSIONS CALCULATIONS

In accordance with the SCAQMD regulations, a landfill gas control/recovery system has been installed at SCL. Calculations regarding projected gas generation (Appendix B) were conducted to determine the estimated number of flares required as SCL expands. The number of additional flares required will depend on the actual amount of LFG the site generates and the amount of gas used for a LFG to energy, LNG or other conversion technology facility that may be installed at SCL. Based on these factors and the calculations in Appendix B, approximately two additional flares are estimated to be required as SCL is developed. The gas control system will be expanded accordingly as the landfill develops. Landfill gas generation calculations will be required and verified in support of the expansion of the collection and control system as it is developed.

C.4.7 SOIL EROSION ANALYSIS

The Universal Soil Loss Equation (USLE) was used to evaluate potential soil losses within the watershed boundary of the SCL site. The USLE was intended for analysis of meadows and cropland soil loss. However, with certain engineered assumptions, it can be applied to soil cover over landfills.

The USLE is:

$$A = RKLSCP$$

where

A	=	average soil loss, in tons/acre
R	=	rainfall and run-off erosivity index
K	=	soil erodibility factor, tons/acre
L	=	slope-length factor
S	=	slope-steepness factor
C	=	cover-management factor
P	=	practice factor

The soil loss analysis performed is based on a "closed landfill" condition. At closure, the potential soil loss is minimal because the landfill will have a compacted final cover, an erosion control surface of vegetation and a stormdrain system installed which all contribute to controlling soil erosion.

The following USLE constants were utilized:

R = 76	Value for Southern California
K = 0.21	Soil Erodibility
$11.0 \geq LS \geq 1.2$	Dependent upon length gradient
C = 0.02	Based on vegetative material
P = 1.0	Practice factor

For the purpose of the soil loss analysis, the landfill was divided into regions based upon the average slopes of the final grades and surface drainage. The average soil loss for SCL is 2.0 tons/acre/year, which is right at the two tons/acre/year recommended by industry standards. The soil loss analysis is included in Appendix L.

C.4.8 SEISMIC STABILITY (27 CCR, SECTION 20370)

The seismicity of SCL including the location of the site with respect to active and potentially active faults and their potential impacts to the proposed waste containment units from earthquakes are discussed in Section D.4.4. Analyses of refuse and excavation slope stabilities under earthquake loads at SCL are discussed in Section D.4.5.

SECTION D.1

GENERAL

D.1 GENERAL

D.1.1 INTRODUCTION AND PURPOSE

In order to obtain new or updated Waste Discharge Requirements (WDRs) from the Regional Water Quality Control Board (RWQCB), an operator must supply information on a site's physical characteristics in accordance with 27 California Code of Regulation (CCR), Section 21750. This section provides the required information which includes site-specific and regional data on topography, climatology, geology, soil characteristics, faulting and seismicity, and water resources (e.g., hydrology). Tables 1 and 2 provide a cross-reference index of the applicable Title 27 requirements and the various subsections of this document in which they are addressed. Much of the information included herein has been summarized from more detailed reports which contain additional information regarding specific site characteristics. Where appropriate, these reports are referenced and are presented either as an appendix to the report or are available upon request. In all cases, these reports are listed in Section D.6 of this Joint Technical Document (JTD).

The purpose of compiling the site characterization information is to provide the RWQCB with adequate site data to determine potential negative impacts to the public and surrounding environment which can be mitigated or minimized through the waste containment and environmental control systems. For example, local and regional geology for the site provides information on the site's natural waste containment characteristics. Similarly, faulting and seismicity data provide information from which to assess potential geologic hazards such as earthquakes, which in turn can influence a landfill's waste containment system design. The information presented will be considered by the RWQCB in their evaluation of the proposed landfill design, operation and environmental monitoring activities.

D.1.2 GENERAL SETTING

Sunshine Canyon Landfill (SCL) is located at 14747 San Fernando Road; part of the landfill is located in the City of Los Angeles and the other in an unincorporated area of Los Angeles County (see Figure 1). A total of 1,102 acres is owned by the project proponent in and around Sunshine Canyon. The SCL is located in the northern edge of the San Fernando Valley and includes a permitted area of approximately 494 acres in the City and approximately 542 acres in the County (see Figure 2). SCL City ~~Unit 2 Solid Waste Facilities Permit (SWFP)~~ currently allows~~permits~~ disposal on 84 acres. ~~A 110 acre increase is proposed as authorized by the City zone change for a total of 194 acres.~~ The SCL County ~~Extension SCL~~ SWFP currently permits disposal on 162 acres. This JTD presents information to combine the City and County landfills under one SWFP which ~~A 17 acre increase is proposed bringing the total to 179 acres which is within the 257 acre limit in the County Conditional Use Permit (CUP). The SCL~~ will result in a single ~~one~~ landfill footprint being developed~~constructed~~ in Sunshine Canyon ultimately encompassing approximately 375~~373~~ acres.

D.1.3 LAND USE (27 CCR, SECTION 21750(h)(4))

The project site is surrounded by unincorporated areas of Los Angeles County to the north and west, and the communities of Granada Hills and Sylmar to the south and east. Land uses within a 1,000-ft. radius of the project site include undeveloped mountainous terrain to the south and southwest, an active oil production area located to the south, freeways to the north and northeast, and open space and residential areas to the south and east. Figures 10, 11, and 12 present surrounding land uses and zoning within a 1,000-ft radius of the SCL.

Several residential housing and light industrial projects are located near the project site. These developments include several residential (single-family) housing tracts. These facilities are located south of the landfill and southward of an intervening ridgeline that ranges in elevation from 2,150 to 1,425 ft msl. Several trailers located across from the landfill entrance and a light industrial area consisting of several buildings are located along the eastern portion of San Fernando Road, north of the landfill entrance [UEI, 1997].

SECTION D.4

GEOLOGY
(27 CCR, SECTION 21750(f))

D.4 GEOLOGY
(27 CCR, SECTION 21750(f))

D.4.1 REGIONAL GEOLOGY

Sunshine Canyon lies within the western portion of the Transverse Ranges geomorphic province of California. This province consists of a distinct group of east-west trending ranges and valleys that truncate the prevailing north-northwest trend of the southern Coast Ranges and Peninsular Ranges. Within the Transverse Ranges, several compressional thrust (i.e., reverse slip) faults and curvilinear strike-slip faults generally trend in an east-west direction. The foremost structural feature that has affected the region is, of course, the San Andreas Fault. A broad bend in the San Andreas fault occurs between the Coachella Valley and the Carrizo Plain. This "big bend" in the fault induces a component of north-south convergence across the fault. The compression associated with this convergence has created the Transverse Ranges and the associated family of east-west trending thrust faults. The thrust faults that break the surface south of the San Andreas fault dip either southward or northward and merge with the broad, buried fold and thrust belts that underlie the Los Angeles and Ventura basins and the southern margin of the Transverse Ranges, where the landfill is situated.

Stratigraphically, the landfill is located within the southeastern limit of the Ventura Basin--defined as a narrow, structural trough or geological downwarp that began to develop at the beginning of the Miocene epoch (approximately 23 million years ago). The Ventura Basin is filled with a sequence of sedimentary rocks that are middle Miocene to Holocene in age. The oldest sedimentary rocks in the sequence belong to the middle Miocene Topanga Formation. Overlying the Topanga Formation, with angular unconformity in places, is the Modelo Formation. The Modelo Formation consists of approximately 3,200 ft of siltstone, mudstone, and shale. It is primarily exposed in the bottom of East Canyon (in an area located northwest of the landfill site) along the axis of the Pico Anticline.

The entire landfill area is underlain by the late Miocene to early Pliocene-age Towsley Formation, which overlies the Modelo Formation. The Towsley

Formation consists primarily of well-indurated arkosic sandstone and conglomerate, sandy siltstone, and mudstone. Sedimentary structures commonly observed within this unit include graded beds, load casts, current ripples, slump structures, and convolute bedding. These sedimentary features are indicative of a turbidity-current depositional environment.

D.4.2 SITE GEOLOGY

General

The Towsley Formation strata that underlie the project area have been folded into the broad east-west trending Pico Anticline and the Oat Mountain Syncline. Uplift, tilting and erosion of the Towsley Formation have resulted in major canyons and resistant ridges controlled with, and aligned with, the strike of bedding. Ridges commonly form "strike ridges" or "hog backs" underlain by erosion-resistant beds. Topography is further modified and often subdued by the occurrence of "translational" (i.e., bedding controlled) landslides. Surficial deposits are now limited to landslide materials on canyon sideslopes, colluvium and man-made fill.

Towsley Formation

The bedrock of the Towsley Formation consists mainly of interbedded, lenticular sandstone with siltstone, mudstone, and conglomerate, in decreasing order of abundance. Sandstone and conglomerate beds throughout the site contain sedimentary structures, such as graded bedding, load casts, current ripples and slump structures that suggest a marine turbidity-current depositional environment. Individual beds range in thickness from laminae size to more than 10 feet. It is not unusual, within this formation, to have single beds several feet in thickness pinch out completely over a distance of a few tens of feet. In general, bedding attitudes are broadly uniform and are controlled regionally by folding.

The resistant sandstone and conglomerate (also pebbly sandstone) units of the Towsley Formation are moderately cemented and form bold topography where beds dip into the slope. The sandstone is predominantly gray to light brown, fine- to coarse-grained. Some sandstone and conglomerate units contain large fractured concretions.

The fine-grained siltstone, shale and mudstone units of the Towsley Formation range from poorly bedded to well bedded. These clay-rich dark-gray units weather brown and commonly show both spheroidal weathering patterns and closely spaced fractures that develop as a result of near-surface creep on steep slopes. Some exposures show evidence that the siltstone and mudstone interbeds have been subjected to flexure shearing between competent sandstone units.

Bedding planes, joints and fractures are the dominant planar features in the Towsley Formation bedrock. Typically, bedding planes are widely spaced in the siltstone, which is often massive, and moderately spaced in the sandstone. The siltstones and mudstones are generally more jointed than the sandstones and conglomerates. The joints close with depth. Materials observed in joints are common weathering products and include silt, clay, iron oxide, calcite, and gypsum. The joints occur at various orientations with dips generally between 45 and 80 degrees from horizontal. Observed faults have relatively small offsets ranging from a few inches to tens of feet.

In general, the bedrock at the site is not highly fractured. Most observed fractures dip steeply, and are either tightly closed or close with depth. A fracture line study was performed by PRA (1987) to assess fractures in the project site (at that time, the study included both County and City areas within the Sunshine Canyon Landfill). The majority of the fractures measured represented inactive, short-offset fault breaks that were the result of flexure folding during uplift of the Oat Mountain area. All fractures observed in the study were found to be tightly closed. Most fractures observed were in-filled with clay, gypsum, iron oxide or calcite.

Overburden

Colluvium occurs generally at the base of slopes and is derived from weathering of Towsley Formation bedrock. It is composed mainly of brown silty sand. The thickness of colluvial deposits is generally less than 5 ft, although deeper accumulations may occur in swales and gullies and in association with landslides. Canyon alluvium was present within the Sunshine Canyon project area prior to grading, but much of the stream-deposited alluvial soils have subsequently been removed and replaced with compacted fill.

Landslides

Landslides have been identified within Sunshine Canyon (both City and County jurisdictions) by aerial photograph interpretation, detailed field mapping, and mapping of features exposed during site operations. Landslides are identified on Figures 44, 44A, 45, 45A and 45B. The topographic expression of the landslides at the site is typically very subtle, especially when viewed on aerial photographs. In many cases, headscarps have been so extensively modified by erosion and vegetation cover, subsequent to failure, that their limits are difficult to delineate accurately. Surface reconnaissance revealed several features, such as hummocky topography, stream realignments, and eroded headscarps that are typical of mature hillside failures.

The landslides are composed of matrix materials that include unconsolidated clay, sand, and boulders that enclose various sizes of sandstone, shale, and conglomerate blocks. The lithologic characteristics and positioning of the landslide masses indicate origins within the Towsley Formation. Landslide morphology appears to be controlled by slip along bedding planes or weak seams parallel to the bedding.

Due to the favorable orientation of the geologic strata bedding, the footprint of the proposed City/County Landfill is relatively free of landslides. A landslide of significance (e.g., that could create operational problems unless successfully removed) was identified within the proposed landfill footprint and is located in the area near the City and County boundary (i.e., where the landfill footprints would eventually connect). The landslide at this location would be removed remediated prior to development of the proposed project.

D.4.3 ENGINEERING AND CHEMICAL PROPERTIES OF GEOLOGIC MATERIALS (27 CCR, SECTION 21750(f)(4))

Information regarding the local soils of Sunshine Canyon was obtained primarily during exploration mapping, drilling, and trenching. The soil thickness in the Sunshine Canyon watershed, as determined from borings and trenches, ranges from a minimum of zero (outcrops) to about 19 feet within the bottom of ephemeral streams and gullies. Soil cover on side slopes and ridges was determined to have a maximum thickness of approximately 16 feet and is typically between 2- and 8-feet thick.

Representative soils and bedrock samples (obtained during 1986) were analyzed in the laboratory for natural and optimum moisture content and density, and recompacted permeability. Results of the laboratory permeability tests are summarized in Table 11.

The soils typically consist of silty sand with minor clay and gravel components. The fine fraction is of low to medium plasticity (i.e., liquid limit less than 50) with a range in Plasticity Index of 2.6 to 23.8 and an average of 12.9.

Constant head permeability tests have been conducted as part of the numerous geologic investigations in the boreholes at the mouth of Sunshine Canyon. In order to ascertain the permeability characteristics of the soils, selected samples were compacted to 90 percent of their maximum dry density at or near their respective optimum moisture content as measured by American Society for Testing and Materials (ASTM) Method D1557 and then subjected to a falling head permeability test in the laboratory in accordance with ASTM Method D2434-68. In addition, several of the samples tested for permeability in the laboratory consisted of pulverized and recompacted bedrock.

The permeability of the tested samples ranged from approximately 5×10^{-6} centimeters per second (cm/sec) to as low as 4×10^{-8} cm/sec. These values are indicative of low-permeability compacted soil and intact bedrock conditions, as shown in Table 11. These permeability values show the excellent containment characteristics of the native geologic materials at the site (i.e., bedrock and soil materials), thereby making them appropriate for use as interim and final cover and for earthen containment structures.

The subsurface soils and bedrock were evaluated to determine whether the materials could be successfully excavated prior to landfilling. The canyon slopes and lower ridgelines are rippable using a Caterpillar D-9 or D-10 (or equivalent) crawler-tractor. The excavated material will be utilized as daily and interim cover material at the proposed landfill. The finer-grained portion of the excavated soil and bedrock can be selected and stockpiled for use in constructing the final cover.

Soil/Bedrock Strength

Information regarding soil/bedrock strength was obtained from the "Geotechnical Report for the Sunshine Canyon City Landfill Sedimentation Basin, Los Angeles, California" prepared by GeoSyntec Consultants (January 1999) Section 4.1.4 "Material Properties".

The interbedded nature of the Towsley Formation must be considered in the evaluation of representative shear strength parameters. Relatively well defined alternating layers of sandstone, siltstone, and claystone are observed in the Towsley formation at the site. The sandstone layers tend to be massive and the siltstone and claystone often appear as thin but continuous beds with clay seams oriented along bedding planes. With well defined bedding such as that observed in the Towsley Formation at the site, the choice of the design shear strength is dictated by the anticipated direction of movement relative to the bedding orientation as follows:

- If the direction of sliding is along bedding planes, then the representative shear strength will be that of the weakest bedding plane material, which for the Towsley Formation are clay seams; and
- If direction of sliding is across bedding planes, the representative shear strength will be dominated by that of the intact bedrock layers.

The shear strength parameters used in the stability analyses for the Towsley Formation intact bedrock and clay seam material, solid waste, and compacted fill are summarized in Table 20 and discussed in the following sections.

Intact Bedrock

Shear strength parameters for the Towsley Formation intact bedrock was estimated from laboratory testing results, observations of stable vertical slopes with favorable bedding at Sunshine Canyon, and GeoSyntec's past experience with cut slopes in the Towsley Formation at the Sunshine Canyon Landfill and at the nearby Lopez Canyon Sanitary Landfill in Lakeview Terrace, California [GeoSyntec, 1995]. A cohesion of 1,000 psf was used for intact bedrock based upon the observed stability vertical cuts of over 50 ft in height in intact bedrock a the site. A friction angle of 36 degrees was assigned to the intact bedrock based upon typical values for this type of material. These assigned values are consistent with values published in the literature for similar materials and are conservative when compared to the laboratory shear testing results. A unit weight of 135 pcf was assigned to the intact bedrock material based upon measurements on the laboratory test specimens.

Clay Seam Material

The shear strength parameters for clay seam materials were selected based on a review of previous geotechnical investigations at the project site which include back-analyses of existing landslides located on the SCL property.

For the development of Phase I and Phase II construction at SCL, the clay seam material shear strength parameters were back-calculated from several existing landslides. The results of those back-analyses indicate that the shear strength of the clay seam material could be characterized by a friction angle of 14 degrees and a cohesion of 400 psf (19.1 kPa) in slope areas where evidence of landsliding is not observed. The results of the back-analyses indicated that the shear strength of the clay seam material could be characterized by a friction angle of 14 degrees and zero cohesion in areas where evidence of past landsliding is observed.

Compacted Fill

The shear strength of the compacted fill was characterized by a friction angle of 35 degrees and a cohesion of 170 psf (8.1 kPa). These strength parameters were based on laboratory testing of site-specific materials compacted as fill during Phase I construction quality assurance testing. The laboratory testing consisted of back-pressure saturated Consolidated Undrained triaxial compression tests performed on fill from the site compacted to 90 percent of the maximum dry density measured in accordance with ASTM D 1557. Specifications for compacted fill at the proposed sedimentation basin will call for use of fill material that provides, at a minimum, this strength and will require conformance testing to demonstrate that the selected fill material meets these specifications. A unit weight of 125 pcf (19.7 KN/m^3) was assigned to the compacted fill based upon the laboratory test data.

Solid Waste

Solid waste material that was disposed of near the proposed sedimentation basin was characterized by a cohesion of 900 psf (43.1 kPa), a friction angle of 31 degrees, and a unit weight of 100 pcf (15.7 kN/m^3). The selected solid waste shear strength parameters represent a lower bound value for the shear strength of solid waste developed on the basis of laboratory testing performed at the Operating Industries, Inc. (OII) Landfill Superfund Site in Monterey Park, California. These parameters were developed on the basis of direct shear and direct simple shear testing on 18-inch diameter reconstituted specimens of solid waste. The testing and results were subject to the scrutiny of separate blue ribbon panels assembled by the OII steering committee and the United States Environmental Protection Agency. These shear strength values are the same as those used for the Phase II design at the County SCL.

D.4.4 SEISMICITY (27CCR, SECTION 21750(f)(7))

Several minor, local faults traversing Sunshine Canyon have been mapped by various geologists [e.g., Barrows et al., 1975; Geolabs, 1981; Saul, 1979; Winterer et al., 1962]. The orientations and sense of movement of the faults on the site, as well as their proximity to the Santa Susana thrust fault system, suggest that they all may be related tectonically. A group of faults with a northeasterly trend is clustered in the southeastern portion of the site. These faults are delineated by offset beds and the faulted contact between the Towsley and Pico Formations, as shown on Figures 44, 44A, 45, 45A and 45B. Another group of faults lies in the northern portion of the site as shown on Figures 44, 44A, 45, 45A and 45B. The northern fault traces have an east-west trend. The three northern fault traces shown on the figure indicates that they may be either separate strands of the same fault or, possibly, the same fault mapped by different geologists [Barrows et al., 1975; Geolabs, 1981], and located with a slight variation between the authors' maps.

A pre-Holocene north-dipping fault (Fault A) has been mapped along and sub-parallel to the axis of the Pico Anticline (Winterer and Durham, 1962; PRA, 1987b; and GeoSyntec, 2001a). This fault is located along the northern portion of the Phase V-VII area of the County Expansion area of the project area, transecting the area from northwest to southeast. The fault dips steeply at between 40 to 70 degrees to the north, sub-parallel to bedding. It was found to contain a clayey gouge-like material up to 2-inches thick. Fault "A" divides into several splays westerly along its mapped trace and appears to die out farther to the west. Although stratigraphy could not be correlated across the fault traces to help determine the amount of offset, GeoSyntec (2001a) concluded that there was little structural change observed across the fault. Only local drag folding was observed immediately adjacent to the fault.

Geologic investigations regarding age of activity on Fault A were conducted by Geolabs (1981) and Gash & Associates (1982), and field observations were made by Richard B. Saul (1982), with the California Division of Mines and Geology. These investigations determined that the fault is not active. There appears to be no geomorphic evidence for the trace of the fault, based on interpretation of stereographic aerial photographs that were flown prior to the development of Sunshine Canyon as a landfill.

The 40 CFR, Parts 257 and 258 (referred to as Subtitle D), requires that new municipal solid waste facilities or lateral expansions located in seismic impact zones be designed to resist the maximum horizontal acceleration in lithified earth material at the site. As an "approved state" under Subtitle D, State of

California minimum standards have been found to be functionally equivalent to Federal (Subtitle D) minimum criteria and provide the design basis for the SCL expansion project. With regards to seismicity, 27 CCR requires that landfills be designed to accommodate the maximum probable earthquake (MPE) event. As defined by the California Division of Mines and Geology (CDMG) (1975), the MPE is the maximum earthquake that is likely to occur during a 100-year interval but not lower than the largest earthquake that has occurred historically. Estimation of the MPE includes consideration of regional seismicity, type and activity of faults within 60 miles (100 km) of the site and the seismic recurrence interval for the area and faults.

GeoSyntec [2002] evaluated potential ground shaking under the conditions of a maximum probable earthquake (MPE) and concluded that the governing seismic sources with respect to Sunshine Canyon Landfill are the following four faults:

Fault	Site-to-Source Distance (km)	MPE (M_w)	Peak Ground Acceleration (g)
Santa Susana	<5	6.5	0.74
San Gabriel	8	7.0	0.50
Northridge	9.9	6.7	0.65
San Andreas	38.6	7.8	0.15

CCR Title 27 requires that expansions of Class III landfills shall not be located on a known Holocene (within the last 11,000 years) fault. Title 27 also requires that Class III waste management units shall be designed to withstand the "maximum probable earthquake (MPE)" without damage to the foundation or structures that control leachate, surface drainage, erosion, or gas. The CCR Title 27 definition for MPE is the maximum earthquake that is likely to occur during a 100-year interval. The CCR Title 27 definition for the MPE does not explicitly provide a probability of exceedance for use in the probabilistic analysis. For the purposes of this study, ground motions with a 10 percent chance of exceedance in a 100-year period were selected, consistent with the California Building Code (CCR Title 24) requirements for critical structures.

The Northridge earthquake is considered to represent the MPE at the site, the regulatory minimum standard for seismic design. Interim grading plans will be designed to withstand strong shaking associated with the MPE. Final grading plans for the proposed County Landfill will be designed to withstand strong shaking associated with the Maximum Credible Earthquake (MCE), an earthquake with greater damage potential than the MPE.

The main shock of the 17 January 1994 Northridge earthquake was assessed by the University of California at Berkeley seismographic station to have a M_w of 6.7. Strong motion stations located in the area near the City Landfill recorded PGAs on the order of 0.9 g during this event. These stations may have been influenced by site and/or topographic effects. GeoSyntec [2002] concluded mean peak bedrock acceleration on the order of 0.65g at the project site for the M_w 6.7 Northridge event. The City Landfill portion of the project area is located close to the surface projection of the estimated fault rupture plane. The City Landfill portion is approximately 6.2 miles (10 km) from the zone of energy release. The interim soil cover system is approximately 8 to 12 ft (2.5 to 3.75 m) thick. The landfill has no geosynthetic liner system, and was constructed so that the south face of the landfill is the canyon wall.

At the City Landfill portion, longitudinal cracks were observed along the top of the waste fill where it interfaces with the natural canyon walls. These cracks varied in width from less than 0.8 inches (20 mm) up to 12 inches (305 mm), exhibiting in some areas 6 to 12 inches (152 to 305 mm) of differential vertical offset. This cracking did not appear to represent any threat of overall instability to the integrity of the landfill. Instead, cracking may have been caused by the differential settlement of the waste fill itself, which occurred as a result of the earthquake shaking. During this period, the landfill gas (LFG) extraction system was temporarily shut down due to a loss of power. Power to the LFG collection and flaring system was restored two days after this seismic event. No damage to the landfill's ancillary structures resulted.

Detailed landslide mapping from aerial photographs by the U. S. Geological Survey [USGS, 1995] indicated that no significant earthquake-induced landslides occurred at the project site. However, the USGS map does show several small landslides within the footprint of the County Extension Landfill, which was not operational at the time, generally located in steep canyons adjacent to primary drainage areas. In addition, a relatively concentrated accumulation of landslides occurred along the south-facing slopes of Aliso Canyon, south of the project site. This is consistent with previous post-earthquake reconnaissance surveys of Sunshine Canyon where several small earthquake-induced or reactivated landslides were observed in both County and City areas of the project site. Several rockfalls occurred on steep bedrock cliffs, including one located within the 100-acre (40-hectare) open space buffer area.

D.4.5 STABILITY ANALYSIS (27 CCR, SECTION 21750(f)(5))

Natural Slope Stability

The natural slopes within a portion of the project area are considered to be relatively stable, although future seismicity is expected to generate additional minor downslope failures. Little evidence has been found by consulting geologists that might indicate the presence of recent downslope failures in the larger, older landslide deposits. These deposits are believed to have formed during a period when precipitation was much higher than at present times. The absence of instability in the older landslide deposits indicates that their present configurations are in static equilibrium.

Existing canyon slopes at the site are sometimes found to be steeper than 1H:1V (horizontal to vertical), although they are typically 2H:1V. Stability analyses of existing landslides indicate that, unless adverse (i.e., out of slope) bedding conditions are present, 1H:1V slopes in the native material are stable under both static and seismic loading. When adverse bedding is present, slope angles of 2H:1V or flatter may be required to provide adequate static stability. Pseudo-static stability analyses for seismic loading and observations of the performance of slopes at the site during the San Fernando and Northridge earthquakes indicate that, when natural slopes at the project site have adequate static stability, the slopes perform well under seismic loading.

Engineered Slopes

A detailed evaluation of base grading cut slopes and final refuse fill slopes was prepared for both the SCL City and SCL County in previous JTDs and are incorporated by reference as noted previously in Section C.3. The latest EIR presented some information regarding the combined site and GeoSyntec conducted a stability analysis of final fill slopes and cover for the combined site. This stability analysis is presented in Appendix N-1.

Geo-Logic Associates conducted additional analyses in response to agency comments and their findings are included in three technical memorandums denoted as Appendices N-2, N-3 and N-4. Their recommendations have been incorporated into the design of the stability berm and soil buttress at the toe of the landfill.

The critical factors for stability of the waste fills include the geometry of the supporting liner systems and waste fill, the strength properties of the waste, interface strengths of geosynthetic and soil components of the liner system, and the strength of geologic units that form the foundation for the waste containment system. The geometry of the base grading contours used in the analysis is the most conservative scenario anticipated. Analyses considered both static and dynamic load conditions.

The static and seismic stability analyses of the landfill waste mass indicated that final landfill waste slopes and final cover would be both statically and seismically stable. Seismic-induced displacements along the landfill liner system for the site MCE design earthquake would be less than the maximum allowable deformation of 6 inches. Excavation, liner, and interim refuse mass stability analyses will be completed as the site is developed.

SECTION D.5

WATER RESOURCES

D.5 WATER RESOURCES

D.5.1 HYDROGEOLOGY (27 CCR, SECTION 21750(g))

This section of the JTD describes the regional hydrogeology and water quality, as well as the site-specific groundwater occurrences, flow conditions, groundwater monitoring system and water quality.

D.5.1.1 REGIONAL HYDROGEOLOGIC SETTING

Surface water and groundwater resources for the region are regulated by the CRWQCB and regulatory standards are described in the Basin Plan [CRWQCB, 1994]. The Basin Plan establishes water quality objectives and beneficial uses for hydrologic units within the basin. The Basin Plan defines surface watershed boundaries by hydrologic unit, hydrologic area and hydrologic subarea as well as groundwater basins within each hydrologic unit. The Sunshine Canyon Landfill lies in the northwest portion of the Los Angeles-San Gabriel Hydrologic Unit, within the San Fernando Hydrologic Area and the Bull Canyon Hydrologic Subarea.

Sunshine Canyon is located in the Upper Los Angeles River Area (ULARA), which serves as a surface watershed that collects and conveys runoff to recharge the San Fernando Groundwater Basin at the Van Norman Retention Basin. The City of Los Angeles retains the water rights to virtually all of the surface and groundwater resources of the ULARA. These resources are managed by the ULARA Watermaster. The ULARA encompasses approximately 328,500 acres and is composed of 122,800 acres of valley fill (i.e., groundwater basins) and 205,700 acres of hills and mountains. The ULARA is bounded on the north and northwest by the Santa Susana Mountains; on the north and northeast by the San Gabriel Mountains; on the east by the San Rafael Hills, which separate it from the San Gabriel Valley Basin; on the west by the Simi Hills; and on the south by the Santa Monica Mountains, which separate it from the Los Angeles Coastal Plain.

Sunshine Canyon is situated in the eastern portion of the east-west trending Santa Susana Mountains, consisting of predominantly consolidated and complexly folded, low-permeability Miocene and Pliocene sedimentary units. These sedimentary units contain groundwater-bearing materials with low potential for economic development due to typically poor natural water quality and low groundwater yield characteristics. The low-permeability materials of the Santa Susana Mountains bound the northern edge of the San Fernando Groundwater Basin, which constitutes an important groundwater resource.

D.5.1.2 LOCAL HYDROGEOLOGIC SETTING

Knowledge of the nature and occurrence of groundwater in the Sunshine Canyon area is based on several exploration studies in the project vicinity and supplemented by groundwater monitoring data gathered from the existing monitoring well network for the active and inactive City Landfills and County Extension Landfill. Detailed information regarding the existing monitoring well network is provided in Section 6.1. Exploration borings and accompanying aquifer tests were conducted within the project site by PRA [1987], Earth Technology [1988], and GeoSyntec [1995, 1997a, b]. The exploratory borings and monitoring wells were used to identify the spatial distribution of subsurface materials, evaluate groundwater transmitting properties and flow directions, and evaluate the groundwater chemical composition. The exploration program targeted hydrogeologic features such as alluvium stream valleys, fault zones and areas of intense fracturing or folding to investigate areas of high groundwater flow potential. Exploration borings and wells in canyon bottoms typically encountered groundwater in stream channel alluvium and weathered bedrock material. Deeper borings also encountered groundwater in unweathered bedrock, although groundwater yield from these borings was typically low.

Information from the exploratory borings and subsequent groundwater monitoring programs indicate that groundwater is typically encountered at shallow depths (10 to 20 ft) within the alluvium and weathered bedrock, and at deeper depths within the unweathered bedrock (25 to 50 ft). Groundwater within the unweathered bedrock is often encountered under confined or artesian conditions [Earth Technology, 1988; GeoSyntec 1995, 1997a, b]. Groundwater movement through bedrock in Sunshine Canyon is controlled by the degree of weathering and fracturing, variability of hydraulic conductivity and gradient, infilling of fractures, faulting, and folding. Based on aquifer tests, the in-situ horizontal hydraulic conductivity in bedrock ranges from 1.0×10^{-3} to 1.0×10^{-9} cm/s. Hydraulic conductivities estimated from laboratory testing were consistently lower than the hydraulic conductivities calculated using in-situ field test data. The hydraulic conductivity values of the bedrock units are expected to decrease with depth as the degree of fracturing and weathering decreases with depth.

Horizontal groundwater flow velocities in the saturated zone are calculated using:

$$V = K i / n$$

where:

K = saturated hydraulic conductivity;
i = hydraulic gradient; and
n = effective porosity of the water-bearing material.

Testing indicates a wide range of in-situ horizontal hydraulic conductivities in the bedrock at the site, with values ranging from 1.0×10^{-3} to 1.0×10^{-7} cm/s. The majority of in-situ values were between 1.0×10^{-5} to 1.0×10^{-6} cm/s. The average gradient from the highest to lowest groundwater elevation along the main canyon is 0.08 ft/ft. Porosities for sandstones generally vary from 5 to 30 percent. Based on an average horizontal hydraulic conductivity of 1.0×10^{-5} cm/s (or 0.072 ft/day), an average gradient of 0.08 ft/ft, and the general range of porosities for sandstones (5 to 30 percent), the average horizontal groundwater velocity in bedrock is estimated to be approximately 3 to 10 ft. per year.

The orientation of folded bedding and on-site topography combine to promote preferential groundwater movement within and down the canyon axis. Groundwater velocities in bedrock are low due to the relatively low hydraulic conductivity measured for the Towsley Formation bedrock materials and the hydraulic gradients at the site. The bedrock units are folded along the east-west trending axes of the Oat Mountain syncline and the Pico anticline.

The transmissivity of the bedrock ranges from 3 to 775 gallons per day, per foot (gpd/ft) with an average value of approximately 61 to 145 gpd/ft. Due to the pervasively folded, fractured, and anisotropic nature of the bedrock (i.e., interbedded sandstone and shale), the flow rate of groundwater at the project site can vary significantly over short distances. However, the presence of pre-Holocene faults in addition to interbeds of low-permeability shale and mudstone tends to restrict the flow of groundwater. Based on results from available groundwater studies, the shallow and deep groundwater systems yield relatively low quantities of water. Limited groundwater resource potential exists beneath the project site.

Unconfined groundwater occurs within the alluvial filled canyons and drainage courses and in the upper weathered bedrock zone in topographic low areas. Areas where groundwater is present within the alluvium and weathered bedrock, are considered the upper aquifer at the site. Groundwater in the upper aquifer is recharged predominantly by precipitation and by upward flow from the lower water-bearing horizons that may be under artesian conditions. Groundwater in the upper aquifer, generally, flows in a south to southeast direction (i.e., down-canyon), following the overall canyon topographic slope.

Groundwater flow velocities in alluvium and weathered bedrock are estimated to be higher than unweathered bedrock flow velocities. Movement of shallow groundwater in alluvium follows the direction and slope of surface water drainages. Based on estimates of hydraulic conductivity using soil descriptions from boring logs, the estimated groundwater discharge velocity in the alluvium is between approximately 0.2 and 200 ft/day.

Groundwater flow in the unconfined alluvial sediments and weathered bedrock materials within Sunshine Canyon primarily follows topography and moves down slopes along the canyon axis toward the mouth of Sunshine Canyon. The primary component of groundwater flow, based on the work performed on site, is horizontal. The vertical component of flow in bedrock is highly variable across the project site. In the upper portions of the canyon, where recharge is likely, a downward component of flow is anticipated. In the lower portion of the canyon, there is evidence of an upward component of groundwater flow direction as evidenced by artesian groundwater conditions.

After independently reviewing published hydrogeologic reports for the Sunshine Canyon area, the ULARA Watermaster concluded that, other than through the alluvium, there was no groundwater connection between Sunshine Canyon and the San Fernando Groundwater Basin. The Watermaster also concluded that the natural bedrock material underlying the canyon is of low permeability and has low storage capability. A report prepared for the City Bureau of Sanitation on groundwater movement in Sunshine Canyon states: *"Whatever groundwater movement that does occur is undoubtedly complicated and slow. Complications include the bedding, which, although generally dipping towards the east in the lower canyon, dips steeper than the hydraulic gradient making it necessary for the groundwater to move across the bedding. Interbeds of siltstone and shale act as subsurface dams with little or no permeability. Groundwater quality is poor."* [Bean, 1978].

Oil Wells

Three oil fields have been developed adjacent to the Sunshine Canyon Landfill site. The Newhall, Aliso Canyon, and Cascade Fields are located within 1 mile of the Sunshine Canyon Landfill property boundary. The Cascade Oil Field is located within 1,000 ft, of the southwestern portion of the Sunshine Canyon Landfill. Approximately 96 active, inactive and abandoned oil/gas wells have been previously identified to exist within the one-mile radius of the project site [Earth Technology, 1988].

Among the known wells, ten abandoned oil wells of the Newhall Field are located within the County Extension Landfill property, including several within the approved waste footprint. These wells are located as shown on Figure 46 and described in Table 12. All the wells were initially abandoned and plugged under supervision of the California Department of Conservation, Division of Oil Gas and Geothermal Resources (DOGGR) between 1945 and 1955. Those located within the County Landfill waste footprint have been or will be reabandoned under DOGGR supervision using current approved procedures to eliminate the potential for the well to be a conduit for oil and gas to contaminate groundwater below the landfill liner system.

Two wells within the landfill footprint were reabandoned in 1997 and four more were reabandoned in 2002. In each case, the well was cleaned out by drilling to a depth ranging from several hundred feet to over 1,000 feet below surface, and then plugged with cement grout. Before constructing landfill liner above the well, the well casing is cut off approximately 10 feet below the liner grade, and capped with additional concrete. The abandonment work is observed and documented by DOGGR personnel as required by law. This procedure will be followed for any additional wells discovered within the landfill waste footprint.

D.5.2 GROUNDWATER QUALITY (27 CCR, SECTION 21750(g)(6))

D.5.2.1 REGIONAL GROUNDWATER QUALITY

The groundwater quality of the San Fernando Groundwater Basin, located approximately 2 miles south of the site, is periodically tested in association with basin groundwater production. Analytical results from many of the groundwater monitoring and production wells within the San Fernando Groundwater Basin indicate the presence of various pollutants. Primary organic pollutants in public water supply wells in the

San Fernando Groundwater Basin include the volatile organic compounds (VOCs) (e.g., tetrachloroethylene (perchloroethylene (PCE)) and trichloroethylene (TCE)). These compounds have been widely used as solvents in industrial, manufacturing, and dry cleaning processes. This deep alluvial basin does not have an effective low-permeability aquiclude in the shallow subsurface, consequently contaminants have migrated through the upper sediments into the groundwater basin production zones [Ultrasystems, 1997].

The CRWQCB has located and abated sources of pollutants that have affected these wells and currently oversees remediation activities. Investigations are conducted by the CRWQCB to identify and eliminate sources of pollutants in public water supply wells, identify and take enforcement action as necessary against dischargers, and oversee remediation of soils and groundwater [Ultrasystems, 1997].

The California Department of Toxic Substances Control (DTSC) has designated large areas of the San Fernando Groundwater Basin as high-priority hazardous substances cleanup sites because of widespread pollution. In addition, the U.S.EPA has designated this area a Superfund site under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The CRWQCB and U.S.EPA are overseeing investigations to further define the extent of pollution, identify responsible parties, and begin remediation.

In addition to VOCs, elevated nitrate concentrations have been identified in the upper 160 ft (48.8 in) of the aquifer of the San Fernando Groundwater Basin. Elevated nitrate levels often originate in agricultural areas where fertilizers have been excessively applied to crops, in stockyards and feedlots where nitrates from manure leach into groundwater, and in unsewered areas where nitrates from septic tank systems leach into the groundwater [Ultrasystems, 1997].

D.5.2.2 LOCAL GROUNDWATER QUALITY

BFI instituted a comprehensive monitoring program at Sunshine Canyon in June 1986. A network of groundwater monitoring wells are used at the Sunshine Canyon Landfill for groundwater quality monitoring purposes, as described in Section B.7.3.1 of this JTD. Since installation of the wells, groundwater has been sampled and analyzed according to regulatory guidelines. The monitoring network also includes a groundwater extraction trench and cutoff wall located across the bottom of the Sunshine Canyon Landfill.

Beneficial uses of groundwater resources beneath Sunshine Canyon are limited. Groundwater samples collected from monitoring wells screened in the shallow and deep groundwater zones exhibit natural total dissolved solids (TDS) concentrations that typically range from 1,000 to 6,500 milligrams per liter (mg/L). Because of their low production capabilities and poor natural water quality, the bedrock lithologies underlying Sunshine Canyon are generally considered to be non-water bearing.

Previous hydrogeologic investigations conducted for the project site have documented a wide variance in the overall composition and quality of natural groundwater beneath the facility (e.g., ETC, 1988a, and A-Mehr, 2002). Sunshine Canyon has, in the past, been the site of extensive oil exploration and production as evidenced by the former presence of numerous oil exploration and production wells (ETC, 1988a). Geologically, Sunshine Canyon is characterized by several east-west trending fault systems, which serve as large-scale crude oil traps. Upward seepage of crude oil along these faults and subsequent contact between groundwater and crude oil has been documented at numerous locations within Sunshine Canyon (PRA Group, 1991; ETC, 1988a&b; A-Mehr, 2002).

The presence of shallow crude oil deposits coupled with the low permeability of the bedrock materials has resulted in extensive areas of reduced (poorly oxygenated) groundwater beneath Sunshine Canyon, with locally high concentrations of alkalinity, ammonia, and, in some cases, sulfide. In addition, pre-landfill monitoring has confirmed the presence of naturally-occurring groundwater with locally elevated concentrations of chloride, TOC, COD, and potassium (ETC, 1988a; A-Mehr, 2003a).

A combined groundwater and waste disposal monitoring report for the Sunshine Canyon City and County Extension Landfills covering the second semi-annual monitoring period of 2006 was completed in February 2007. The report addresses 2006 annual reporting requirements for both facilities. The principal findings of the report are summarized below.

SCL County

During the second semi-annual monitoring period of 2006 there were no confirmed exceedances of site water quality protection standards noted for groundwater monitoring wells located downgradient of the County Landfill (i.e., CM-15, CM-16, and CM-17). Based on the lack of confirmed landfill impacts at the facility's formal point of compliance, the County Landfill is considered to be operating in accordance with applicable WQPS. As in previous monitoring periods, several volatile organic compounds were again detected in subdrain liquids collected from the County Landfill. The low level VOC detected in these subdrain liquid samples are thought to be associated with migrating landfill gas from the County Landfill, and are collected and managed as part of the facility's ongoing corrective action program. Approximately 8,221,163 gallons of subdrain liquid with low level VOC concentrations were collected and managed by the facility during the second semi-annual monitoring period of 2006.

During the 2006 annual monitoring period, 11 additional landfill gas collection wells were installed at the County Landfill. During the second semi-annual monitoring period, monthly measurements of methane gas concentrations were conducted at upper subdrain termination points to evaluate the progress of the CAP in reducing landfill gas migration to the subdrain system. No methane concentrations exceeding 5 percent were detected at the County Landfill subdrain termination points during the second semi-annual monitoring period of 2006. In addition, none of the facility's perimeter gas monitoring probes exhibited methane concentrations above 5 percent.

During the Third Quarter of 2006 concentrations of three volatile organic compounds were above State of California drinking water limits in the County Landfill water use sample. The RWQCB was notified of these detections and necessary modifications were made to the County Landfill leachate treatment plant. No volatile organic compound detections were noted above State of California drinking water limits in the County Landfill water use sample collected during the Fourth Quarter of 2006.

SCL City

During the 2006 annual monitoring period, exceedances of site-specific WQPS were again noted for groundwater monitoring points located downgradient of the City Landfill. The monitoring parameter/well pairs currently in tracking mode at the City Landfill are as follows: 1,4-dioxane at monitoring Well MW-1; 1,4-dioxane, chloride, and chemical oxygen demand at monitoring Well MW-2A; 1,4-dioxane at monitoring Well MW-5; 1,4-dioxane, cis-1,2-dichloroethene, methyl-tert-butyl ether, 1,2-dichloroethane, 1,1-dichloroethane, and ammonia at monitoring Well MW-9; 1,4-dioxane at monitoring Well MW—13R; and 1,4-dioxane, chlorobenzene, cis-1,2-dichloroethene, methyl-tert-butyl ether, 1,4-dichlorobenzene, and 1,1-dichloroethane at the extraction trench. The following monitoring parameter/well pairs were newly added to the City Landfill tracking mode list during the second semi-annual monitoring period of 2006: chloride at monitoring Well MW-2A and chemical oxygen demand at monitoring Well MW-2A.

During the second semi-annual monitoring period, BFI continued to operate the groundwater barrier and extraction system pursuant to RWQCB Order R4-2003-0155. Groundwater extraction continued throughout the 2006 annual monitoring period at the groundwater extraction trench, cutoff extraction wells, and additional extraction points established in the area between City Landfill Units I and II. During the second semi-annual monitoring period of 2006, a total of approximately

9,203,980 gallons of impacted groundwater was removed from groundwater extraction points at the City Landfill. It is anticipated, based on the development of the combined facility, that a number of the existing wells will be abandoned. The M&RP prepared by the RWQCB for the combined landfill will be complied with and modification of the existing systems will be implemented as the site is developed.

D.5.3 WATER USAGE (27CCR, SECTION 21750(h)(5))

The ULARA consists of four groundwater basins. These groundwater basins include the San Fernando, Sylmar, Verdugo, and Eagle Rock Basins. The basins are replenished by rainfall percolation, surface runoff, and active recharge. Sunshine Canyon is located approximately 1 mile north of the northern boundary of the San Fernando Basin, as illustrated on Figure 47. The San Fernando Groundwater Basin is the largest of the four basins, consisting of approximately 112,000 acres and comprising 91.2 percent of the total valley fill. Approximately 90 percent of the City's groundwater supplies are extracted from the San Fernando Groundwater Basin [Ultrasystems, 1997]. The City and County Public Works Departments (DPW) work cooperatively to maximize recharge within the San Fernando Groundwater Basin. Most runoff is captured and discharged at spreading grounds during the winter and spring seasons, but some runoff is captured upstream of these spreading grounds and released for recharge at a later time. The Van Norman Retention Basin, located approximately 2 miles south of the Sunshine Canyon Landfill, is the closest spreading ground to the project site. Surface water contained in the Van Norman Retention Basin is used to recharge the San Fernando Groundwater Basin.

D.5.4 POTENTIAL RELEASE FROM THE WASTE MANAGEMENT UNIT (27 CCR, SECTION 21750(a))

As required in 27 CCR 21750(a), this section evaluates potential impacts of the landfill on surface water and groundwater, and potential effects of ground or surface water on the landfill.

Surface Water

The site is located in an area of low annual rainfall, surface-water drainage courses on and around the site are normally dry. During precipitation events, surface-water run-on is directed away from the refuse fill area. Therefore, potential impacts of surface water on SCL are considered minimal.

Surface-water runoff from the site is controlled by an engineered surface-water management system. All runoff from the SCL will be controlled by management practices and facilities. During periods of heavy precipitation surface-water runoff may come in contact with exposed earthen slopes and carry sediment downstream. On-site sedimentation basins control the amount of sediment that flows off-site. Operational grading of berms around the active refuse disposal face and the use of daily cover materials prevent surface water runoff from contacting refuse. As a result of engineered controls implemented at the site, it is expected that SCL will have little impact on surface water.

Groundwater

Potential impacts of groundwater on landfill construction and operation are minimized by excavating below disposal areas to remove alluvial sediments and intercept any groundwater springs or seeps and convey them in a subdrain system outside the refuse disposal area. Beneath portions of the existing County Extension Landfill, some impacts to subdrain liquids by volatile organic compounds (VOCs) have been noted as a result of contact between these subdrain liquids and migrating landfill gas. However, such impacts are of relatively low magnitude (i.e., at or near drinking water limits) and have not impacted groundwater resources downgradient of the County Extension Landfill.

Landfill construction and operation is unlikely to significantly impair beneficial uses of groundwater based on:

- Construction of impermeable liners below waste disposal areas;
- Existing poor groundwater quality due to naturally occurring hydrocarbons and inorganic constituents;
- Absence of existing beneficial uses of groundwater near the site; and
- Presence of the existing groundwater extraction trench and composite liner cutoff wall, downgradient of the SCL, which intercepts groundwater leaving the site.

D.5.5 ESTIMATED COST FOR WORST CASE RELEASE MITIGATION (27 CCR, SECTION 20380(b))

In accordance with 27 CCR, Section 20380(b), BFI is in the process of establishing assurance of financial responsibility for initiating and completing corrective action for all known or reasonably foreseeable releases from the landfill. The RWQCB adopted Order No. R4-2007-0046 (see Appendix O) on December 6, 2007 which establishes amounts of financial assurance for corrective actions, this order required BFI to submit a financial assurance mechanism which covers the established amount by March 5, 2008. The mechanism is in place for 5.8 million dollars for both the City and County combined. The mechanism has been approved by CIWMB.~~has submitted a corrective action proposal to the RWQCB for their review and ultimate approval. The proposal includes a corrective action scenario and associated cost estimate in the amount of 2.8 million dollars. Once the RWQCB approves the proposal of the corrective action proposal is included in Appendix O.~~

SECTION E.1

PRELIMINARY CLOSURE PLAN
(27 CCR, SECTIONS 21769(b) and 21790)

E.1 PRELIMINARY CLOSURE PLAN (27 CCR, SECTIONS 21769(b) AND 21790)

E.1.1 INTRODUCTION AND PURPOSE

Closure of the landfill will be performed in accordance with the applicable regulatory standards included in 27 CCR, Chapters 3 and 4, and 40 CFR, Subpart F. The components and systems required for closure of the landfill include the final grading, final cover configuration, drainage and erosion control systems, landfill gas monitoring/control system, leachate control system, site security and structure removal. A description of these closure components, as well as a schedule for construction of the closure improvements, is presented in the following Subsections. The closure date for the site is projected to be 2037 based on available technology and refuse inflow rate projections. The SCL will be maintained as open space during the closure and the 30-year post-closure maintenance period. No definitive plans have been proposed for use of the site after completion of the post-closure maintenance period. Any future development of the site would be consistent with County General Plan elements and zoning requirements in effect at the time.

Pursuant to CCR Title 27, Section 21790(a), the purpose of this Preliminary Closure Plan is to provide a basis to establish a preliminary estimate of closure costs. In addition, this Preliminary Closure Plan (Part E, Section E.1) also includes a subsection regarding the phased closure of the site, including the associated reduction to the maximum extent of the landfill ever requiring closure, as well as, the accompanying closure cost estimate. The information listed below is included in Subsection E.1.12, Phased Closure:

- Engineering Design Plans (Closure Sequencing Plans) presenting the anticipated phased closure of the SCL, which also shows existing and proposed final limits of waste placement (liner area);
- An estimate of the maximum extent of the landfill that will ever require closure at any given time during the life of the landfill based on the Phased Closure Sequencing Plans;

- Closure implementation schedule for the final closure phase based on volumetric calculations; and
- A revised closure cost estimate based on the maximum extent of the landfill ever requiring closure as based on the Closure Phase sequencing versus refuse fill development of the life of the landfill.

E.1.1.1 <u>ESTIMATE OF CLOSURE DATE</u>

The landfill will be closed incrementally as each closure phase reaches final grades. Phase A is the old SCL City Unit 1 for which closure construction has been completed and is currently awaiting certification by the RWQCB. This area occupies approximately 205 acres of which 77 acres will be filled over as part of the expansion. Therefore, 128 acres is encompassed by Phase A closure as shown on Figure 50. It is anticipated that the Phase B Closure area project will begin in approximately 2013. The actual closure dates for each phase will depend primarily on the amount of refuse received over time, although operational factors and/or design considerations may also increase or decrease available airspace which can also affect an individual phased closure date. Therefore, the subsequent closure dates for Phases C through E are subject to change. Two years prior to reaching final fill elevation for each phase, a partial final closure plan will be prepared and submitted for review and approval from those regulatory agencies having jurisdiction over the SCL. The overall site closure date is 2037.

E.1.2 FINAL GRADING

The final grading plan, Figure 7, presents the landfill configuration after closure. Upon completion of refuse placement, the deck area will be set at a minimum gradient of 3 percent which will provide adequate drainage from the top deck, while taking into account projected landfill settlement. The final cover described in Section E.1.3 will then be placed over the refuse prism. The final slopes of landfill will be at maximum grades of 2.5:1 to 3:1. General construction procedures will be utilized to promote lateral run-off of surface water and to minimize the effects of settlement. Perimeter maintenance roads and deck access roads will be used for maintaining the final cover and environmental control systems throughout the post-closure maintenance period.

The final grading configuration was designed by a registered civil engineer in accordance with 27 CCR, Section 21090 (b)(1)(C).

E.1.3 FINAL COVER

The purpose of a final cover is to provide long-term minimization of surface water intrusion, to isolate wastes from the ground surface, and to reduce the potential for odors and gas emissions. The cover also provides a base for vegetation, which will reduce drainage velocities and erosion. In addition, the final cover configuration is designed to accommodate maintenance and cover, settlement, subsidence and the effects of seismic events during the minimum 30-year post-closure maintenance period and beyond.

E.1.3.1 FINAL COVER DESIGN

E.1.3.1.1 REGULATORY DESIGN STANDARDS

California Final Cover Prescriptive Design Standard

The minimum final cover standards for the site, as outlined in the closure and post-closure requirements for Class III landfills contained in 27 CCR, Section 21090, include:

- Foundation Layer: A minimum 2-foot thick layer of soil placed immediately over the entire surface of the last lift of refuse. This layer shall have the appropriate engineering properties, so as to provide a relatively unyielding surface upon which to place and compact the low-hydraulic-conductivity layer.

- Low-Hydraulic-Conductivity Layer: A minimum 1-foot thick layer of clean low-hydraulic-conductivity soil containing no waste or leachate placed over the foundation layer. The low-hydraulic-conductivity (or low through-flow rate) soils shall be placed on top of the foundation layer and compacted to attain a hydraulic conductivity, which is the lesser of either:
    - 1×10^{-6} cm/sec.
    - The hydraulic conductivity of any bottom liner system or underlying natural geologic materials.

- Erosion Resistant Layer: A minimum 1-foot thick layer of soil containing no waste or leachate placed on top of all portions of the low-hydraulic conductivity layer. Vegetation root depths must not exceed the topsoil layer thickness. Vegetation is to be replanted, as needed, to provide effective erosion resistance.

The final cover should be designed to allow for minimal maintenance. The final grading design for areas flatter than 5:1 (horizontal:vertical) shall have a gradient of at least 3 percent, to prevent ponding and to accommodate settlement.

Federal Final Cover Prescriptive Design Standard

The minimum final cover standards for the site, as outlined in the closure criteria of 40 CFR, Subpart F, Section 258.60, include:

- A cover with a permeability less than or equal to the hydraulic-conductivity of any bottom liner system, natural sub-soils present or a permeability no greater than 1×10^{-5} cm/sec, whichever is less. The barrier layer shall consist of a minimum 18 inches of earthen material.
- A cover which minimizes erosion of the final cover by the use of an erosion resistant layer that contains a minimum 6 inches of earthen material and is capable of sustaining native plant growth.

Alternative Final Cover Requirements

Approval of alternative cover systems is allowed in 27 CCR, Section 20080(b), and 40 CFR, Section 258.60, in cases where the discharger demonstrates that:

(1) The construction of prescriptive standard is not feasible as provided in Subsection (c) of Section 20080, and

(2) There is a specific engineered alternative that:

  (A) is consistent with the performance goal addressed by the particular construction or prescriptive standard; and

  (B) affords equivalent protection against water quality impairment.

As stipulated in Subsection (c) of Section 20080, to establish that the prescriptive standard is not feasible the discharger must demonstrate that the prescriptive standard:

(1) is unreasonably and unnecessarily burdensome and will cost substantially more than alternatives which meet the criteria in Subsection (b) of Section 20080; or

(2) is impractical and will not promote attainment of applicable performance standards.

E.1.3.1.2 PROPOSED FINAL COVER DESIGN

The final cover was designed by a registered civil engineer in accordance with State and Federal regulations and will be constructed in accordance with an approved Final Closure Plan submitted two years prior to the anticipated date of closure. Closure activities will then commence within 30 days following the last receipt of waste and will conclude within 12 months following the beginning of closure in accordance with the closure implementation requirements contained in 27 CCR, Section 21110, or in accordance with an alternate schedule approved by the LEA and CIWMB in the approved Final Closure Plan.

Unless an alternative final cover is proposed in the Final Closure Plan, a prescriptive final cover will be constructed on the SCL. As prescribed in 27 CCR, Section 21090, this cover will consist of the following layers, from bottom to top:

- A foundation layer consisting of a minimum of 2 feet of on-site soil, compacted to 90 percent of maximum density at optimum moisture content;
- Geocomposite gas drainage layer (optional);
- A low hydraulic conductivity layer, consisting of a minimum of 1 foot of soil compacted to attain a hydraulic conductivity of not more than 1 x 10^{-6} cm/sec;
- 40 mil linear low density polyethylene (LLDPE) geomembrane;
- Geocomposite drainage layer; and
- An erosion-resistant layer consisting of a minimum of 12 inches of soil suitable for sustaining native or other suitable vegetation that required irrigation or maintenance and will prevent surface erosion.

The proposed final cover system design is illustrated in of Figure 48. In accordance with normal engineering practice, all soil layers are specified for construction with a minimum thickness and a maximum tolerance, typically of 2 inches. Thus, the low hydraulic conductivity layer and erosion resistant (vegetative) layer would have a minimum thickness of 12 inches and a maximum thickness of 14 inches. An exception to this thickness would be on drainage benches and roads, which would have 3 feet of vegetative cover in order to protect the underlying geomembrane. Specific information on the materials and methods of constructing the final cover follow.

E.1.3.1.3 FINAL COVER CONSTRUCTION

Clearing and Grubbing

Prior to final grading and placement of the final cover, all existing vegetative materials will be removed from the surface without disturbing the underlying refuse. All deleterious materials generated by the clearing and grubbing operation will be buried and covered with the final cover system.

Foundation Layer

The 2-foot-thick foundation layer will be constructed using on-site soils. Based on requirements that all areas that are inactive for 180 days must receive intermediate cover, it is anticipated that the majority of the site will already have 12 inches of soil in place. An additional 12 inches of soil will be added to the in-place interim cover to satisfy the 2-foot foundation layer requirement. This additional 12 inch layer represents approximately 600,000 cy of soil (see section C.4.2 for on-site quantitative soil availability and section D.4.3 for a discussion on suitability of on-site soils for final cover). The assumptions and estimates are based on the most conservative scenario regarding activities that affect the soil availability, especially excavation (also see Section C.3.9.1).

To ensure the minimum thickness of 12 inches of interim cover is still in place at the time of final closure and the engineering characteristics of these soils (primarily in-place density) meets the minimum specified in the final cover design (design to be prepared and submitted for regulatory approval 2 years prior to implementation of each closure phase), a program of test pits and density testing will be undertaken. Under this program, the minimum bottom 12 inch thickness of the interim cover will be verified through test pits conducted at an average frequency of 1 per 20,000 square feet of final cover area which is equivalent to one borehole every 741 cy of foundation material. Boreholes will be more frequent in areas prone to erosion (e.g., steeper slopes) and less frequent in areas less prone to erosion. The thickness of the in-place cover will be measured and logged by a third party CQA representative. Concurrent with the test pit activity, the CQA representative will conduct soil density tests and evaluate soil particle size for compliance with the final cover design and specifications. Should there be areas with less than the one-foot of intermediate soil in-place, these areas will be built up to include the required soil depth prior to placement of other final cover materials. In order to represent a worst case scenario, costs for an entire additional one foot of foundation cover are included in the cost estimate in Table 18 in the preliminary grading line item. Use of the existing one foot intermediate cover as part of the foundation layer will be reviewed and approved as part of any partial final or final closure plan.

Low Hydraulic Conductivity Layer

The low hydraulic conductivity layer will achieve a hydraulic conductivity equal to or less than that of the bottom liner system by use of one foot of low permeability soil, overlain by a geomembrane of linear low density polyethylene (LLDPE). The low-permeability soil cover will employ the same off-site clay used for construction of bottom liners at SCL. This material has been certified as suitable for achieving hydraulic conductivities well below the maximum 1.0×10^{-6} cm/sec. In the event these materials are not available at the time of closure construction, alternative sources of clay or an alternative design will be proposed.

The LLDPE geomembrane will be supplied and installed by qualified geosynthetic materials suppliers under rigorous third-party quality assurance protocols.

Erosion-Resistant Layer

The erosion resistant layer will consist of three elements: a drainage layer, a minimum of one foot of soil, and vegetation. Except on drainage benches and roads, the vegetative soil layer will be a minimum of 12 inches thick, with a maximum of 14 inches. The erosion layer will be a minimum of 3 feet thick on all drainage benches (which typically host access roads as well) and under all access roads located over the top deck of the final cover. This additional thickness will provide additional protection to the underlying geomembrane components of the final cover in areas most likely to see vehicular traffic. Since it will be limited to relatively flat areas with less than 10 percent slope, the additional thickness of the vegetative soil layer on benches and roads will not affect the slope stability of the final cover. The drainage layer, consisting of a geocomposite drainage media, serves to minimize the likelihood of long-term moisture saturation of the vegetative layer, improving the slope stability of the cover system and decreasing the potential for water infiltration through the permeability barrier layers.

The soil used for the erosion layer will be on-site soil, fertilized or amended with organic material as needed to make it suitable for supporting plant growth. Soils are available for final cover on-site. In the event that an entity other than SCL implements closure, at any time throughout the life of the landfill, they would have access to those on-site soils for final cover construction. See section C.4.2 for complete calculations of soil availability and soil needs throughout the life of the facility and section D.4.3 for a discussion on suitability of on-site soils for final cover.

The final cover will comply with requirements for an erosion-resistant layer by establishing grassy vegetation on the top of the 1-foot thick minimum soil layer. Pursuant to 27 CCR, Section 21090(a)(3), the plant species selected for the final cover must be shallow-rooted, fast-growing and requiring of minimal irrigation and maintenance. Based on these criteria, BFI has selected the following planting mix as suitable for the particular soils of the site:

Species	Lbs./Acre
Bromus carinatus, Cucamonga Brome	15
Hordeum californicum, California Barley	4
Trifolium hirtum, Hykon Rose Clover	20
Lupinus bicolor, Bicolor Lupine	1
Agrostis alba, Red Top	6
Deschampsia caespitosa, Tufted Hairgrass	2
Trifolium incarnatum, Crimson Clover	6
Vulpia myuros, Zorro Fescue	10
Total	**64**

The seed mixture will be applied by hydroseeding, and supported during its early stages of establishment by temporary irrigation if needed. Any areas where seed fail to germinate or grasses fail to become established will be replanted.

E.1.4 LANDFILL SETTLEMENT

E.1.4.1 SETTLEMENT ANALYSIS

A settlement analysis was performed for the site by GLA and results are included in Appendix K. The mechanics of refuse settlement are complex due to the extreme heterogeneity of refuse fill. According to Edil et al. (1990), the main mechanisms involved in refuse settlement are:

- Mechanical distortion (bending, crushing and reorientation);
- Raveling (movement of fines into large voids);
- Physical-chemical changes (corrosion, oxidation and combustion); and
- Biochemical decomposition (fermentation and decay).

The magnitude of refuse settlement can thus be inferred to be a function of: (1) initial refuse density or solid/void ratio, (2) overall density of the refuse prism or ratio of refuse to daily cover soil, (3) content of decomposable materials in the refuse, (4) thickness of refuse lifts and total height of the refuse prism, (5) stress history, (6) time elapsed since each individual lift was placed, and (7) environmental factors such as moisture content, temperature and gas content.

Based on GLA's experience, the most consistent refuse settlement estimates are obtained by modeling the refuse prism as a 3-dimensional net, calculating the settlement at each node of the net with a time-dependant exponential decay function and adding the total settlement for each node of the net. Total settlement contours would normally be generated by subtracting total settlement from the final grade at landfill closure; however, since fill sequencing plans are unavailable, the entire site has been modeled as having been filled in equal thickness increments during the entire history of the landfill. Based on the work of Huitric (1981), settlement can be modeled as an exponential decay function of the form:

Remaining settlement = $\mathbf{a}Te^{-bt}$

Where **a** and **b** are constants such that total expected settlement is a proportion **a** of the original thickness, T, of a particular lift of refuse, and the rate of settlement decays at an exponential rate of **b**t, where t is the number of years elapsed since the particular lift of refuse was placed. For a municipal landfill with standard compaction equipment **a** varies between 0.2 and 0.35, and b varies between 0.10 and 0.11. For this analysis, intermediate values of 0.3 and 0.105 have been used, respectively.

Based on the analysis, total projected post-closure settlement might be as much as 90 feet. The settlement contours in Figure 1 of Appendix K generally follow the landfill contours/drainage bench contours; therefore, localized differential settlement will be minimal in magnitude. Any low spots resulting from settlement will be filled in and made to drain as appropriate. This settlement analysis is based on the projected site life of the site continuing to the year 2037 and additional year for the final phase of closure construction (2038).

E.1.4.2 SURVEY/SETTLEMENT MONUMENTATION

In order to monitor the future settlement of the landfill, survey monuments will be installed on the landfill in accordance with 27 CCR, Section 20950 (d). These monuments are proposed to consist of galvanized pipe, 2 inches in diameter and 6 inches in length placed in blocks of concrete, 24 inches in diameter by

8 inches in depth. A nail and tag will be placed in the center of each monument for identification (see Figure 49).

Proposed settlement monuments will be placed on the landfill as shown on Figure 7. Permanent survey monuments are located as shown on Figure 7. These monuments will provide both horizontal and vertical control points by which to monitor settlement of the final fill contours throughout the post-closure maintenance period. In addition, an aerial photographic survey of the site will be made at final closure to produce a map in accordance with 27 CCR, Section 21090 (e)(1), and a similar survey will be made of the site every five years throughout the post-closure maintenance period in accordance with 27 CCR, Section 21090(e)(2). From this information, an iso-settlement map will be produced showing the changes in elevation between consecutive aerial surveys of the landfill.

E.1.5 CLOSED LANDFILL STABILITY

A slope stability analysis is required by 27 CCR, Section 21090, when the closure design includes final slope faces steeper than 3:1 (horizontal:vertical) or a synthetic component is utilized in the final cover configuration. The proposed final slopes for the site do exceed 3:1; therefore, a stability analysis was performed for the final cover. The proposed alternative final cover design was found to be stable with respect to surficial failure (i.e., failures solely within the soil cover). Further discussion of the final cover stability is included in Section D.4.5 and Appendix N.

E.1.6 CONSTRUCTION QUALITY ASSURANCE

The construction of the final cover system shall be carried out in accordance with a CQA Plan prepared in compliance with 27 CCR, Sections 20323 and 20324, which has been certified by an appropriately registered professional. The CQA Plan will provide evidence that suitable materials and standard construction practices are used to place the final cover system and to document that placement is consistent with the closure plan design specifications in 27 CCR, Section 20324. A Preliminary CQA Plan for the site has been developed and is included as Appendix M. This plan reflects typical CQA procedures necessary to document the construction of components of the final cover system for purposes of estimating the associated cost. A Final CQA plan will be developed for the approved final cover design when the final closure plan is prepared. Elements of the CQA Plan include: project description and definitions, qualifications and responsibilities, requirements for the final cover evaluation, inspection standards, testing frequencies, meetings and documentation.

E.1.7 DRAINAGE AND EROSION CONTROL

E.1.7.1 DRAINAGE CONTROL SYSTEM DESIGN

The primary function of the drainage control system is to collect and convey stormwater in a controlled manner to minimize erosion and infiltration of stormwater into the refuse prism. The following sections describe the site hydrology, the existing drainage control features, and the proposed drainage control features.

E.1.7.1.1 HYDROLOGY

A hydrology study for the proposed conditions at the SCL was completed in accordance with 27 CCR, Section 20365. The Los Angeles County Hydrology and Sedimentation Manual (Los Angeles County 2006) was used to calculate peak discharge rates for a 96-hour, 50-year storm event. Three computer modeling programs were used to analyze runoff conditions on the project site. These programs included the Los Angeles County time of concentration program (T C Calculations), Civil Design's LAR04 and HEC-HM's. These programs were used to predict the quantity of run-off from the surrounding upstream areas, establish the size of channels and pipes for conveying the run-off around the landfill to the proposed desilting basin down-gradient from the landfill, and was used to evaluate drainage channel hydraulic grade line to verify that run-off will flow through the drainage system without backing up and overtopping berms, thereby, causing inundation or ponding on waste disposal areas. The hydrology study is included in Appendix J.

E.1.7.1.2 PROPOSED FINAL DRAINAGE CONTROL SYSTEM

The final drainage control system locations for the site are shown on Figure 29. The final surface area of the landfill decks will be graded at a minimum 3 percent gradient to minimize ponding and promote lateral run-off.

The final cover will be graded to drain surface water to engineered channels and down drain pipes, which will have inlets on the landfill top deck and on drainage benches constructed on side slopes. Drainage swales will be constructed on the top deck to limit uninterrupted flow distances and to convey water to the perimeter drainage. The perimeter drainage channels discharge into a system of debris basins; with all surface water eventually flowing by the terminal basin which discharges to a native drain course at the mouth of the canyon.

Sandbag or rock check dams will be installed in earthen channels and drainage swales to reduce flow velocity and minimize erosion and sediment transport. Erosion control matting, jute mesh or similar material, will be applied to the areas of the final cover with 3:1 or steeper slopes prior to the application of hydroseed. The jute mesh will reduce erosion in the early years of post-closure until the vegetative cover is fully established (approximately 2 to 5 years depending upon weather conditions). For additional drainage control information, refer to Section C.3.8.

E.1.7.2 SOIL LOSS ANALYSIS

A soil loss analysis was performed for the site and is discussed in detail in Section C.4.7. The soil loss analysis, included in Appendix L, predicts 2.0 tons/acre/year of soil loss which translates into 9.8×10^{-3} inches/year. Over the 30-year post-closure maintenance period, the average soil loss over the entire site will be approximately 0.28 inches. The 30-year soil loss represents 2.3 percent of the 12-inch vegetative cover layer thickness. The landfill soil loss analysis data is presented in Appendix L.

E.1.7.3 <u>EROSION CONTROL</u>

The landfill closure design has three primary erosion control features that will reduce the potential for soil erosion due to water and wind. These features include fill area grading, vegetation and a slope bench system.

The decks will be graded for sheet flow run-off with a minimum gradient of approximately 3 percent. The final vegetative cover will be comprised of plant species native to the landfill area. Plant species for erosion control will be selected to adapt to a non-irrigated environment and to maintain beneficial erosion control and aesthetic characteristics within the local climatic environment.

The slope benches and/or access roads will be placed at 40-foot vertical intervals on the landfill slope. The final slope bench system will reduce the length of travel of run-off on the slope face thus reducing the opportunity for rilling and gullying.

Additionally, during the interim period between closure and the full establishment of vegetation various erosion control measures such as slope rolls and silt fences will be used to prevent soil loss. Shredded green waste placement may also be performed. These measures will be implemented until the vegetative cover is adequately established to control soil loss.

E.1.8 ENVIRONMENTAL MONITORING AND CONTROLS

As the landfill is developed, concurrent installation of environmental monitoring and control systems will occur. Monitoring and control systems to be installed or maintained as each phase of the landfill is developed including drainage control systems, gas monitoring and recovery facilities; groundwater wells; subdrain collection systems; leachate monitoring and collection systems and all ancillary facilities.

At the time of final closure of the entire landfill, it is anticipated that all required environmental control systems, equipment and monitoring and operations will have previously been established. In accordance with applicable regulations and permits, all required monitoring programs and environmental control procedures will remain in effect during closure activities and throughout the post-closure maintenance period.

E.1.9 FINAL COVER INTEGRATION OF THE LANDFILL GAS RECOVERY SYSTEM

The purpose and intent of the landfill gas recovery and monitoring system during closure and post-closure is to protect public health and safety and the environment. The installation and operation of the landfill gas control and monitoring system has been installed in accordance with 27 CCR, Section 20920. As explained in Section E.1.8, expansion of the landfill gas collection system is not proposed for closure. However, in order to integrate the gas recovery system with the final cover, the following procedures are anticipated for closure construction.

Prior to placement of the final cover over a given closure phase, the header system will be removed. In order to minimize interruption of the system operation, the header will be removed in discreet areas with one area reinstalled and operational prior to removal of the next area. The affected landfill gas extraction wells will be disconnected and temporarily capped prior to removal of the header. Headers will be reinstalled if the integrity of the pipe remains intact; otherwise, the pipelines will be replaced. The main perimeter header system will remain on-line during the entire construction period.

Gas collection wells, in place at closure, will be protected during the placement of the final cover. The top of the vertical or horizontal wells will be surveyed, cut-off and capped below grade prior to placement of the final cover. Once the final cover is placed, the well head will be extended above grade and then reconnected to the lateral header line as before.

The condensate currently drains along the subheaders and main headers to collection tanks. When the headers are re-installed after final cover construction they will again gravity drain back to the collection tanks.

E.1.10 SITE SECURITY/SIGNAGE

In accordance with 27 CCR, Section 21135, signs will be posted at all points of access to the site 60 days prior to the last receipt of waste at the site and for a period not less than 180 days after the facility has received the final shipment of waste. Signs will state the intended date of last receipt, the site and location of alternative solid waste management facilities and a number to call in case of emergency. In addition, the operator is required to secure all points of access with a lock and gate and place signs at all access points prohibiting unauthorized entry. These measures are intended to reduce incidents of vandalism and illegal disposal of wastes during the post-closure maintenance period.

In accordance with 27 CCR, Section 21135, all points of access to the site will be restricted as of the date of the final shipment of waste. Site security at the site is currently provided by topography and fencing. Access gates with locks are located at the entrance to the landfill.

The only foot, vehicle and/or equipment that will be allowed within the phased closure areas will be for post-closure monitoring and maintenance.

E.1.11 STRUCTURE REMOVAL/DECOMMISSIONING OF ENVIRONMENTAL CONTROL SYSTEMS

Site structures, not deemed essential for closure construction or post-closure maintenance, will be dismantled and removed in accordance with 27 CCR, Section 21137.

All structures and foundations will be demolished and properly disposed of at the site. Scale pits and excavations remaining from demolished foundations will be backfilled with inert soils and compacted. The scales and associated mechanisms, office supplies and computer equipment for the scalehouse will be removed and salvaged.

At this time, there are no plans to decommission any of the environmental control systems at the site during the closure period. If deemed necessary, any decommissioning of boreholes, monitoring wells or piezometers will be conducted in accordance with the appropriate regulatory agency requirements (including notifications) and in general accordance with post-closure maintenance plan procedures.

E.1.12 PHASED CLOSURE SEQUENCING

The phased closure of the SCL will be performed in accordance with the applicable regulatory standards included in 27 CCR, Chapters 3 and 4 and 40 CFR, Subpart F. The closure sequencing for the SCL will be implemented in five phases (Phases A through E) as shown on Figure 50. The closure cost estimate is described in Part F. The components and systems required for the phased closure of the SCL include the final grading plan, final cover design, drainage, erosion and landfill gas system modifications as well as site security. A closure implementation schedule for construction of the final closure phase, is presented Subsection E.1.13. Figure 50 illustrates the five closure phase limits.

Partial final closure projects are allowed under 27 CCR, Section 21120. As described herein, separate closure phase projects will be implemented over the life of the SCL with each one having a separate partial final closure plan prepared two years in advance of the anticipated closure stage. These improvements will clearly enhance landfill containment and environmental protection. A primary benefit of the partial or early closure is the reduction of potential surface water infiltration, which in turn will reduce leachate generation, as well as the related surface seeps that are sometimes observed in unclosed areas following storm events. Additionally, a secondary benefit may include reduced landfill gas generation potential.

Termination points between a given closure phase and the active fill areas will be separated by the exterior benches. Those interface connections between the closure and active fill areas which are not separated by an exterior bench or discernable grade break, that is the connection which is made laterally, will be marked. Additional vegetative soil will also be placed to overlap the edge of the final cover by 10 feet. The protective soil and markers will provide adequate protection of the final cover and form a clear separation for continuing active fill operations outside the closure areas. In areas of vehicle activity, the vegetative soil overlap will be 20 feet.

In addition, those interim and final drainage control structures controlling surface water run-on and/or run-off for the designated closure phases will be inspected and maintained to appropriately divert run-on and control run-off.

The landfill gas control system will be installed as the site is developed. Permanent gas migration monitoring probes have been or will be installed prior to the closure of each phased construction period. The landfill gas system will be taken off-line and those drainage control system features over refuse will be removed while the final cover is placed and then reinstalled. The landfill gas well head stations will be extended up through the final cover and then reconnected.

Closure Phases

The phased closure of the SCL will be conducted throughout the development of the landfill. Phase A has already undergone closure construction. It is anticipated that the Phase B closure area will be closed in 2013. Subsequent staged closure dates are subject to future refuse inflow rates. Subsequent Partial Final Closure Plans will be submitted two years prior to reaching final fill elevations for each closure phase based on the refuse inflow rates for the preceding phased closure area. In addition, Construction Quality Assurance (CQA), including closure certification, will be completed for each closure phase to verify proper final closure construction.

Phase A

Phase A includes Unit 1 of the SCL City which consists of 205 acres which were previously closed (128 acres of which will not be overlain by new waste - see Figure 50) with a monolithic final cover system. The Final Closure and Postclosure Maintenance Plans (FCPMPs) for the SCL City Unit 1 (Phase A) consist of the following:

- Final Closure Plan for the Sunshine Canyon Landfill, Sylmar, California, dated 30 November 1990, Revised 19 April 1991, Second Revision 30 April 1992, Third Revision 18 November 1994, Volume 1 of 2;

- Final Closure Plan for the Sunshine Canyon Landfill, Sylmar, California, dated 30 November 1990, Revised 19 April 1991, Second Revision 30 April 1992, Third Revision 18 November 1994, Volume 2 of 2;

- Addendum to the Final Closure and Post-closure Maintenance Plans, Sunshine Canyon City Landfill, Sylmar, California, Responses to Comments and Appendices, March 1997, Volume I of II;

- Addendum to the Final Closure and Post-closure Maintenance Plans, Sunshine Canyon City Landfill, Sylmar, California, Responses to Comments and Appendices, March 1997, Volume II of II; and

- Response to Regulatory Comments on the Addendum to the Closure and Post-Closure Maintenance Plans, Sunshine Canyon City Landfill, Sylmar, California, November 1997.

The FCPMPs for SCL City Unit 1 (Phase A) has been approved by the regulatory agencies. A chronology of the FCPMP approval is as follows:

- the CRWQCB approved the FCPMP on 15 July 1997;

- the Mitigated Negative Declaration was completed and Notice of Determination signed on 29 January 2001;

- the Enforcement Agency (i.e., the City of Los Angeles Environmental Affairs Department) approved the FCPMP on 13 February 2001; and

- the CIWMB approved the Final Closure and Postclosure Maintenance Plans (and associated addenda) on 26 March 2001.

Phase B

Phase B is a 76-acre area as shown on Figure 50. This area includes the top deck area on the northeastern end of the landfill with an elevation ranging from 1,800 to 1,904 feet above mean sea level (AMSL). The closure volume estimates are based on the deck area to an elevation 1,904 feet. As part of this project, the area will be cleared and grubbed, as necessary, and the closure improvements constructed (e.g., final cover, permanent drainage, landfill gas system modification, etc.). It is anticipated that this area will be closed in 2013 depending on actual refuse inflow rates experienced over time.

Phase C

Phase C is a 51acre area as shown on Figure 50. This area includes the final fill slopes along the southeastern and northwestern edge of the southwestern tip of the landfill with elevations ranging from 1,500 to 1,875 feet AMSL. The closure volume estimates are based on a slope area to an elevation of 1,875 feet. As part of this project, the area will be cleared and grubbed, as necessary, and the closure improvements constructed (e.g., final cover, permanent drainage, landfill gas system modification, etc.).

Phase D

Phase D is a 28-acre area as shown on Figure 50. This area includes the final fill slopes along the northwestern edge of the landfill adjacent and to the north of Phase C and the northern top deck area adjacent and to the west of Phase B with elevations ranging from 1,600 to 1,800 feet AMSL. The closure volume estimates are based on a slope area to an elevation of 1,800 feet AMSL. As part of this project, the area will be cleared and grubbed, as necessary, and the closure improvements constructed (e.g., final cover, permanent drainage, landfill gas system modification, etc.).

Phase E

Phase E is a 215-acre area as shown on Figure 50. This area includes the two top deck areas. The first deck area is adjacent and to the southwest of Phase B with elevations ranging from 1775 to 1875 feet AMSL. The second deck area is adjacent and to the northeast of Phase C with elevations ranging from 1950 to 2004 feet AMSL. The second deck area is surrounded by final fill slopes with elevations ranging from 1700 to 1950 feet AMSL. The closure volume estimates are based on the two deck areas with elevations of 1875 feet and 2004 feet AMSL. As part of this project, the area will be cleared and grubbed, as necessary, and the closure improvements constructed (e.g., final cover, permanent drainage, landfill gas system modification, etc.).

E.1.12.1 MAXIMUM EXTENT OF LANDFILL THAT WILL EVER REQUIRE CLOSURE

The maximum extent of the landfill that will ever require closure during the life of the landfill is 215-acres. Table 21 presents the anticipated phased closure acreages versus the refuse fill phases to show the maximum extent that would ever require closure. As shown, refuse fill will be placed over 215 acres before Closure Phase E can be completed creating the basis for maximum extent.

The site's phased closure was developed so as to not interfere with active disposal operations.

E.1.12.2 CONSTRUCTION MANAGEMENT

A Construction Manager will be onsite during the entire period of closure construction. The Construction Manager will be responsible for supervision of construction of the various features included in the closure plan. The Construction Manager will coordinate the activities of the onsite contractor(s) and will provide liaison between the design engineer and the contractors. Other key staff may include a Site Engineer and Construction Inspector(s). A survey crew and a geotechnical CQA crew will also be present, as required.

Survey Control

The survey control crew, under the direction of the selected contractor, will be responsible for the surveyed location of the closure plan improvements and for record drawing information. They will be responsible for establishing that the various components of the cover conform to the grade and/or thickness requirements of the construction drawings and specifications.

CQA For Final Cover Placement

The construction specifications will include a final CQA Plan for final cover placement as part of the final closure plan. A geotechnical CQA crew, under the direction of a Geotechnical Engineer, will be onsite full-time during the placement of the final cover to monitor compliance with cover design and installation methods included in the CQA Plan. The CQA personnel will have day-to-day responsibility to oversee cover placement and to evaluate whether the cover is constructed according to the project specifications. A preliminary CQA plan is included in Appendix M which contains all the elements required for the placement of soil, geosynthetic materials and other components of the proposed final cover system.

California Environmental Quality Act Documentation

As discussed above, stand alone Partial Final Closure Plans will be prepared in advance of each closure phase. The operator will comply with CEQA and evaluate potential impacts associated with each staged closure project. Appropriate CEQA documentation will be prepared in support of obtaining agency approval of the Partial Final Closure Plans.

E.1.13 PHASED CLOSURE IMPLEMENTATION SCHEDULE

E.1.13.1 CLOSURE/CONSTRUCTION SCHEDULE

As discussed in Section B.3.3, the landfill is projected to reach capacity in the year 2037. As required by 27 CCR, Section 21780 (c)(2), a Final Closure and Post-Closure Maintenance Plan (FCPCMP) will be submitted for regulatory agency approval two years prior to the anticipated date of closure. In accordance with 27 CCR, Section 21110, closure activities will then commence within 30 days following the last receipt of waste within a given Phased Closure Area and will conclude within 180 days following the beginning of closure construction of that phase or in accordance with an alternate schedule approved by the LEA and the CIWMB.

A closure implementation schedule for the final closure phase (Phase E) of the SCL is presented in Table 22. For Closure Phases B through D an implementation schedule for each phase will be submitted as part of the individual Partial Final Closure as phased closure is implemented.

Typical closure construction activities will include the following tasks:

- Equipment Mobilization
- Signage
- Site Exploration and Survey

- Structure Removal/Demolition (last phase only)
- Excavation of Final Cover Soil (foundation and vegetative layers only)
- Final Cover Placement (including geomembrane)
- Landfill Gas System Modifications
- Permanent Drainage Control Feature Installation
- Drainage Control Systems Modifications
- Seed and Mulch Installation
- Demobilization

Some of these activities will be conducted concurrently.

Closure construction will begin with mobilization of equipment and materials. The type of equipment and required personnel expected to be utilized during closure construction includes, but is not limited to, the following:

- Equipment
  - Scrapers
  - Dozers
  - Loaders
  - Compactors
  - Trucks
  - Soil Screening Equipment
  - Motor Grader
  - Water Truck

- Personnel
  - Construction Manager
  - Field Inspector(s)
  - Engineer(s)
  - Geotechnical Engineer/Geologist
  - Geotechnical Technician(s)
  - Labor Crews
  - Equipment Operators

- Surveyors
- Mechanics

SECTION F.1

CLOSURE/POST-CLOSURE MAINTENANCE COST ESTIMATE
(27 CCR, SECTION 21769(b)(2)(A) and 21790(b)(1))

F.1 CLOSURE/POST-CLOSURE MAINTENANCE COST ESTIMATE (27 CCR, SECTIONS 21769(b)(2)(A) AND 21790(b)(1))

F.1.1 INTRODUCTION

In order to establish the basis for the proper level of funding for a landfill to be closed in increments over its active life, a closure sequence or phasing plan must be prepared. Then, in order to meet 27 CCR requirements, the cost estimate must be based on the maximum extent or area of the landfill that would ever require closure. Since the SCL is proposed to be closed in four phases, the basis of the closure cost estimate is the largest area requiring closure over the life of the landfill which, based on Table 21, is 215 acres. The closure cost estimate reflects not only the closure of the specifically identified disposal area but also activities such as installation and/or verification of security and environmental monitoring/control systems that would have to address the entire landfill property should the landfill close prior to reaching final capacity. The active fill area will be maintained to an area equal to or less than this coverage area.

The cost estimate presented in Table 18 is a new closure cost estimate for this PCPCMP and serves as the basis to fund the closure account over the life of the landfill. The closure cost estimate reflects third-party costs in 2007 dollars in order to close the maximum 215-acre area ever requiring closure at one time.

The closure features are grouped into categories for convenience in presenting the cost estimate. A brief description of the components included in each category is given below.

F.1.2 CLOSURE COST ESTIMATE

The closure plan features are grouped into categories for convenience in presenting the cost estimate. A brief description of the components included in each category is given below. The total closure cost estimate is shown on Table 18 and is projected in 2007 dollars.

F.1.2.1 FINAL COVER

Based on the proposed final grading plan, the approximate area which will require placement of final cover is 372 acres. However, the largest extent of landfill which will ever require closure for its active life is 215 acres. The proposed final cover for SCL will consist of a 4-foot thick composite cover as described in section E.1.3 (including one-foot of in-place intermediate cover). The cost of constructing the final cover includes site preparation, removal of soils from onsite stockpiles, soil compaction, synthetic and clay material placement, site grading and survey monument installation. An engineered alternative cover system consisting of a five-foot thick monolithic soil layer may be proposed to address specific engineering requirements that arise in the course of preparing detailed designs for the individual closure phases.

F.1.2.2 FINAL COVER CONSTRUCTION QUALITY ASSURANCE MONITORING AND TESTING

Costs for CQA include the final cover placement tests, inspections and reporting.

F.1.2.3 DRAINAGE CONTROL SYSTEM

Costs for the drainage control system include the removal and replacement of inlet structures, and downdrains over a 215-acre area. Construction of the permanent drainage control system for the current fill area is installed. As operations expand, the drainage control facilities for the upcoming fill area are installed concurrent with liner construction as part of normal landfill development. No costs for drainage construction, other than for final closure items, are included in the closure cost estimate.

F.1.2.4 LANDSCAPING AND EROSION CONTROL

This category covers the cost of landscaping construction which includes soil preparation and planting of vegetative materials and installation of an irrigation system.

F.1.2.5 GAS CONTROL SYSTEM

This category includes the cost of modification of the well head stations and lateral piping system during placement of the final cover system.

F.1.2.6 SITE SECURITY

This category includes costs for required signage at closure of Phase D. The site is currently enclosed with a perimeter fence and gates or has topographic constraints to prevent unauthorized access to the site property. The fence will be fully functional at the time of closure due to ongoing inspection and maintenance during operations.

F.1.2.7 DEMOLITION

This category generally includes costs for dismantling and removal of on-site structures (i.e., fee booths and landfill scales). However, the entrance facilities including the administration and maintenance building will remain on-site during the post-closure maintenance period to house necessary equipment and staff.

F.1.2.8 GAS MIGRATION MONITORING SYSTEM

This category includes the cost to replace 15 percent of the gas migration monitoring probes during the final stage of closure (Phase D) or any lesser portion of the site.

F.1.2.9 GROUNDWATER MONITORING SYSTEM

No costs are associated with this category since additional groundwater monitoring facilities are not proposed for the site at closure.

F.1.2.10 ENGINEERING DESIGN

This category includes costs for the preparation of construction level engineering design plans and specifications for bid purposes. This cost is assumed to be 0.5 percent of the construction cost.

F.1.2.11 CONSTRUCTION MANAGEMENT

The construction management cost for the SCL is based on the closure construction period. This cost is assumed to be 1 percent of the construction cost.

F.1.2.12 PARTIAL FINAL CLOSURE AND POST-CLOSURE MAINTENANCE PLAN PREPARATION

This category covers the cost to prepare a Partial Final Closure Plan for the Phase D Closure area.

F.1.2.13 CONTINGENCY

A 20 percent contingency factor has been added to the construction cost estimate.

F.1.3 POST-CLOSURE MAINTENANCE COST ESTIMATE

The post-closure maintenance cost estimate has been prepared utilizing information contained in Section E.2 and estimates of manpower, materials and equipment to maintain SCL in compliance with current applicable regulations. The total annual maintenance and monitoring cost estimate for post-closure is shown on Table 19. These costs are projected in 2007 dollars, assuming no change in the regulatory environment with respect to SCL. The total 30-year post-closure cost estimate was calculated by multiplying the annual cost estimate from Table 19 by 30. The total 30-year post-closure cost obligation does not factor in inflation or interest over the funding period. The actual future value of the 30-year total may be different. Annual funding will be calculated year to year in accordance with 27CCR, Section 22225.

The operator will initiate post-closure maintenance activities as the phased closure of the SCL is implemented. The operator's understanding is that a minimum of the last thirty (30) years of post-closure maintenance must be funded. Therefore, the ongoing post-closure obligation under state law will continue for a minimum of 30 years after the Phase D closure area is completed.

It should be noted that the maintenance and monitoring costs presented have been projected utilizing current regulations and applicable requirements. In the event that changes occur in the regulatory conditions pertaining to SCL, these estimates will be adjusted accordingly, if necessary, and submitted to the CIWMB, LEA, and RWQCB.

F.1.4 DEMONSTRATION OF FINANCIAL RESPONSIBILITY

Closure/Post-Closure Maintenance Fund

In accordance with 27 CCR, Chapter 6, and 40 CFR, Subpart G, an operator must demonstrate financial assurance for the proper closure and post-closure maintenance at a landfill. The financial assurance mechanism is in the form of Certificates of Insurance for closure of the City and County SCL in the amounts of $15,032,610 and $24,275,231, respectively. The County SCL also has financial assurance in the form of a Certificate of Insurance for ~~and~~ post-closure maintenance in the amount of $21,431,266~~the County SCL~~. The CIWMB approval notice for the Certificates of Insurance is included in Appendix Q.

The financial assurance for the City SCL post-closure maintenance is in the form a bond. ~~A~~ The Travelers Bond Rider to Bond No. 104256401 ~~increasing the bond~~ is in the amount ~~to~~ of $~~14,608,950~~23,117,820. ~~was made effective July 20, 2006. This rider covered the 2005 inflation adjustment. At that time~~ Tthe CIWMB ~~did~~ has not provided written confirmation of the bond adjustment; therefore there is no current correspondence from the CIWMB approving the financial assurance mechanism. ~~Since then the CIWMB has notified BFI of the 2006 annual inflation factor, which is 1.029 or 2.9 percent. The amount of bond needs to be increased to $15,032,610 to reflect the 2006 annual inflation factor. BFI will be preparing a new rider to the bond to cover the 2006 annual inflation factor and submitting it to the CIWMB.~~

TABLES

TABLE 5

SUNSHINE CANYON LANDFILL

COMPARISON OF GEOSYNTHETIC TARPS AND PROCESSED GREEN MATERIAL TO DAILY SOIL COVER

Property	Daily Soil Cover	Synthetic Tarps	Processed Green Material
Hazardous or pathogenic nature of the cover	None	None	None
Resistance to heat and fire after application and compaction	On site soils do not burn or propagate flame and will have a tendency to smother fires	The tarps used will have a flame retardant coating applied	Naturally occurring moisture in the green material and the 1-day limitation in use will max. Resistance to heat and fire.
Field permeability after application and compaction	Soil analysis indicate a permeability of 1.0 x 10^{-5} at 90% compaction	Most tarps are water repellent; runoff will be controlled and managed accordingly	Like soil, processed green material will absorb water until the surface is saturated to cause lateral run-off.
Compaction capability of the cover	Soils are conducive to compaction	Tarps will not be subject to compaction	Processed green material is conducive to compaction as noted in the applicable regulations.
The ability of the cover to control the emergence, attraction, or harborage of vectors	Vectors can emerge from the waste; however, compacting the cover significantly reduces emergence and breeding	Control similar to soil; waste types and operation dictate severity of emergence and attraction	Similar performance as soil.

TABLE 6
SUNSHINE CANYON CITY/COUNTY LANDFILL
LANDFILL EQUIPMENT

Equipment	Current
100K Pound Class Waste Compactors	6
D8/D9 Class Bulldozers	6
D6R LGP Class Bulldozer	2
Motor Grader	1
3500 Gallon Water Trucks	3
Sweeper	1
657 Scrapers (or 2 - 40 ton ADT & 1 - 330 Excavator)	2
Light Plants	3 to 9
Fuel/Lube Truck	1
Wheel Loader	1
Pick-up Trucks	5
Mechanic Trucks	2

Note: Equipment listed is based on maximum daily tonnage of 12,100 tpd. Lower daily tonnage will require fewer pieces of equipment.

TABLE 18
SUNSHINE CANYON CITY/COUNTY LANDFILL
CLOSURE COST ESTIMATE SUMMARY
(2007 DOLLARS, PHASE E)

ITEM	DESCRIPTION	QUANTITY		UNIT PRICE	ESTIMATED COST ($)
1	**FINAL COVER**				
	Site Preparation (Survey/Exploration/Mobilization)	1	ls	$500,000.00	$500,000
	Slope Area (73 acres) (1)				
	Preliminary Grading (2)	3,179,370	sf	$0.12	$381,524
	Foundation Layer (2' thickness - 1' existing) (3)	117,754	cy	$2.20	$259,059
	LFG Collection Medium - HDPE Geocomposite (3)	317,937	sf	$0.41	$130,354
	Barrier Layer (1' thickness - clay)	117,754	cy	$28.45	$3,350,101
	Barrier Layer (40-mil LLDPE Geomembrane)	3,179,370	sf	$0.27	$858,430
	Drainage Medium - HDPE Drainage Geocomposite (3)	317,937	sf	$0.41	$130,354
	Reinforcing Geogrid	3,179,370	sf	$0.56	$1,780,447
	Vegetative Layer (1' thickness)	117,754	cy	$2.20	$259,059
	Deck Area (142 acres)				
	Preliminary Grading (2)	6,185,545	sf	$0.12	$742,265
	Foundation Layer (2' thickness - 1' existing) (3)	229,094	cy	$2.20	$504,007
	LFG Collection Medium - HDPE Geocomposite (3)	618,555	sf	$0.41	$253,607
	Barrier Layer (1' thickness - clay)	229,094	cy	$28.45	$6,517,724
	Barrier Layer (40-mil LLDPE Geomembrane)	6,185,545	sf	$0.27	$1,670,097
	Drainage Layer - HDPE Geocomposite (3)	618,555	sf	$0.41	$253,607
	Vegetative Layer (1' thickness)	229,094	cy	$2.20	$504,007
	Settlement/Survey Monument Installation	6	ea	$600.00	$3,600
				Subtotal	**$18,098,244**
2	**FINAL COVER CONSTRUCTION QUALITY ASSURANCE**				
	Field Personnel/Monitoring/Reporting	213	acres	$2,500.00	$532,500
				Subtotal	**$532,500**
3	**DRAINAGE CONTROL SYSTEM (4)**				
	AC Downdrain - Slopes	11,200	lf	$60.00	$672,000
	Bench Crossing/Inlets	97	ea	$2,700.00	$261,900
	Top Deck Inlets	21	ea	$2,200.00	$46,200
				Subtotal	**$980,100**
4	**EROSION CONTROL**				
	Soil Testing	1	ls	$5,500.00	$5,500
	Soil Preparation/Seeding	213	acres	$2,750.00	$585,750
	Silt Fences	40,300	lf	$3.00	$120,900
	Slope Rolls	42,300	lf	$1.25	$52,875
				Subtotal	**$765,025**
5	**GAS CONTROL SYSTEM (5)**				
	Extend Well Heads/Replacement (if nec.)	214	ea	$1,000.00	$214,000
	Synthetic Boots	214	ea	$500.00	$107,000
	Main Collection Header	N/A	lf	$0.00	$0
	Lateral Piping	101,000	lf	$15.00	$1,515,000
	Exp. Valves, Joints, Ports, Flare Sta., Sumps Etc.	1	ls	$250,000.00	$250,000
				Subtotal	**$2,086,000**
6	**SITE SECURITY**				
	Signage	4	ea	$900.00	$3,600
				Subtotal	**$3,600**

TABLE 18
SUNSHINE CANYON CITY/COUNTY LANDFILL
CLOSURE COST ESTIMATE SUMMARY
(2007 DOLLARS, PHASE E)

ITEM	DESCRIPTION	QUANTITY		UNIT PRICE	ESTIMATED COST ($)
7	**DEMOLITION**				
	Building, HW Storage Area)	1	ls	$100,000.00	$100,000
				Subtotal	**$100,000**
8	**GAS MIGRATION MONITORING SYSTEM MODIFICATION** [6]				
	Replacement of Gas Migration Monitoring Probes	3	probes	$14,000.00	$42,000
				Subtotal	**$42,000**
9	**GROUNDWATER MONITORING SYSTEM** [7]				
				$0.00	$0
				Subtotal	**$0**
10	**ENGINEERING DESIGN** [8] **(0.5% of construction cost)**	-	ls	-	$110,375
				Subtotal	**$110,375**
11	**CONSTRUCTION MANAGEMENT** [9]	1680	hrs	$100.00	$168,000
				Subtotal	**$168,000**
12	**FINAL CLOSURE PLAN PREPARATION**	-	ls		$50,000
				Subtotal	**$50,000**
		Total Construction Cost			**$22,935,844**
		Contingency 20%			**$4,587,169**
		Total Closure Cost Estimate [10]			**$27,523,012**

Notes:

(1) Slope factor of 1.09 was added to slope final cover quantities.

(2) Costs for preparation (e.g., removal of oversize particles) and compaction of the existing one foot of foundation is included in this item. Alternatively, should another foot need to be added at the time of closure, the costs included in this item are more than enough to accommodate it (i.e., $763,066 for an additional foot as compared to $1,123,789).

(3) Cost assumes that only one foot of random soil would need to be placed for the foundation layer because one foot of soil would already be in-place. Cost for drainage and LFG collection medium assumes 10 percent coverage.

(4) Estimate assumes cost to repair/remove or replace the existing surface water control system features for Phase E at time of closure. The trapezoidal perimeter drainage channels and the debris basins will have already been installed at the facility.

(5) This item includes costs to modify in-place landfill gas control system at closure during placement of the final cover. Main headers lines will be placed below grade in native ground around the perimeter, therefore remove/replace cost included.

(6) Conservatively assumes spontaneous failure and replacement of 3 landfill gas migration monitoring probes at closure.

(7) An extensive groundwater system is in-place at the site and any necessary modifications associated with the expansion will be in place at the time of closure. Therefore no cost is associated with this item.

(8) Cost is for engineering design and preparation of construction documentation (plans and specifications) for bid purposes.

(9) Cost is for monitoring contractors work, coordinating CQA activities, meetings, liaison between design engineers and contractors, etc. with a full time construction manger for 10 months (see Table 22).

(10) $27,523,012 was divided by 215 acres (total closure acreage) resulting in a rounded cost of $128,000/acre unit cost for estimating phased closure costs included in Table 21.

TABLE 19
SUNSHINE CANYON CITY/COUNTY LANDFILL
ANNUAL POST-CLOSURE MAINTENANCE AND MONITORING
COST ESTIMATE SUMMARY
(2007 DOLLARS)

Item No.	Description	Quantity	Unit Price ($)	Total ($)
1	**LANDFILL GAS CONTROL SYSTEM MONITORING AND MAINTENANCE**			
	Flare Station Operation and Maintenance	-	$82,000 LS	$82,000
	System Monitoring (Well Field Monitoring)	384 hrs	$55 hour	$21,120
	Condensate Sump Inspections (daily)	96 hrs	$55 hour	$5,280
	LFG Extraction System Inspections (daily)	-	$15,000 LS	$15,000
	Flare Source Testing	5 ea	$16,000 ea	$80,000
	Instantaneous Surface Emission Monitoring	1235 ea	$22 ea	$27,170
	Instantaneous Surface Emission Re-Monitoring (10%)	123.5 ea	$22 ea	$2,717
	LFG Control System Monthly Monitoring	237 ea	$12 ea	$2,844
	Probe Sample Laboratory Analysis	6 ea	$475	$2,850
	Reporting		$12,500 LS	$12,500
	Project Coordination and Engineering	72 hrs	$110 hour	$7,920
	Equipment/Materials		$24,000 LS	$24,000
	Maintenance	-	$82,000 LS	$82,000
			Subtotal	**$365,401**
2	**LANDFILL GAS MIGRATION/VADOSE ZONE SYSTEM MONITORING AND MAINTENANCE**			
	Monitoring	288 hrs	$55 hour	$15,840
	Monitoring Equipment	-	$3,800 LS	$3,800
	Reporting	96 hrs	$115 hour	$11,040
	Maintenance and Replacement			
	Labor	288 hrs	$55 hour	$15,840
	Equipment/Materials	-	$7,100 LS	$7,100
	Maintenance/Repair (1)			
	Total Repair/Replacement	34 probes	$14,000 probe	$476,000
	Total Repair/Replacement divided by 30 years (476,000/30)	-	-	$15,867
			Subtotal	**$69,487**
3	**GROUNDWATER MONITORING SYSTEM MAINTENANCE AND REPAIR**			
	Well Replacement (replace one well during the post-closure period)			
	Inspection	41 hrs	$110 hr	$4,510
	Permit		$220 LS	$220
	Mobilization		$11,400 LS	$11,400
	Labor	6 days	$1,600 day	$9,600
	Drilling/ Equipment/Materials	1267 ft	$92 ft	$116,564
	Replacement Well Development	48 hrs	$185 hr	$8,880
	Well Pump Replacement (one every 2 years)	15 ea	$2,000 ea	$30,000
	Existing Well Redevelopment (one every 5 years)	6 ea	$2,000 ea	$12,000
	Total Repair and Replacement	-	-	$193,174
	Total Repair - Replacement/30 years	-	-	$6,439
			Subtotal	**$6,439**

TABLE 19
SUNSHINE CANYON CITY/COUNTY LANDFILL
ANNUAL POST-CLOSURE MAINTENANCE AND MONITORING
COST ESTIMATE SUMMARY
(2007 DOLLARS)

Item No.	Description	Quantity	Unit Price ($)	Total ($)
4	**GROUNDWATER/LEACHATE/CONDENSATE/SURFACE WATER MONITORING**			
	Labor	128 hrs.	$76 per/hr	$9,728
	Analysis - Routine	60 ea.	$220 ea.	$13,200
	Analysis - COCs (total for 6 events/30 years)	86 ea	$1,100 ea.	$3,153
	Reporting	6 ea	$5,500 ea.	$33,000
			Subtotal	**$59,081**
5	**LEACHATE MANAGEMENT SYSTEM (2)**			
	Operation and Maintenance of Leachate Treatment System	360 hrs	$55 per/hr	$19,800
	Leachate Disposal	-	$18,250 LS	$18,250
	Leachate Sampling	16 hrs.	$76 per/hr	$1,216
	Leachate Analysis	6 per/yr	$1,150 sample	$6,900
			Subtotal	**$46,166**
6	**STORMWATER MONITORING**			
	Sampling/Reporting/Inspection/Permit	-	$8,700 LS	$8,700
	Analysis	-	$1,100 LS	$1,100
			Subtotal	**$9,800**
7	**FINAL COVER INSPECTION/MAINTENANCE AND REPAIR**			
	Inspection	80 hrs	$55 per/hr	$4,400
	Cover Repair (3)			
	Heavy Equipment	200 hrs	$136 per/hr	$27,200
	Labor	200 hrs	$55 per/hr	$11,000
	Staff/Principal Geologist	200 hrs	$110 per/hr	$22,000
	Word Processor	40 hrs	$52 per/hr	$2,080
	Materials	-	$20,000 LS	$20,000
			Subtotal	**$86,680**
8	**LANDFILL SETTLEMENT MONITORING AND MONUMENT MAINTENANCE**			
	Inspection/Maintenance			
	Labor	26 hrs	$55 per/hr	$1,430
	Materials ($900 to replace every 3 years)	-	$330 LS	$330
	Aerial Survey (Once every 5 years)($14,000/5yrs)	-	$3,050 LS	$3,050
	Settlement Report			
	Engineer	12 hrs	$115 per/hr	$1,380
	Labor	8 hrs	$55 per/hr	$440
			Subtotal	**$6,630**
9	**VEGETATIVE COVER INSPECTION**			
	Inspection	128 hrs	$55 per/hr	$7,040
	Soil Quality	4 acres	$2,400 ac/yr	$9,600
	Rodent Control	16 hrs	$55 per/hr	$880
	Weed/Dust and Fire Control	128 hrs	$33 per/hr	$4,224
			Subtotal	**$21,744**

TABLE 19
SUNSHINE CANYON CITY/COUNTY LANDFILL
ANNUAL POST-CLOSURE MAINTENANCE AND MONITORING COST ESTIMATE SUMMARY
(2007 DOLLARS)

Item No.	Description	Quantity	Unit Price ($)	Total ($)
10	**ACCESS ROAD MAINTENANCE**			
	Inspection			
	Labor	40 hrs	$55 hr	$2,200
	Repair			
	Labor/Materials	-	$4,800 LS	$4,800
			Subtotal	**$7,000**
11	**DRAINAGE CONTROL SYSTEM INSPECTION AND MAINTENANCE**			
	Inspection	40 hrs.	$55 per/hr	$2,200
	Drainage Pipes/Inlets			
	Labor	200 hrs	$55 per/hr	$11,000
	Heavy Equipment	200 hrs	$136 per/hr	$27,200
	Materials - Drainage Basin	-	$3,900 LS	$3,900
	Perimeter Drainage Facilities			
	Labor	452 hrs	$55 per/hr	$24,860
	Heavy Equipment	88 hrs	$136 per/hr	$11,968
	Materials		$6,000 LS	$6,000
			Subtotal	**$87,128**
12	**SITE SECURITY INSPECTION AND MAINTENANCE (4)**			
	Labor/Maintenance/Repair Materials	-	$8,960 LS	$8,960
			Subtotal	**$8,960**
13	**SITE ADMINISTRATION**			
	Site Coordinator	384 hrs	$45 per/hr	$17,280
			Subtotal	**$17,280**
TOTAL ANNUAL POST-CLOSURE MAINTENANCE AND MONITORING COSTS				**$791,796**
TOTAL 30 YEAR POST-CLOSURE MAINTENANCE AND MONITORING COSTS				**$23,753,884**

Footnotes:

1) Conservatively assuming all of the 34 probes will be replaced during the post-closure period.
2) The proposed SCL will undergo rolling closure which will significantly reduce the overall amount of leachate produced at the time of closure of the final stage. This is due to construction of the final cap in stages which will limit the introduction of storm water to the landfill. Also, the proposed landfill will be much deeper and have a much higher carrying capacity for moisture which will also reduce the amount of leachate reaching the LCRS at closure of the final stage therefore it is estimated that approximately 5,000 gallons/day of leachate will be generated and at $.01/gallon for disposal costs multiplied by 365 days equates to $18,250.
3) Assumes that final cover soils obtained from an on-site borrow/stockpile sources. Includes monolithic cover for Phase A
4) Assumes replacement of the entire 11,200 linear feet of fencing once during the post-closure period at $24/ft for a total of $268,800 which amounts to 3.3 percent per year or $8,960 per year for 30 years.

TABLE 21
SUNSHINE CANYON CITY/COUNTY LANDFILL
PHASED CLOSURE MATRIX

DEVELOPMENT (LINER) PHASE	FILL PHASE AREA	CLOSURE PHASE	CLOSURE PHASE AREA	UNCAPPED AREA START OF CLOSURE PLAN	UNCAPPED AREA AT CLOSURE PHASE COMPLETION	ESTIMATED CLOSURE PHASE COST**
Unit 1 of the SCL City	-	A	87	-	-	-
Current Lined and Filled Refuse Area	166 AC	-	-	163*	163	
Phase CC-I	32 AC	B	76	195	119	$9,728,000
Phase CC-II	11 AC	-	-	130	130	
Phase CC-III	81 AC	C	51	208*	157	$6,528,000
Phase CC-IV	21 AC	D	28	178	150	$3,584,000
Phase CC-V	68 AC	E	215	215*	0	$27,520,000

* There are approximately 3 acres of soil fill in each of the phases CC-1, CC-2 and CC-3 that will not be subject to closure.

** Based on a per acre cost of approximately $128,000 per Table 18.

TABLE 23
SUNSHINE CANYON CITY/COUNTY LANDFILL
GROSS VOLUMETRIC CAPACITY SUMMARY

Landfill Area	Current Permitted Capacity	Used as of (date)	Additional Capacity Proposed	Total Volume	Total Tons*
County Landfill	37.3 mcy	21.8 mcy used as of 10/31/2007	17.6 mcy	54.9 mcy	35.4 million tons
City Landfill	13.4 mcy	3.8 mcy used as of 10/31/2007	72.6 mcy	86.0 mcy	55.5 million tons
Total	50.7 mcy	25.6 mcy used as of 10/31/2007	90.2 mcy	140.9 mcy	90.9 million tons

* The estimated tonnages are based on net volume and assume a waste density of 0.8 tons/cy and a waste-to-cover ratio of 5:1. Tonnages may vary vased on actual densities and waste-to-cover ratios achieved in the field.

TABLE 24
PERIMETER LANDFILL GAS MIGRATION MONITORING SYSTEM
REGULATORY COMPLIANCE DETERMINATION
REMOVE FROM TEXT
NO LONGER APPLICABLE