CLOSURE PLAN
And
POST-CLOSURE MONITORING & MAINTENANCE PLAN

Grijalva Site – Former Union Pacific Railroad Landfill
City of Orange, CA

Final

Submitted to:

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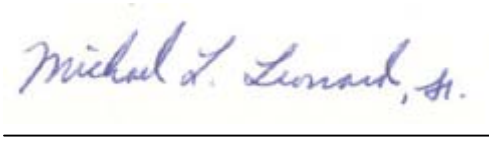
Project No. 01203027.00

December 10, 2005

This Plan, dated December 10, 2005, for the Grijalva Site (Former Union Pacific Railroad Landfill) in the City of Orange, California was prepared and reviewed by the following persons:



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EXECUTIVE SUMMARY

Site Name: Grijalva Landfill

Location: Northwest Corner of East Spring Street and North McPherson Road, City of Orange, California

Property Description: The total property is approximately 27 acres in area and in past years was occupied by an asphalt plant, abandoned railroad tracks, and a construction debris landfill. The asphalt plant was located on the northern portion of the site and is no longer in existence. Santiago Creek occupies the western portion of the western half of the site. Tracks from the now abandoned railroad formerly crossed through the eastern portion of the property. The now-closed landfill still occupies the southern portion of the site.

The property is surrounded by a combination of residential areas to the west across Santiago Creek, vacant land, a storage unit business, and residential areas to the south, City-owned Grijalva Park at Santiago Creek and residential areas to the east, and residential areas to the north.

Conditions: Lead concentrations - Based on the Phase II site assessment performed by SCS Engineers in June 2004, it was concluded that the landfill at the Grijalva Site contains concentrations of lead considered hazardous by the State of California, but that native soils below the landfill materials have not been impacted.

Gas Monitoring - Two (2) interior and three (3) perimeter gas monitoring probes were monitored monthly for a period of 6 months for the presence of potentially explosive methane gas. The monitoring events took place between July and December 2004. No methane was detected in either the perimeter or interior gas monitoring probes. Further monitoring is deemed unnecessary and none is proposed.

Landfill Closure Plan: Placement of a soil mono-cover is proposed as the cost-effective and efficient means of protecting the public from lead contaminated soils at the landfill. The details of the proposed cover design and operation and maintenance requirements are the subject of this Plan.

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1.0 INTRODUCTION

This Closure and Post-Closure Maintenance Plan has been prepared by SCS Engineers (SCS) on behalf of the City of Orange for implementation at the former Grijalva Landfill, located in Orange, California (Figure 1). The Plan has been prepared following the guidelines given in California Code of Regulations Title 27, Division 2, Chapter 3, Subchapter 5, Articles 1 and 2, and pursuant to the request of Mr. Ray Ahktarshad of the Santa Ana Regional Water Quality Control Board (SARWQCB).

SCS completed a Phase II site assessment at the site in June 2004. The study indicates that concentrations of lead are present in the landfill soils at concentrations above total lead and Soluble Threshold Limit Concentration (STLC) levels. Samples collected and analyzed from native soils underlying the landfill indicate that lead has not leached into, or otherwise impacted, those soils. A Draft Report of this investigation, dated January 10, 2005, was submitted to the Environmental Protection Agency - Region IX (EPA), the Regional Water Quality Control Board – Santa Ana Region (SARWQCB) and the Orange County Health Care Agency (OCHCA) for review. The EPA has approved the report and required no further assessment action. The OCHCA has also approved the report and required no further assessment action. The SARWQCB has also approved the report and required no further assessment action.

The City of Orange wishes to convert the land from its current idle state into a section of a planned Municipal Park and Recreation Facility in accordance with the current Master Plan for the area. A landfill cover has been proposed as the most cost-effective method to protect human health and the environment at the site from exposure to lead contaminated soils of the landfill. This plan describes both the design of the proposed landfill cover as well as the post-closure monitoring and maintenance requirements.

1.1 Site Location and Description

The Grijalva Site is located in the City of Orange and borders the northwest intersection of Spring Street and McPherson Road. The Tax Assessor's parcel number for this site is A.P. No.

093-031-02 and it is located in Section 28 of Township 4 South, Range 9 West. The total site area occupies 27 acres in a mixed residential and recreational area. The site is bordered by a residential community on the north, vacant land to the immediate south, a City of Orange Municipal Park (Grijalva Park) to the east, and by Santiago Creek to the west.

The land is flat for the most part, but has a steeply sloped embankment on the west side, which inclines down into the Santiago Creek channel. The site is enclosed by a chain link fence with locked gates, and is currently unused and undeveloped. A former asphalt plant, which occupied the northern portion of the site, has been removed. A site location map is shown in Figure 2. Major site features and facilities are shown on an aerial photo in Figure 3.

1.2 Summary of Past Site Investigations

Previous Investigations and Regulatory Involvement - Previous investigations have been performed at the site at various times for various entities, including the City of Orange and the Santa Fe Pacific Realty Corporation. SCS reviewed these reports and the information was used to develop the framework for a conceptual model prior to conducting the Phase II assessment. The following reports were reviewed:

1) Kenneth G. Osborne & Associates, September 25, 1984, *Geotechnical Feasibility Study: Southern Pacific Railroad Property, East Side of Santiago Creek, North of Chapman Ave, Orange, California*, Job No. 4116-1.

Report Summary: A limited geotechnical investigation was performed at the former landfill for the Century American Company. The primary purpose was to establish the general subsurface conditions, and to ascertain if any "deleterious" fill materials had been placed on the site following sand and gravel mining operations. The field investigation consisted of excavating 9 exploratory test pits to depths ranging from 10 to 17 feet below grade. Fill material consisting of varying quantities of wood, brick, asphalt, concrete, organic materials and other waste materials were encountered to a depth of one foot in Test Pit TP-8 and to depths ranging from 8 feet to greater than 17 feet in the remaining test pits.

2) SCS Engineers, June 1985, *Subsurface Trash Fill Investigation at Southern Pacific Railroad Property, East Side of Santiago Creek, North of Chapman Avenue, Orange, California*.

Report Summary: SCS was retained by the Sante Fe Pacific Realty Corporation to conduct a subsurface trash fill investigation at the site. The purpose of the study was to identify: **1)** the nature of the in-place fill materials, **2)** the extent to which former site uses might affect future development, and **3)** site mitigation measures that would allow development.

A total of 10 monitoring wells were installed at the site. Seven (7) were placed in areas where organic (decomposable) wastes may have been deposited. Three (3) were located along property boundaries as a means of checking for the potential migration of landfill gas away from the site. Well depths varied from 8 to 20 feet. Boring logs were prepared for each well location. In general, it was found that fill material consisted of organics (wood debris, plastic, and rags), inert material (glass, concrete, brick, and sand and gravel), and metals (aluminum, nails, and wire). At four locations, the investigators noted "oily gas or diesel odors". Soil samples were obtained at 3 locations and oil and grease were detected at concentrations of between 0.49 and 0.93 percent by weight using a Freon extraction method.

Gas probes were monitored on May 20 and 22, 1985. Subsurface methane gas concentrations and pressures were tested on both days with a portable combustible gas indicator and Magnehelic pressure gauge. Gas samples for analysis in the laboratory using gas chromatography were taken at Well No. 6 (18 ft) and No. 8 (18 ft) for the purpose of confirmation of readings from the portable instrumentation. No methane was detected in either case.

3) SECOR, January 2001, *Environmental Assessment Report, Union Pacific Railroad Property, Santiago Creek Site, North of Spring Street and McPherson Road, Orange, California*, SECOR Job No. 40236-002-01.

Report Summary: SECOR was retained by the City of Orange to conduct a subsurface site investigation at the site. The objectives of the investigation were to do the following:

- Identify previous or current on-site surface hazardous materials and/or hazardous waste releases based on the review of previous investigations.

- Evaluate the extent of surface or subsurface contamination in soils at the locations of environmental concern identified during the review of previous investigations.

- Estimate potential remediation time lines and costs.

The work was performed concurrently with a geotechnical engineering investigation.

Eleven (11) exploratory borings (S-1 through S-11) and 11 trench pits (TP-1 through TP-11) were completed during December 1999 and January 2000. Total depths of the borings ranged from 11 to 45 feet below ground surface (bgs). Trench pit excavations ranged from 7 to 15 feet bgs. SECOR divided the site into three distinct areas: the asphalt plant, the former landfill area, and undeveloped areas (including Santiago Creek).

Former Asphalt Plant Area – No significant environmental concerns, which would warrant additional investigation or remedial action, were identified by SECOR in the vicinity of the former asphalt plant portion of the site.

Former Landfill Area – Low concentrations of extractable hydrocarbons (49 mg/kg at TP-1 at a depth of 5 feet bgs) and motor oil (380 mg/kg at TP-4 at a depth of 2 feet bgs) were detected in landfill soils. VOCs were not detected above laboratory method detection limits in select soil samples analyzed.

Select soil samples analyzed did not contain elevated concentrations of California Title 22 metals above presumed background concentrations, with the exception of lead. Lead was reported at 1,000 and 2,500 mg/kg in soil samples collected from TP-4 at a depth of 2 feet bgs, and TP-7 at a depth of 4 feet bgs, respectively.

Undeveloped Areas – No significant environmental concerns, which would warrant additional investigation or remedial action, were identified by SECOR in the vicinity of undeveloped portions of the site which are located on the southwest portion of the property.

4) Orange County Water District (OCWD), *Map of Groundwater Levels and depth to first groundwater*, November 1996.

Map Summary: The OCWD publishes maps of groundwater levels the depth to first groundwater throughout the Orange County Region. Depth to groundwater beneath the Grijalva site is about 200 feet below ground surface (bgs).

5) In addition to the reports described above, Geomatrix also performed a Phase II investigation at the site in October and December of 1998. The investigation consisted of 8 soil borings, 6 exploratory trenches, and a total of 25 soil samples selected for chemical analysis. However, the Geomatrix Phase II Report could not be located and has not been reviewed by SCS. What is known about this investigation was taken from a summary written by SECOR in their investigation report.

6) SCS Engineers, January 10, 2005, *Phase II Environmental Assessment – Lead Investigation and Installation of Perimeter and Interior Gas Monitoring Probes, Grijalva Site, Former Union Pacific Landfill, Orange, California.*

Report Summary: A Phase II Lead Investigation and a perimeter and interior gas-monitoring program were performed at the Grijalva Site between June and December of 2004. The work was performed under a Brownfields Assessment Demonstration Pilot Grant (the Program), which was funded by the EPA's *Brownfields Economic Redevelopment Initiative.* The Report has been approved, without further action required, by the following agencies:

1) EPA – Region IX's Quality Assurance (QA) Office in San Francisco, CA.

2) Orange County Health Care Agency (OCHCA) - Environmental Health, the Local Enforcement Agency (LEA) for this project.

3) Santa Ana Regional Water Quality Control Board (SARWQCB) – The lead environmental agency overseeing the project.

The Phase II site assessment work was performed from June 1 through 10, 2004, and consisted of the following:

Lead Assessment Borings – Soil samples were collected from nineteen (19) borings drilled throughout the landfill site. Relatively undisturbed soil samples from the borings were collected at the surface and then every 5 feet to the total depth of the landfill and into the underlying native soil. The samples were packaged in the field, sent to ATL Laboratories, and analyzed for lead.

All but two of the soil borings drilled and sampled at the site had at least one soil sample that contained elevated concentrations of lead (i.e. greater than 1,000 mg/kg by standard method 6010, or above 5 mg/L STLC by the WET method for 6010). The highest concentration of lead detected at the site during this investigation was 1,700 mg/kg.

All samples containing hazardous concentrations of lead were detected only within the landfill, and did not extend into native soils underlying the fill area. At every boring location where hazardous concentrations of lead were identified; at least one additional sample was collected from a depth deeper than that of the sample with hazardous concentrations of lead. Those samples were analyzed and determined to be non-hazardous with respect to lead concentrations.

Gas Monitoring: Three (3) **perimeter monitoring probes** (VP1 through VP3) were installed at different locations around the landfill perimeter between the landfill and existing residential areas. The probe locations were chosen in accordance with specifications set forth in the California Code of Regulations (CCR), Title 27, Division 2, Chapter 3, Subchapter 4, Article 6, Section 20925: *Perimeter Monitoring Network.* These probes were monitored for a period of six months for methane gas.

Two (2) **interior monitoring probes** were installed in the central interior portion of the landfill. These probes were not required by the regulatory agencies, but were installed because the City of Orange wanted to verify that no methane gas existed within the landfill which might pose a future problem, given that its planned site use is as part of a recreational facility. These probes were also monitored for methane gas for 6 months.

The monitoring events took place between July and December 2004. No methane was detected in either the perimeter or interior monitoring probes, indicating that the landfilled materials are not decomposing or generating methane. Thus, no further monitoring is proposed.

Based on the above information SCS concluded that the landfill at the Grijalva Site contains levels of lead considered hazardous by the State of California, but that native soils below the elevation of landfilled materials have not been impacted.

1.3 Summary of Landfill History

A review of past studies, as well as interviews with City of Orange personnel, indicates that the Grijalva Site was acquired by the City of Orange in February 2001 with the intent of converting the land into a recreational area. Prior to 2001, the site was owned by the Union Pacific Railroad Company (UPRC). Prior to that, the Conrock Corporation mined (excavated) sand and gravel from the banks of Santiago Creek. UPRC used the excavated area as a landfill, filling it with inert material to buttress the banks of Santiago Creek. The majority of the debris deposited there was rubble consisting of concrete, brick and other mainly inert solid waste. The landfill was used between the early 1950's until the flood of 1969.

Operational History

A records search at the State Department of Health Services, conducted by SCS in 1985, revealed that the landfill was granted a permit by the Orange County Environmental Management Agency for the dumping of solid waste, concrete, and brick into a former gravel pit located next to Santiago Creek. The site was filled in stages between the early 1950's and until

the flood of 1969. The City of Orange also used the site for disposal of asphalt and curb and gutter sweepings. Records of fill volumes are not available, indeed such information may not have been recorded at all. The northern portion of the property was also mined for gravel, however the exact years of this operation are unknown. An asphalt plant was later built at that location and operated for a period of approximately 52 years, terminating in late 2000.

1.4 Current Status of Grijalva Landfill

The landfill has been idle since 1969 and has not received additional refuse of any kind. No maintenance has been performed on the landfill and a substantial vegetative growth has covered a large portion of the surface. The area is fenced off to the public. The City has plans to convert the entire 27-acre area, of which the landfill is a part, into a Municipal Park and Recreation Center.

Landfill Delineation - The estimated limits of the deposited waste are outlined in red on the aerial photo shown on Figure 3. In general, SCS and others have defined the landfill's boundary today on three sides (the north, east, and west), i.e., the fill boundary within the property owned by the City of Orange. However, the southern boundary of the filling has not been well-delineated beyond the city's property line to the south. During the course of the Phase II study several attempts were made by both SCS and the City of Orange to obtain permission from the owner of the adjacent property parcel to continue the assessment to the south and delineate the southern perimeter of the landfill. However, access was not granted.

2.0 GENERAL LANDFILL CLOSURE DESCRIPTION

The project team decided that isolation of the landfilled material would be the optimal final closure measure, based on site conditions and experience in similar situations. In particular, it is proposed to close the Grijalva Landfill by placing an engineered mono-cover comprised of suitably graded and compacted soil. This section describes the proposed cover and the post-closure maintenance steps that will be conducted during the post closure period.

2.1 Responsible Parties

The responsible party to contact regarding this plan and its implementation is:

Mr. Majid Farhat
City of Orange
300 East Chapman Ave.
Orange, CA 92866-1591
714-744-5562

Mr. Farhat is aided by Ms. Pamela Galera.

2.2 Closure Description

The landfill will be closed using a soil mono-cover. The landfill requires a cover, as well as bank protection along the Santiago Creek, to preclude erosion of the lead-containing soil into the creek that could impact surface water quality. The landfill cover will isolate the waste mass and thus prevent public exposure to the lead in the landfill. Moreover, the cover will serve to minimize, if not eliminate, the infiltration of water into the waste mass that may otherwise leach lead over the long term into soils beneath the landfill. The fact that no lead is present in the soil underlying the waste mass (per the Phase II investigation) indicates that the potential for leaching is very low at this site even without the placement of an engineered landfill cap. Properly designed and maintained landfill covers are a cost effective, proven way to isolate wastes and thereby protect human health and the environment.

Stabilization of the bank along the western edge of the landfill, i.e., along Santiago Creek, will protect the integrity of the cover over the long term and minimize or prevent lead contaminants from entering the environment. Map 1 (Appendix A) shows the area of the proposed landfill cover. As proposed, the landfill cover will be placed only on those portions of the landfill on City property and will not cross the property boundary on the southern side of the site.

2.3 Waste Removal and Relocation

To achieve proper final grades in-place an unknown volume of soil (X cubic yards) of wastes will be removed from alongside Santiago Creek and re-deposited elsewhere over the landfill's surface prior to placement of the final cover. These areas are indicated on Map 1. The work may require an approved Excavation Management Plan and Permit from the South Coast Air Quality Management District for excavation in a landfill (under SCAQMD Rule 1150). Dust suppression will be required during this phase of work. No special disposal requirements are planned at this time, and no wastes will be removed from the site boundaries. However, any items found during excavation that may be considered as hazardous waste, i.e., leaded car batteries, etc…will be segregated out and disposed of at an appropriate disposal facility. A copy of the excavation management plan is located in Appendix B. Municipal park features will be constructed over the landfill after the new cover is in place. If other parts of the park are opened prior to placement of the landfill cover, the entire landfill area will be fenced to preclude public access.

2.4 Extent of Landfill Cover

As envisioned, the landfill soil cap will extend a maximum of 20 feet beyond the limits of the landfill on the north and east sides. Although the landfill is believed to extend across the property line on the southern side, the cover will stop at the property line. Bank stabilization and California Department of Fish and Game (CDFG) permits may be required for the southwestern edge and the west-central portions of the landfill where the landfill cover intersects with the waterway (Santiago Creek). The slopes at the edge of the landfill cover will be tapered to match the required grade (except on the creek side). Side slopes will not exceed 3 horizontal to 1 vertical to minimize the potential for erosion and slope instability issues during heavy rains.

2.5 Proposed Cover Material and Conceptual Design of Cover System

The proposed cover is to be comprised of a graded soil (a mono-cover) designed to minimize infiltration from natural incident precipitation and irrigation into the waste mass, based on local

conditions including climate, evapotranspiration rates, and surface drainage controls. Such "all soil" covers have been used as an acceptable alternative to clay or geomembrane covers for landfills located throughout southern California to effectively reduce infiltration rates such that they do not exceed the combined water losses due to evaporation and transpiration.

Figure 4 shows a schematic diagram of the proposed landfill cover. Map 1 shows the landfill cover outline in plan view and the areas along the west side of the landfill from where materials will be removed and placed back into other parts of the landfill's surface. As indicated, this type of cover is typically comprised from bottom to top as follows:

- A 2-feet thick foundation layer (i.e., a compacted layer of soil that provides a stable base for overlying soil layers), and

- Three (3) feet of vegetative cover soil selected for its ability to support the desired plant growth. The landscaping plan will preclude use of deep rooted bushes or trees to avoid creation of pathways for infiltration of surface water into the landfilled waste.

Stockpiled soil - Figure 5 shows the location of an existing soil stockpile adjacent to the landfill. Material from this stockpile is being considered for use in the final soil cap, for both the foundation layer and the vegetative cover. The mono-cover will function in conjunction with a surface drainage network and controlled irrigation system as described later in this document to minimize the potential for infiltration into the landfilled waste.

Volume of soil required for landfill cover – It is estimated that 44,000 cubic yards of soil will be required to construct a 5-foot thick landfill cover at this site. The calculated volume accounts for soil shrinkage, which will occur when the soil is compacted.

Volume of soil in the stockpile– The estimated volume of soil currently existing in the stockpiled soil is estimated at 43,000 cubic yards. Therefore an additional 1,000 cubic yards of suitable soil will be imported to complete the landfill cover.

2.6 Analysis of Stockpiled Soil

Composite samples of the stockpile material were acquired on February 24, 2005, and analyzed for grain size distribution and chemical analyses (metals, PCBs and semi-volatile compounds). Figure 6 shows the locations where the soil samples were collected. These locations are indicated on Figure 6 as stockpile samples #1, #2, and #3.

Soil classification and grain size analysis - A grain size distribution analysis performed on Composite Samples A (Stockpile #1) and B (Stockpile #2) and Composite A + B indicate the soil to be silty or clayey sand with some gravel. Fines content (i.e., the fraction passing the number 200 sieve) ranged from 45.6% to 46.1% by weight. Hydrometer analyses indicate the clay fraction of the fines (i.e., the portion smaller than 2 microns) to range from 12.7% to 19.6%.

The grain size distribution curves and the classification of the soils for the three composite samples analyzed are shown in Appendix C. The soils were classified using the grain size distribution curves and the soils were classified according to the Unified Soil Classification System (USCS).

Based on these analyses, the soils are considered to be suitable for use in the construction of a soil mono-cover. This is because the soils have a sufficiently high silt and clay content to impede the infiltration of water through the 4 to 6 feet of cover and into the waste, and a low enough content of fines to promote both evaporation and transpiration of pore water from the upper layer of the cover.

Metals, PCB and Semi-Volatile Organics Analysis - The soil samples were also analyzed for ICP Metals using EPA Method 6010, for Aroclor PCBs using EPA Method 8082, and for semi-volatile organic compounds (SVOCs) using EPA Method 8270C. These analyses indicate that the stockpiled soils contain no chemicals of concern above threshold concentrations. The results of the analyses are presented in Appendix D.

2.7 Grading

The surface of the landfill will be graded to eliminate the existing swales and to promote runoff while minimizing erosion of the final cover. These results can be achieved by initial rough grading to a uniform level followed by fill placement and final grading, or by placing the final cover such that the design minimum cover depth is present over the "high" spots (and thus placing more than the minimum over the lower spots). The final grades will provide positive drainage off to the sides with minimum slopes of 1% to 2%. Alternatively, a subsurface drainage system can be installed to collect rainfall or irrigation water at internal locations on the landfill in lined French drains with the collected water conveyed by pipes to a perimeter drainage system. Any drainage system will be placed in the cover material and not in the waste mass.

2.8 Surface drainage

Surface drainage ditches will be incorporated into the landfill cover and will be lined with concrete or asphalt. As the material disposed in the landfill was primarily inert construction demolition and soil, further settlement of the landfill surface is not expected to be significant. However, local pockets of organic wastes within the landfill prism will continue to decompose and possibly cause settlement cracking in various areas. This may present some maintenance issues in the future. The use of decomposed granite or gravel on walkways and other areas needing surfacing is suggested to minimize maintenance requirements.

2.9 Creek Protection Barrier

Creek Protection Barrier - Rip-rap rock will be specified to protect the landfill cover and channel embankment, for erosion prevention during times of high water. The design and construction supervision of this aspect of the project will be performed by an experienced hydraulics engineer from a specialized firm retained by the City of Orange to design and install a rip-rap barrier along the western side of the landfill that borders the Santiago Creek channel.

3.0 LANDFILL OPERATION AND MAINTENANCE PLAN

The Operation and Maintenance (O&M) Plan will include those items described in this section below. Investigations show that groundwater has not been impacted by the landfill, surface water is being addressed by the implementation of a landfill cover, and no methane or other hazardous gases were detected during a recent 6-month monitoring period. The O&M Plan excludes monitoring for surface or groundwater quality, but will include methane gas monitoring of on-site structures within 1,000 feet of the landfill and in utility vaults.

3.1 Erosion Control

Erosion Control Design Features - Several features will be included in the design of the landfill cover for the control of surface erosion, including:

- The planting of thick grass and native California species (shallow rooted plants which will not penetrate the cover) over the majority of the site surface that is regularly irrigated and maintained.

- The protection of slopes with ground cover except on the Santiago Creek side where rip-rap will be placed to serve as erosion protection as well.

- The installation of a surface stormwater drainage system that collects runoff and conveys it in lined ditches.

Erosion Inspections - Inspections of the erosion control features will be made as follows:

- The surface of the landfill will be observed monthly by City maintenance personnel for evidence of damage to the erosion control features due to differential settlement of the landfill surface, rapid runoff, burrowing animals, and other causes.

- After heavy rains (i.e., storms exceeding 0.50 inches precipitation in a 24-hour period), the Maintenance Superintendent, or his appointed representatives, will inspect all landfill surfaces to identify any areas of erosion or other storm damage.

- The site will be inspected annually to include observations of erosion impacts, settlement and surface ponding, etc, as described in the following sections.

Erosion Control Measures and Implementation - If the inspections identify any areas of erosion damage, the Maintenance Superintendent will be immediately notified. He will review the conditions and, if warranted and the storm runoff is still in progress, implement one or more of the following temporary measures to prevent further damage:

- Place erosion control mats or 20-mil plastic sheeting (taken from onsite storage) over the impacted area.

- Install sandbags or silt fences at critical locations to trap the soil and prevent it from clogging drainage structures.

- Replace the eroded soil with pre-tested soil (i.e., soil that has been sampled, tested and verified as free of contamination). The soil to be used will have a clay content similar to the soils currently programmed for use in the soil cover. At a minimum the candidate replacement soil will be tested for metals, PCBs and SVOCs.

- Re-vegetate the area as appropriate as soon as weather conditions allow.

The damage and implemented repairs will be documented with photographs and recorded in the Superintendent's daily log.

3.2 Surface Drainage Control Systems

The proposed surface drainage control system will include a network of concrete lined trench-type ditches located strategically over the landfill cover to collect and convey sheet flow and direct it into a lined drainage collection network, which will ultimately discharge into Santiago Creek.

Inspection Program - The surface drainage system will be inspected as follows:

- During heavy storms the complete surface drainage system will be systematically observed by the Superintendent or his appointed representatives for evidence of clogging, overflowing ditches, erosion of ditch sidewalls or bottom areas, and sheet flows overtopping ditches.

On an annual basis, a detailed inspection of the surface drainage system will be completed. The inspection will be made in the dry season (e.g., July/August) to evaluate the readiness of the system for the upcoming rainy season. A second inspection will be performed as needed during the rainy season if clogging develops.

Based on the inspections, the Superintendent will determine the need for implementing one or more of the following types of measures and or repairs.

- Cleanout of ditches or overflows by hand tools or small mechanical equipment.

- Excavation of shallow, temporary ditches to drain ponding areas.

- Pump-out of ponded areas.

These measures will be implemented before the rainy season. However, other measures may need to be taken during a storm event or immediately after a storm event, as appropriate. The

implemented repairs will be documented with photographs and recorded in the Superintendent's logbook.

3.3 Irrigation Control System

As envisioned the irrigation will consist of a Rain Bird *Nimbus II* Central Control System, or equivalent, similar to what is used on many golf courses. The *Nimbus II* system is integrated with an on-site weather station, which monitors wind direction and speed, solar radiation, air temperature, relative humidity and rainfall. The Nimbus system allows the operator to monitor site-specific evapotranspiration rates and precipitation rates, and adjusts watering frequency and schedules accordingly (to conserve irrigation water). This function also helps guard against over-watering of the landfill surface that could lead to infiltration into the waste. Irrigation system records will be stored on a computer file including maps, flow rates, and length of time of irrigation.

Inspections and Maintenance - The following inspections and maintenance of the irrigation system will be implemented:

- During routine Park operations and maintenance, the City crews will observe and report areas with broken sprinkler heads or piping and repair these as soon as possible.

- The crews will also observe and report areas of excess or inadequate watering; the system will be modified by adjusting control valves, and replacing, adding or deleting sprinkler heads to prevent ponding or vegetation from dying (since the vegetation is as an important component of the cover system).

- The automated control system that adjusts the watering duration and schedule will be tested per the manufacturer's specifications every 6 months or whenever improper operation is noted. The electronic controls will be repaired or replaced as determined by results of the testing and evaluation process.

- The implemented repairs will be documented with photographs and recorded in the Superintendent's daily log.

3.4 Settlement, Ponding and Cracking

The following inspections will be implemented to observe and identify areas of settlement, ponding and cracking:

- The Park maintenance crew will look for, and report to the Superintendent, any locations with observable settlement, ponding or cracking during the course of performance of their regularly scheduled activities.

- Immediately following a significant rain storm the Superintendent will make an inspection of the Park landfill cover to observe for areas of ponding.

- On an annual basis the Superintendent will make a detailed inspection of the landfill cover surface. The inspection will be made in the dry season (e.g., July/August) to evaluate cracking and areas that are very dry and possibly prone to cracking.

The Superintendent's duties will include implementation of the following procedures after each report of ponding, settlement, cracking, erosion or slope creep:

Procedures for Settling and Ponding – SCS will design the landfill cover so that it slopes sufficiently to prevent ponding from occurring. However, in the event that the surface settles or ponding develop in specific areas of the cover for other reasons, these areas will be repaired as the first priority due to the potential for infiltration into the landfill from standing water. The Superintendent will implement the following procedures:

- Observe the extent and depth of ponding to define the limits of settlement and pathway or source of ponded water (i.e., direct rainfall, sheet flow, channelized flow, irrigation water or a combination), take photographs and mark the area on a map.

- If the source is channel flow, steps will be taken to block the flow from entering the area. These may include strategic placement of hay bales, sandbags, or other diversion devices or excavation of shallow V-ditches (these are not to penetrate through the cover and will only be temporary, i.e., they will be filled in soon after flow stops) to redirect the flow.

- If the source is sheet flow, measures will be taken to redirect the flow from the area, including strategic placement of hay bales or other diversion devices or excavation of shallow V-ditches placed to intercept the sheet flow and direct it to an area not subject to ponding and where the water can disperse.

- If the source is irrigation water, the irrigation system will be adjusted to redirect the water from the area until the ponding has subsided and readjusted to reduce the water reaching the area in the future.

- Water that has already accumulated in low areas will be removed by either pumping or excavation of a shallow V-ditch to gravity drain the area. The pump discharge or drainage will be directed to an area not subject to ponding and where the water can disperse or enter a nearby drainage ditch.

- Once the rain event is over and the subject area has been dewatered, the Superintendent will assess the extent of the settled area and decide whether to place soil to raise the grade and/or install a subgrade drain (French Drain). The method chosen will be based on the severity of the ponding problem and aesthetic needs of the Park. In some cases, it may be decided to both raise the grade and install the French drain.

- Other areas where settlement is visually obvious, but ponding has not yet occurred, will also be documented (photographs taken and the location marked on the site record map) and evaluated for repair. The superintendent will schedule such areas for re-grading, attempting to accomplish this primarily by filling rather than excavating.

- Fill soil used for any re-grading at the site will be from a source that has been tested and verified clean. The soil may either be pre-tested and stockpiled in the maintenance area or delivered from a source that has verified test results on file. Typically when the fill is to be greater than 1 foot in thickness, it will be comprised of a bottom layer that is clayey (to provide the low permeability) and the upper layer (e.g., about 6 inches) will consist of more sandy or silty soil capable of support the grass growth needed for Park use and for erosion control.

- The implemented repairs will be documented with photographs and recorded in the Superintendent's daily log.

Cracking - Areas with observed cracks larger than ½ inch in width and 2 feet in length will be immediately sealed by placement of low permeability soil and hand tamping. Reseeding of vegetation will be completed as appropriate. Other areas with smaller cracks will be noted for future inspection and repair as needed. Locations observed with cracking over substantial area will be scheduled for re-grading by filling using pre-tested soil and re-vegetation.

3.5 Slope Creep

Slope creep occurs if the surface soils and vegetation are slowly and progressively moving downslope resulting in cracks opening at the top of the slope and an undulating surface on the slope face itself. Areas that exhibit these conditions generally need to be re-graded or otherwise stabilized by other means. A re-grading plan may involve filling the area with imported soil to flatten the slopes and thus provide enhanced usability as well as reduce the potential for slope creep. A grading plan would be prepared and the import soil would be obtained from a source with documented testing to demonstrate that no contaminants are present in the soil. The fill soil would be selected to provide a balance between low permeability and ability to sustain vegetation (grass) growth. The fill material would be placed and compacted to minimum 85 percent of maximum laboratory density and near optimum moisture content to provide for a stable fill.

Other areas observed in the future, semi-annual inspections to be undergoing slope creep would be documented and evaluated for similar re-grading or other stabilizing measures. One other stabilizing measure to be considered would involve the placement of geo grids in the cover soil (buried about 6 inches to 1 foot) that would extend beyond the top and sides of the slope area and provide support to resist the slope creep forces.

4.0 INSPECTION AND REPORTING SCHEDULE

Routine Inspections: Routine inspections of the landfill cover, irrigation and drainage systems will be occurring on a monthly basis. Areas requiring further evaluation or immediate maintenance or repair will be reported to the Superintendent and documented in his daily log.

Post-Storm Event Inspections: During and immediately following any rainfall event exceeding 0.5 inches in 24 hours, a post-storm event inspection will be made. The findings will be documented on the Inspection Form included in Appendix E and these will be forwarded to the SARWQCB and OCHCA upon completion. Actions required to repair or maintain the drainage systems and alleviate ponding will be taken as described above. These actions will be reported to SARWQCB and OCHCA by telephone or e-mail within 24 hours.

Annual Inspections: This inspection will be performed in July or August each year. The findings will be documented on the Inspection Forms included in Appendix E and these will be forwarded to the SARWQCB and OCHCA upon completion. SARWQCB and OCHCA will be notified of minor repairs within 24 hours and more substantial repairs two weeks in advance in writing.

Major Repairs or Maintenance Activity Reports: Each major repair (e.g., new French drain construction, major re-grading) will be documented with photographs and a brief letter report prepared for submittal to SARWQCB and LEA. The letter report will include the Inspection Forms, a map with the location of the work shown, a short description of the nature of the work and intention, selected photographs depicting the basic work elements, verification of the soil and other materials used (including verification that the soil was tested and shown to have a

chemical content that conforms to regulatory standards), evidence of proper handling and disposal of any waste that may have been excavated incidentally during the repair work,, and a description of the procedure to verify effectiveness of the repair or maintenance.

Methane Gas Monitoring – Structures located within 1,000 feet of the landfill will be monitored for methane gas by City personnel. The City of Orange will purchase an RKI Eagle 401, which is a hand held methane monitoring instrument. SCS Engineers will train a qualified worker at the Parks Department in the City of Orange how to calibrate and use the instrument. The City will monitor for methane gas in all enclosed structures and utility vaults, as well as in the perimeter probes, on a quarterly basis for a period of 2 years. Additionally, the three existing perimeter landfill gas monitoring probes (VP-1, VP-2 and VP-3) will be attempted to be saved for future monitoring. If that proves unfeasible, they will be replaced after the engineered cover is constructed.

5.0 CLOSURE ACTIVITIES SCHEDULE

The proposed project schedule is shown on Table 1 located in Appendix F.