Solar Improvements
Final Post Closure Land Use Plan
City of Sacramento
28th Street Landfill

Presented to:
City of Sacramento
Solid Waste Division
2812 Meadowview Road
Sacramento, CA 95832

Presented by:
SCS ENGINEERS
3117 Fite Circle, Suite 108
Sacramento, CA 95827
(916) 361-1297

Revised April 12, 2013
Revised January 8, 2013
September 2012
File No. 01197137.05, Task 11

Offices Nationwide
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POST CLOSURE LAND USE PLAN

The following Post Closure Land Use Plan (PCLUP) has been prepared for the City of Sacramento (City) 28th Street Landfill (Figure 1) for the addition of 1.5 Mega Watts (MW) of Solar generating panels on parts of the permitted landfill property. The support structures associated with the solar panels will be ground mounted and column supported. The City of Sacramento is the owner of the site and is the Responsible Party (RP) for implementation of this PCLUP and the latest 28th Street Landfill Post Closure Maintenance Plan and Amendments.

The proposed post closure land use plan has been prepared in accordance with California Code of Regulations (CCR) Title 27, Section 21190. The Plan addresses the following requirements of Section 21190. The PCLUP will be implemented in compliance with Central Valley Regional Water Quality Control Board (RWQCB) waste discharge requirements Order R5-2004-0039 as well as all CEQA requirements.

1 PROJECT LOCATION

The project site is located at the northern end of 28th Street, in the northeast area of downtown Sacramento, in the Sutter’s Landing Park (see Figure 1 and Figure 2). The Assessor’s Parcel Numbers (APNs) are 001-0170-018, -019, -021, -026, 003-0010-001, 003-0050-016, and 003-0042-002. The solar arrays will be constructed on parcel APN 003-0010-001.

The site is bordered by the American River to the north, Interstate 80 Business Route to the south, Southern Pacific Railroad tracks to the east, and industrial properties to the west. Surrounding land uses include recreational open space to the north, residential to the east, undeveloped lands zoned for residential uses to the south, and the remainder of the Sutter’s Landing Park to the west, beyond which is an industrial use.

The land use designation for the project site in the 2030 General Plan is Parks and Recreation. The site is zoned A-OS-PC (Agriculture-Open Space-Parkway Corridor). The PC designation reflects the project site’s location within the American River Parkway Corridor, which is an overlay zone in the City Municipal Code (Chapter 17.160).

2 SETTING AND PAST INVESTIGATIONS

The proposed solar arrays will be located on West Site which includes approximately 48 acres of which 11 acres were not used for disposal. Approximately 37 acres were used for the Inactive Waste Unit (IWU), Figure 2. The Parking Area (Array 1), Dog Park (Array 2), and Soil Stockpile (Array 3) will be located on West Site. The following are summaries of subsurface conditions from the Feasibility Study for Sutter Landing Park, dated February 23, 2005 for the proposed solar arrays.
Array 1

Array 1 and the Viewing Platform are proposed on parcel APN 003-0010-001 in a portion of the compost/parking area of West Site as shown on Figure 3. The cover system in this area consists of 2 to 4 inches of asphalt over 6 to 18 inches of aggregate base. Under the aggregate base are 3 to 18 feet of soil cover and 12 to 32.5 feet of landfill debris. Beneath the landfill debris are native sand and gravel layers typically encountered from 32 to 43.5 feet below ground surface. The concrete support footings for these arrays will extend approximately three feet below the surface of the asphalt and will be placed on compacted soil cover. Asphalt will be sealed against the concrete base of the footings in this area.

Array 2

Array 2 is proposed to be located on parcel APN 003-0010-001 in the area of the Dog Park, Figure 4. The dog park area is not paved and has a soil cover. The underlying strata are 3 to 18 feet of soil cover and 12 to 32.5 feet of landfill debris. The debris underlying this area consists of layers of street cleaning debris. Beneath the landfill debris are native sand and gravel layers typically encountered from 32 to 43.5 feet below ground surface. The concrete support footings for these arrays will extend approximately three feet below the surface of the ground and will be placed on compacted soil cover. A soil bentonite mixture will be compacted to seal against the concrete base of the footings in this area.

Array 3

Array 3 is proposed to be located on parcel APN 003-0010-001 in a portion of the compost/parking area of West Site as shown on Figure 5. The cover system in this area consists of 2 to 4 inches of asphalt over 6 to 18 inches of aggregate base. Under the aggregate base are 3 to 18 feet of soil cover and 12 to 32.5 feet of landfill debris. Beneath the landfill debris are native sand and gravel layers typically encountered from 32 to 43.5 feet below ground surface.

Damaged paved areas will need to be repaired prior to installation of the solar arrays. Repair will include compaction of fill materials and placement of the 3 to 4 inch asphalt pavement to restore the surface. Cracks in the asphalt will be sealed with asphalt sealant.

The concrete support footings for these arrays will be set on paved surface of the existing landfill cover. The supports will not penetrate the landfill cover in this area. An alternate to the ballast mounting system using helical earth screws is presented in Appendix F.

3 PERMITS

Postclosure maintenance requirements as well as the financial assurance requirements for the site are contained in the 1991 Final Closure and Postclosure Maintenance Plans and subsequent
Amendments. The Landfill Facility No. is 34-AA-0018. The Waste Discharge Number is WDR No. R5-2004-0039. Copies of both permits are presented in Appendix A.

4 DESIGN LOADING

The design load calculations for the ground-mounted and column supported solar arrays were prepared by Mounting Systems, Inc. and are presented in Appendix C. The loads were used to size the pads under the ground-mounted arrays and to size the column footings. The objective was to keep the ground pressure on the existing landfill soil cover less than 2,000 pounds per square foot (psf).

5 ESTIMATED SETTLEMENT

Settlement of the cover for self-weight and other general loads was estimated in the Sutter Landing Feasibility Study, Appendix C. Additional settlement calculations have been prepared in Appendix C for the design loads on the ground-mounted and column footings as part of this Land Use Plan.

6 COVER MAINTENANCE

Maintenance of the 28th Street Landfill cover must be carried out by the RP. The requirements are described in the 1991 Closure and Postclosure Maintenance Plan and Amendments. The proposed solar improvements will result in activity and land use that will have an effect on the landfill cover maintenance for the site. The effects and proposed mitigations are described in the following paragraphs. A separate maintenance plan associated with the Solar Array installation has been prepared and is presented in Appendix D.

Asphalt Cover

The existing asphalt cover will be penetrated in the Array 1 and Viewing Platform area by columns and footings for the carport. This will require replacement and compaction soil and bentonite to fill excavated cover soil, aggregate base, and asphalt at the surface to match and seal the existing asphalt cover around the support columns.

It is anticipated that with passage of time that settlement will gradually occur within the maximum estimated amount of 31.2 inches. It will be necessary to maintain the seal around the columns to prevent liquid infiltration and LFG migration.

In the area of Array 3, the paved area footings will rest on the surface of the existing pavement and will not penetrate the existing cover. It is anticipated that with passage of time that settlement will gradually occur to the maximum estimated amount of 15 inches.

It will be necessary to periodically move the ground-mounted solar racks to perform maintenance if localized settlement occurs or damage to the paved surface occurs.
Soil Cover

The existing soil cover will be partially penetrated by the columns and footings in Array 2 in the Dog Park area. This will require replacement and compaction soil and bentonite to fill excavated cover soil at the surface to match and seal the existing soil cover around the support columns.

It is anticipated that with passage of time that settlement will gradually occur to the maximum estimated amount of 23.1 inches. It will be necessary to maintain the seal around the columns to prevent liquid infiltration and LFG migration.

Grass and Vegetation Control

Grass control will not be associated with Array No. 1 in the Parking Area. For Arrays 2 and 3, grass will be controlled by periodic mowing beneath the solar arrays. Array 2 will be best maintained by using a manual weed trimming type of device that allows selective grass removal in planter areas and near the support footings of the solar arrays. Annual mowing in early summer after plants turn brown is recommended at minimum.

7  DRAINAGE AND MAINTENANCE

Drainage and its maintenance must be carried out by the RP. The drainage features for runoff from the solar arrays is shown on Figure 2. Runoff from Arrays 1 and 2 are piped from the down drains to the existing nearby drop inlets. The volume of runoff from these areas was determined using HydroCAD software and is presented in Appendix E.

Array 3 is sloped at a minimum and has an engineered ditch that runs along the south boundary of the area from west to east to a new drop inlet. The volume of runoff from these areas was determined using HydroCAD software and is presented in Appendix E.

Drain pipes and surface ditches will be inspected on an ongoing basis for signs of silting or blockage and will be cleaned when access to the location allows.

8  PROTECT PUBLIC HEALTH AND SAFETY AND PREVENT DAMAGE TO PROPERTY

(a) Proposed post closure land uses shall be designed and maintained to:
   (1) Protect public health and safety and prevent damage to structures, roads, utilities and gas monitoring and control systems.

The proposed solar panel array locations are shown on Figure 2. Array 1 will be used as a carport for parking of vehicles under the shade created by the solar panels. The location is
currently paved and will remain paved. Runoff from the carport will be directed to the drop inlet as shown on Figure 2.

Array 2 will provide shade for the dog park. Runoff from the shade cover will be directed to the drop inlet shown on Figure 2.

Array 3 will be ground mounted and will cover a portion of the existing paved area. The array will be a semi-permanent installation so it will not cover material that will be used in post closure maintenance. The area of Array 3 will be constructed over the existing paved area as shown on Figure 2. Drainage from Array 3 will be collected in the drainage ditch immediately south of the soil stockpile and will be routed to the east to a collection point.

Waste was placed in the locations of Arrays 1, 2, and 3 at shallow depths prior to permitting of 28th Street Landfill. The solar panels in Arrays 1 and 2 will be column supported. Array 3 will be pavement-mounted on concrete skids that do not penetrate the subsurface and can be moved and relocated if necessary.

The arrays are not near any of the components of the current environmental monitoring systems and should not interfere with their continued use.

9 PREVENT PUBLIC CONTACT WITH LANDFILL CONTENTS

(2) Prevent Public Contact with Waste, Landfill Gas (LFG), and Leachate
The proposed solar arrays do not require removal of the existing cover barriers in the proposed locations. Arrays 1 and 2 will have column supports that will have footings on or part way through the existing soil cover. The penetration into the barriers will be sealed using a mixture of soil and bentonite for the soil cover and asphalt for existing paved areas.

The ground-mounted panels sit on skids that do not penetrate the existing cover barriers. Movement of the skids will not damage the existing cover. Any damage to the existing paved cover caused by equipment will be repaired with the same cover barrier material in accordance with the closure specifications.

The Project site is a Class III landfill area as defined by Title 27 of the California Code of Regulations (CCR). This landfill is capable of producing leachate and landfill gas as a result of the decomposition of waste. It may also be harmful to workers to contact the waste. The Contractor shall enforce safety procedures to minimize hazards to workers, the public, and the environment.

Waste materials encountered during installation of the solar arrays shall be handled, tested, and disposed of at a licensed landfill in accordance with CCR Title 27 requirements.
10 PREVENT LANDFILL GAS EXPLOSIONS

(3) Prevent Landfill Gas Explosions

(b) The design shall consider one or more proposed uses of the site toward which the operator will direct its effect.

The solar arrays are proposed to complement the existing Sutter Landing Park parking, Dog Park, and paved area. None of the solar installations involve buildings or enclosures that will potentially trap landfill gas (LFG). The City will maintain and operate the Park with the solar improvements and will make repairs to the soil cover and asphalt parking areas when needed.

(c) All post closure land uses, other than open space, on sites implementing closure or on closed sites shall be submitted to the LEA, RWQCB, local air district and land use agencies.

This Post Closure Land Use Plan has been prepared to meet the requirements of Title 27, Section 21190 and will be submitted to the agencies having jurisdiction on the closed 28th Street Landfill and Sutter Landing Park.

(d) Construction on the site shall maintain the integrity of the final cover, drainage and erosion control systems, and gas monitoring and control systems.

Construction of the proposed solar arrays will have a minimal effect on the existing cover barriers as previously described. Penetrations and seals will be maintained and damage from equipment or park operation will be repaired in accordance with the Closure Plan for the site.

(e) Construction of structural improvements on top of landfilled areas during the post closure period shall meet the following conditions:

(1), (2), and (3) Automatic methane gas sensors, designed to trigger an audible alarm when methane concentrations are detected, shall be installed in all buildings.

There are no buildings or basements associated with the solar array installations, therefore accumulation of methane in buildings is not anticipated.

(4) and (5) Utilities shall be constructed to mitigate the effects of differential settlement. All utilities shall be designed with flexible connections and utility collars.

Utilities associated with the solar arrays will be installed above the closure barriers with flexible connectors to accommodate differential settlement.

(5) and (7) Piling shall not be installed in or through any bottom liner unless approved by the RWQCB. Penetration through the low permeability layer of final cover must be sealed and repaired.

Columns to support the solar arrays in the Parking Area and Dog Park will be installed partially through the existing soil and asphalt covers.
(8) Periodic methane gas monitoring shall be conducted inside all buildings and underground utilities in accordance with Section 20933 of Article 6, of Subchapter 4 of Title 27.

No buildings are planned as part of the solar array improvements.

(f) The LEA may require that an additional soil layer or building pad be placed on the final cover prior to construction to protect the integrity and function of the various layers of final cover.

The proposed solar array improvements will be in direct contact with the final cover barriers in Array 1, 2, and 3. The arrays will be supported by columns and skids. Care will be taken to not damage the barriers when installing column supports and moving solar panel skids.

(g) All onsite construction within 1,000 feet of the boundary of any disposal area shall be designed and constructed in accordance with subparagraphs (1 through 7), or in accordance with an equivalent design which will prevent gas migration into the building, unless an exemption has been issued:

No buildings are planned as part of the solar array improvements.

11 SITE SECURITY

The electrical wiring will be below grade to the maximum extent possible and control/power cabinets will be locked. The solar arrays are bolted to the support structures and are not easily removed.

Site security will be maintained through a combination of fencing, locked gates during closed park hours, security camera installations, and 24-hour security service onsite. Arrays 1 and 2 will be generally open to public access during park hours and will be secured by security camera installations and closed park security service onsite. Array 3 will be surrounded by fence and will be monitored by security camera installations.

Security of the solar array installations will be the responsibility of the RP. Periodic reviews of the security measures in place will be made to determine if additional measures are warranted to protect the solar arrays.

12 REFERENCES


Figures
PROJECT TITLE: 28TH STREET LANDFILL
CITY OF SACRAMENTO
SACRAMENTO, CALIFORNIA

LOCATION MAP

FIGURE NO.: 1

SCALE: N.T.S.
NOTE:
THIS DRAWING IS BASED ON CONERGY 30 PERCENT PLANS.

PLAN VIEW
SCALE: 1"=60'

25' 2 3/5'

STEEL COLUMN PER PLAN
24" DIA. CONCRETE CAP
SLOPE AWAY FROM COLUMN FOR DRAINAGE

1" DIA. ANCHOR BOLT
W/12 1/2" EMBEDMENT

11'-0" X 11'-0"

3'-0" MAX.

1'-4" (TYP.)

18" X 18" X 1 1/2"
BASE PLATE

3" COVER

2500 PSI CONCRETE FOOTING
W/#4 BARS @ 6" O.C. EACH WAY

FINISHED GRADE

COMPACTED SUBGRADE

CARPORT FOOTING PLAN DETAIL
SCALE: 1"=30'

SEE FOOTING DETAIL

EQUAL (TYP.)

EQUAL (TYP.)

152' 10 1/8'

27" DIA. (TYP.)

27" DIA. (TYP.)
NOTE:
THIS DRAWING IS BASED ON CONERGY 30 PERCENT PLANS.
NOTE:
THIS DRAWING IS BASED ON CONERGY 60 PERCENT PLANS.

SCALE: 1"=80'

DETAIL OF GROUND MOUNTED PANELS

FOOTING DETAIL

SCALE: 1"=3"
Appendices
APPENDIX A
Facility/Site Summary Details: Sacramento City Landfill (34-AA-0018)

For this facility, please contact Local Enforcement Agency (LEA) below

CalRecycle Contact: Nevin Yeates
Phone Number: (916) 341-6442

Identification:
Location: Sacramento City Landfill
28th and 'A' Streets
Sacramento, CA 95816
Latitude: 38.58736
Longitude: -121.45592
GIS Confidence: Map

Local Enforcement Agency (LEA):
County of Sacramento
Environmental Management Department
Environmental Compliance Division
10590 Armstrong Avenue, Suite A
Mather, CA 95655
Phone: (916) 875-8484
Fax: (916) 875-8513

US EPA FRS ID: Not Available

Operator/Business Owner:
City of Sacramento, Dept. of Utilities
2812 Meadowview Road
Sacramento, CA 95832
Phone: (916) 808-4934
Fax:

Land Owner(s):
City of Sacramento, Dept. of Utilities
Solid Waste Division
2812 Meadowview Road
Sacramento, CA 95832
Phone: (916) 808-4934
Fax:

Surrounding Land Use:
Open Space - Irrigated

Permit Details:
Current - Permit or EA Notification Issue Date: September 21, 1984 Type: Full

Unit Specifications:
Unit: 01
Activity: Solid Waste Disposal Site
Classification: Solid Waste Disposal Site
Category: Disposal
Regulatory Status: Permitted
Operational Status: Closed

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The California Regional Water Quality Control Board, Central Valley Region, (hereafter Regional Board) finds that:

1. The City of Sacramento (hereafter referred to as Discharger) owns and operates the 28th Street Landfill, a closed Class III landfill at the northern end of 28th Street in downtown Sacramento, as shown in Attachment A, which is incorporated herein and made part of this Order. The 172-acre facility is in Section 32, T9N, R5E, MDB&M, corresponding to Assessor’s parcel Numbers 001-0170-018, 001-0170-021, and 001-0170-026.

2. The facility consists of two classified landfill units covering 107 acres east of 28th Street (WMUs A and B), and two older, unclassified fill areas west (22.5 acres) and north (16 acres) of 28th Street. WMU A is a 79.5-acre unlined unit in the northern part of the site and WMU B is a 27.5-acre clay-lined expansion unit immediately south of WMU A, as shown on Attachment B, which is incorporated and made a part of this Order. The unclassified fill areas are unlined.

3. The landfill was used for disposal of non-hazardous residential, commercial and industrial wastes, primarily collected by the City of Sacramento waste collection services. Refuse filling in the unclassified fill areas took place from approximately 1963 to 1971, while refuse filling in WMU A was from 1971 to 1986, and in WMU B from 1986 until 1994. WMUs A and B were closed with a low permeability clay cover in 1997, while the unclassified fill areas were previously capped with asphalt and/or compacted soil.

4. The facility was previously regulated by Waste Discharge Requirements (WDRs) Order No. 96-286, which was issued prior to landfill closure. The landfill has since been closed and the previous WDRs no longer adequately describe the facility. These updated/revised WDRs describe the closed landfill and prescribe requirements for post-closure maintenance and monitoring.

5. Effective 18 July 1997, the water quality regulations for Class II and Class III disposal facilities formerly contained in Chapter 15, Title 23, California Code of Regulations (CCR), and the solid waste regulations formerly in Title 14, CCR, were consolidated into Chapters 1 through 7, Subdivision 1, Division 2, Title 27, CCR (Title 27). These WDRs reference Title 27 regulations.
6. On 9 October 1991, the United States Environmental Protection Agency (USEPA) promulgated regulations (Title 40, Code of Federal Regulations, Parts 257 and 258, "federal municipal solid waste (MSW) regulations" or "Subtitle D") that apply, in California, to dischargers who own or operate Class II or Class III landfill units at which MSW is discharged. This landfill is subject to all Subtitle D regulations since it accepted MSW after 9 October 1991 and did not meet the applicable federal deadline for cessation of waste acceptance (9 October 1993).

WASTES AND UNIT CLASSIFICATION

7. The landfills accepted wastes defined as “inert” and “nonhazardous” under Sections 20230 and 20220 of Title 27, respectively.

8. Hazardous wastes and liquid wastes have never been knowingly accepted at the landfill. However, typical early (pre-1980s) disposal procedures did not routinely check incoming wastes closely for liquids and/or hazardous wastes. In addition, all municipal wastes contain some portion of household hazardous wastes, mixed in with the non-hazardous garbage, including used oils, paints, lead-acid batteries, pesticides, etc. An assessment conducted in 1985 of the types and quantities of household hazardous waste in materials accepted at the facility found that less than 0.12% of the total waste stream was categorized as household hazardous waste.

9. WMU A is an existing, reclassified Class III waste management unit under Section 20080(d) of Title 27, since it operated prior to 27 November 1984. WMU B is a new Class III waste management unit under Section 20080(d) because it did not receive all of its permits and did not operate until after 27 November 1984.

10. Wastes were initially placed in WMU A in a cut and fill operation to an elevation of about 15 feet above MSL. WDRs order No. 75-155 prohibited discharge of waste below an elevation of 20 feet above MSL after June 1975. About 20 to 25 feet of fill was placed from a southwest to northeast direction across the site. In 1984, the initial lift was completed and the direction of filling changed to southwesterly with an average seven-foot lift placed over the entire WMU A. Additional waste was placed in phases over the site to achieve final grades between 3 and 10 percent in preparation for closure construction. WMU A reached final design elevation in November 1991.

11. At the time of closure, the landfill was permitted to accept up to 1,200 tons of waste per day. It was estimated that actual waste acceptance was approximately 600 tons of waste per day with the facility operating 5 1/2 days per week. The total capacity of the landfill, at final closure, was estimated to be 6,514,000 cubic yards. It is assumed that this applies only to the known waste disposal operations in WMUs A and B.

SITE DESCRIPTION

12. The site is bounded by the American River to the north, Business Interstate 80 to the south, Southern Pacific Railroad tracks to the east, and industrial properties to the west.

13. Land within 1,000 feet of the facility is used for domestic housing, industry, agriculture, recreation, and open space.
14. Significant acreage, including the Dellar Property (the name is that of the current owner, Mr. Lincoln Dellar), has been landfilled to the west of the current 28th Street Landfill. This area is privately owned and the Discharger did not include this acreage in the permitted site closure schedule. However, the existing network of 19 groundwater quality monitoring well does encompass the area to the west of the Discharger-owned property.

15. The topography surrounding the landfill is basically flat with elevations ranging from 25 to 40 feet above MSL with about 45 feet of local topographic relief due to landfill construction. Other man-made features in the area include flood control levees and highway and railway embankments.

**GEOLOGY**

16. The site is underlain by 200 to 300 feet of Holocene age alluvial stream channel deposits consisting primarily of sandy silt, fine to medium grained sand, silty sand, silty clay, and clay. The upper water-bearing unit beneath the landfill is within the more permeable of these materials. Sand and sandy silt acting as aquifer material has hydraulic conductivities reported to range from approximately $1 \times 10^{-4}$ to $1 \times 10^{-2}$ cm/s.

17. Underlying the stream channel deposits, in order of depth, are the Laguna, Fair Oaks, and Mehrten formations.

**WASTE MANAGEMENT UNIT DESIGN**

18. WMU A is unlined and has no leachate collection and recovery system (LCRS).

19. WMU B was constructed in 1985 with a 1.5-foot thick clay liner with a maximum permeability of $1 \times 10^{-7}$ centimeters per second (cm/s) overlain by an additional 1.5 feet of compacted soil with a maximum permeability of $1 \times 10^{-5}$ cm/s. The clay liner extends up the sides of the containment berms to an elevation varying from 27 feet above MSL at the west end of the unit to 30 feet above MSL at the northeast end. The disposal area was excavated prior to construction so that the maximum depth of waste would be 15 feet above mean sea level (MSL).

20. A dendritic LCRS was installed over WMU B’s compacted liner. The LCRS layer consists of a gravel blanket and perforated leachate collection piping. The collection piping drains to a collection sump/pump station at the west end of WMU B which is equipped with two 150-gallon per minute (gpm) pumps (one serving as back-up). The leachate pumps operate using a float control system, which ensures the sump is emptied when liquids accumulate to pre-set level. Leachate is pumped out into the City of Sacramento’s combined storm water/sanitary sewer system. The Discharger monitors leachate quality on a regular basis.

21. A subdrain consisting of a gravel blanket with perforated pipe laterals was constructed underlying WMU B’s base liner to help protect the liner from uplift due to high groundwater. The collection piping tied into a series of three dewatering pump stations located between WMU A and WMU B. The system was intended for use during WMU B’s cell construction and early filling and has not been operated since 1989.
CLOSURE AND POST-CLOSURE

22. The Discharger submitted A Final Closure Plan on 18 June 1991. Several amendments and related technical reports followed before closure construction was implemented, including:
   a. Final Closure and Postclosure Plan Amendment No. 2, dated 18 December 1995, by Harding Lawson Associates;
   c. Special Provisions & Plans (90% Design) for Construction of the 28th Street Landfill Closure, dated 16 February 1996 by Harding Lawson Associates; and
   d. Sacramento Metropolitan Air Quality Management District Permit to Construct the Landfill Gas Collection and Flare System dated 24 September 1996.

   The above documents were reviewed and approved by Regional Board staff, Sacramento County Solid Waste Local Enforcement Agency (LEA), and the California Integrated Waste Management Board (CIWMB).

23. A final cover for both WMUs consists of, described from top to bottom as, one-foot of soil cover, one-foot of low permeability clay, two-feet of concrete and asphalt rubble, and one-foot of intermediate soil cover.

24. The 1991 Final Closure and Post-Closure Maintenance Plan for the facility increased the final cover elevations of WMU A from 72 feet above MSL to 86 feet above MSL to ensure that positive surface drainage would be maintained during the post-closure period. This change increased the fill capacity of this unit from 5,309,000 cubic yards to 6,514,000 cubic yards. The capacity of WMU B was also slightly increased (by 134,000 cubic yards) as a result of a change in the surface drainage design to “V” ditches. As a result of the increased capacity, the active life of the landfill was extended to September 1994 when the landfill ceased accepting municipal solid wastes. The final cover elevation of WMU B was 63 feet above MSL. Both units were vegetated with native grass.

25. As part of closure, the landfill was graded to prevent ponding water and a drainage system was installed. Collected storm water is routed through concrete V-ditches that discharge into the American River, or into one of two detention basins in the southwest and southeast corners of the site, respectively. Detention basin locations are shown in Attachment B. The cover and drainage improvements act to prevent or minimize the infiltration of water into waste.

26. A 10-acre portion of the older fill area west of 28th Street and the 16-acre former fill area north of 28th Street (described in Finding 2) were covered with, from top to bottom, 3 inches of asphalt concrete (to provide an all weather surface and prevent infiltration of water), 6 inches of asphalt street grindings, two-feet of concrete and asphalt rubble, and one-foot of soil paved with asphalt concrete. The remaining 12.5-acres of the fill area south of the compost facility was graded to a minimum 3% slope and covered with, from top to bottom, two-feet of soil cover, 6 inches of asphalt street grindings, two-feet of concrete and asphalt rubble, and 6 inches of soil cover.
Post-Closure

27. The crest areas of both WMUs have settled since landfill closure, as indicated by the first five-year aerial topographic survey of the site conducted on 12 March 2002. The measured crest elevation at WMU A was 83 feet indicating that it had settled about two feet since last repaired. The measured crest elevation at WMU B was 62 feet above MSL, indicating that the unit cover has settled about 1.5 feet since closure in 1997 (no cover repairs have been previously performed at this unit).

28. The covered area north of 28th Street is now the City’s corporation yard and is used for storage, vehicle parking and facility offices. The City Department of Parks and Recreation has also developed small portions of this area as the Sutter’s Landing Park, including pedestrian/bike trails, paved parking, picnic areas and a skate-park area. The former compost area and uncovered area west of 28th Street are not currently being used. These areas are now controlled by the City Department of Parks and Recreation, which is considering the areas for incorporation into Sutter’s Landing Park.

29. Landfill access roads along the landfill unit perimeter were slurry sealed with an asphalt emulsion to maintain an impermeable surface.

Landfill Gas Collection System

30. Migration of landfill gas from the active site was also identified in 1987. The effects of landfill gas migration include distressed vegetation along the American River and south of the landfill near Interstate Business 80. Elevated levels of ammonia in soil were also found in these areas. As such, the Discharger constructed a passive landfill gas collection trench east of the active site to intercept any landfill gas migrating in that direction.

31. A landfill gas (LFG) collection system was installed in 1990 and has been upgraded in phases. In addition to controlling migration of combustible gases, the system serves as a corrective action measure to help prevent migration of gas-borne contaminants, principally volatile organic compounds (VOCs) that could otherwise migrate to groundwater. The system includes 100 interior extraction wells, including 82 interior extraction wells at WMU A and 18 at WMU B. These wells extend into the refuse mass to depths ranging from approximately 40 to 60 feet below ground surface (bgs). Under a lease agreement with the Discharger, Gas Recovery Systems, Incorporated (GRS) captures the LFG for use as an alternate energy source. GRS operates the WMU A wells and the Discharger operates the WMU B wells. Collected landfill gas is sold as fuel to fire a small process boiler at an off-site industrial location. Excess recovered landfill gas that is not sold as fuel is combusted in one of two ground flares maintained by GRS and the Discharger.

32. The LFG collection system also includes 66 perimeter extraction wells operated by the Discharger for migration control purposes. The wells are installed in a soil levee/berm along the southern fill perimeter. LFG extracted from the perimeter system is combined with excess LFG from WMU A and WMU B (i.e. LFG that is not used for cogeneration) and combusted in one of two flares. Gas extraction well and collection header piping layout for the landfill gas system are shown in Attachment D, which is incorporated herein and made part of this Order.
SURFACE AND STORM WATER

33. The site is in the Lower American Hydrologic Sub-Area, Coon-American Hydrologic Area of the Valley-American Hydrologic Unit in the Sacramento Hydrologic Basin Planning Area (as depicted on the interagency hydrologic maps prepared by the Department of Water Resources in August 1986).

34. The American River, which is tributary to the Sacramento River, flows along the north side of the site. The beneficial uses of these surface waters are municipal and domestic supply; agricultural irrigation; industrial service and power supply; recreation; freshwater habitat; migration; spawning; and wildlife habitat.

35. The facility receives an average of 18 inches of precipitation per year.

36. The average annual precipitation at the facility is 17.6 inches and the 100-year, 24-hour precipitation event for the facility is 4.4 inches, as calculated from Rainfall, Intensity, Duration and Frequency for the Sacramento Station based on the period 1903-2002, Plate No. 2. The calculated precipitation at this station for a wet season with a 100-year return period is 31.9 inches.

37. The facility’s containment levees and other embankments are designed to prevent inundation or washout of waste management units due to floods with a 100-year return period. The facility is not within a 100-year flood plain.

38. Landfill runoff drains by sheet flow over the side slopes and is collected in perimeter “V” ditches. Areas of differential settlement are periodically graded to prevent ponding of storm water and maintain proper drainage. Drainage ditches are lined with low permeability clay and extends to detention basins before the surface runoff leaves the site.

39. Most landfill runoff is discharged into the American River at two points along the north side of the facility. The Discharger has obtained coverage under the General Industrial Storm Water Permit for these discharges. The remaining surface water runoff is discharged to the City of Sacramento’s sanitary sewer system, which flows to and is treated at the Sacramento Regional Wastewater Treatment Plant. An industrial sewer use permit for the landfill was obtained from the County of Sacramento.

GROUNDWATER

40. Groundwater elevations at the landfill vary seasonally and correspond to fluctuations in water levels in the American River. Groundwater elevations in monitoring wells at the landfill are typically in the range of 2 to 20 feet above MSL. At 20 feet above MSL, groundwater elevations are up to five feet above the base of the WMUs. During the winter of 1986 and the spring of 1995, groundwater elevations greater than 25 feet above MSL were measured at the landfill. Therefore, a portion of the waste in the unlined WMU A was inundated by groundwater in 1986 and 1995.
41. Groundwater gradients are south to southwesterly in the winter during high river stages. Northerly groundwater gradients occur between the central portion of the landfill and the river during the late spring, summer, and fall months when river flow is low. The net hydraulic gradient is to the southwest and net groundwater flow is about 30 to 50 feet per year. Due to the seasonal changes in groundwater flow direction in areas of the facility adjacent to the river, monitoring wells used at this site for background water quality data are not necessarily up-gradient from the landfill at all times.

42. Monitoring well data also indicate a significant vertical hydraulic gradient can occur in the area south of Interstate Business 80. This downward gradient is associated with pumping of a nearby agricultural supply well.

43. The beneficial uses of the groundwater are municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply.

Groundwater Monitoring

44. In October 1985, the Discharger installed seven (7) monitoring wells around the active portions of the landfill (WMUs A and B). These wells were numbered B-1, B-3, B-4, C-7, C-8, C-9, and C-10. The Discharger performed monitoring of the wells during 1985 and 1986 and concluded that the shallow groundwater beneath the site had been impacted with VOCs of which the predominant compound was vinyl chloride.

45. In November and December 1986, the Discharger installed seven (7) more wells to comply with the Solid Waste Assessment Test (SWAT) Report requirements (B-6, C-11D, C-11S, C-12, C-13, C-14 and C-15). Four of these wells (C-12 through C-15) were located around the inactive disposal areas west of WMU A. Well B-6 was installed north of WMU-A and wells C-11D and C-11S were installed south of WMU B. The last two wells are a shallow and deep pair intended to assess vertical groundwater gradients in the area.

46. The SWAT Report was produced in June 1987. A total of twenty (20) VOCs were detected in the wells tested, with vinyl chloride being detected in five wells (B-3, B-6, C-7, C-13, C-14), including detections of vinyl chloride in the same wells on different sampling dates. Concentrations of vinyl chloride reported in the SWAT Report ranged from 0.22 to 19 µg/L, and in wells B-6 and C-7 vinyl chloride concentrations exceeded the California Department of Health Services action level of 0.5 µg/L.

47. After the SWAT Report and tests were completed, the Discharger expanded the groundwater monitoring network to include five (5) more wells, bringing the total to nineteen (19). Monitoring well locations are shown in Attachment C, which is incorporated herein and made part of this Order.

48. In June 1999, the Regional Board conducted an inspection of the landfill facility and prepared an inspection report dated 11 June 1999. The report stated that the Discharger needed to prepare a Corrective Action Plan for the landfill due to a release of VOCs indicated by the groundwater monitoring data. The Discharger submitted a Corrective Action Plan (CAP) in March 2000,
prepared by Phase Three Environmental Management in response to the inspection. The March 2000 CAP identified three release mechanisms that may have caused the VOC impact, including: the migration of landfill leachate to groundwater; the direct contact of wastes in the unlined landfill areas with groundwater; and impacts from landfill gas. The report also identified the following corrective actions measures that had already been implemented:

a. Closure of WMUs A and B;
b. Capping/covering the City-owned unclassified fill areas north and west of 28th Street, including the former compost area, as described in Finding 26;
c. Installation of additional storm water controls, including concrete-lined V ditches at WMUs A and B;
d. Installation of an LFG extraction system at WMUs A and B; and
e. Removal of leachate from the LCRS sump at WMU B.

The Discharger proposed to continue monitoring the effectiveness of these corrective action measures and consider additional corrective action measures as necessary based on the results of post-closure corrective action monitoring. Reporting Requirement D.8 of the MRP requires that the Discharger submit semiannual reports as to the effectiveness of corrective action.

49. Since completion of landfill closure in 1997, concentrations of VOCs, including vinyl chloride, in compliance wells at the site have declined to low to trace levels.

50. In a 30 May 2003 report Cost Estimate and Financial Assurance for Corrective Action for Known or Reasonably Foreseeable Releases to Groundwater, the Discharger requested that the Regional Board review their proposal for new corrective action concentration limits (concentration limits greater than background or CLGB) proposed in the Corrective Action Plan dated March 2000. In a letter dated 5 June 2003, the Regional Board did not approve the request for CLGB because the Discharger did not justify that groundwater clean-up to background levels is technologically or economically infeasible to achieve.

**FINANCIAL ASSURANCES**

51. In a 14 October 2003 revision to the above report, the Discharger evaluated reasonably foreseeable release (RFR) scenarios for the landfill. The report concluded that VOC impacts from a complete or partial failure of the LFG controls and/or groundwater impacts from intrusion of high groundwater into landfill waste were the most likely release scenarios. The report provided cost estimates for remediation of the RFR impacts as follows:

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<thead>
<tr>
<th>RFR Scenario</th>
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<tbody>
<tr>
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<td>Evaluation</td>
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<tr>
<td>Complete or partial failure of LFG controls</td>
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</tr>
<tr>
<td>Intrusion of groundwater into landfill waste</td>
<td>15,200</td>
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</tbody>
</table>
In a 6 November 2003 letter to the Discharger, the Executive Officer approved of the $551,100 (2003 dollars) total RFR cost estimate for the site. The CIWMB has not yet approved of the amount or established a financial assurances mechanism, however.

52. The Discharger has provided $1,898,892 in 2003 dollars to cover the estimated costs of post-closure maintenance of the landfill over the post-closure period. The CIWMB has approved a Pledge of Revenue as the funding mechanism.

**CEQA AND OTHER CONSIDERATIONS**

53. This action to revise WDRs for this facility is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21000, et seq.), in accordance with Title 14, CCR, Section 15301.

54. On 17 June 1993, the State Water Resources Control Board adopted Resolution No. 93-62 implementing a State Policy for the construction, monitoring, and operation of municipal solid waste (MSW) landfills that is consistent with the federal MSW regulations promulgated under Title 40, Code of Federal Regulations, Part 258 (Subtitle D). Title 27 incorporates State Water Resources Control Board (SWRCB) Resolution No. 93-62.

55. This order implements:


   b. The prescriptive standards and performance goals of Chapters 1 through 7, Subdivision 1, Division 2, Title 27, of the California Code of Regulations, effective 18 July 1997, and subsequent revisions;

   c. The prescriptive standards and performance criteria of RCRA Subtitle D, Part 258; and


56. Section 13267(b) of California Water Code provides that: "In conducting an investigation specified in subdivision (a), the Board may require that any person who has discharged, discharges, or is suspected of discharging, or who proposed to discharge within its region, or any citizen or domiciliary, or political agency or entity of this state who had discharged, discharges, or is suspected of discharging, or who proposed to discharge waste outside of its region that could affect the quality of the waters of the state within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the Board requires. The burden, including costs of these reports, shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports." The monitoring and reporting program required by this Order and the attached Monitoring and Reporting Program Order No. R5-2004-0039 are necessary to assure compliance with these waste discharge requirements. The Discharger operates the facility that discharged the waste subject to this Order.
PROCEDURAL REQUIREMENTS

57. All local agencies with jurisdiction to regulate land use, solid waste disposal, air pollution, and to protect public health have approved the use of this site for the discharges of waste to land stated herein.

58. The Regional Board notified the Discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for this discharge, and has provided them with an opportunity for a public hearing and an opportunity to submit their written views and recommendations.

59. The Regional Board, in a public meeting, heard and considered all comments pertaining to the discharge.

60. Any person affected by this action of the Regional Board may petition the State Water Resources Control Board to review the action in accordance with Sections 2050 through 2068, Title 23, California Code of Regulations. The petition must be received by the State Water Resources Control Board, Office of Chief Counsel, P.O. Box 100, Sacramento, California 95812, within 30 days of the date of issuance of this Order. Copies of the laws and regulations applicable to the filing of a petition are available on the Internet at http://www.swrcb.ca.gov/water_laws/index.html and will be provided on request.

IT IS HEREBY ORDERED, pursuant to Sections 13263 and 13267 of the California Water Code, that Order No. 96-286 is rescinded, and that the City of Sacramento, and its agents, successors, and assigns, in order to meet the provisions of Division 7 of the California Water Code and the regulations adopted there under, shall comply with the following:

A. PROHIBITIONS

1. The discharge of any additional waste at this site is prohibited.

2. The discharge shall not cause any increase in the concentration of waste constituents in soil-pore gas, soil-pore liquid, soil, or other geologic materials outside of the Unit if such waste constituents could migrate to waters of the State — in either the liquid or the gaseous phase — and cause a condition of nuisance, degradation, contamination, or pollution.

3. The discharge shall not cause the release of pollutants, or waste constituents in a manner which could cause a condition of nuisance, degradation, contamination, or pollution of groundwater to occur, as indicated by the most appropriate statistical or non-statistical data analysis method and retest method listed in this Order, the Monitoring and Reporting Program, or the Standard Provisions and Reporting Requirements.

4. The ponding of any liquid on any landfill module is prohibited.

5. The discharge of solid or liquid waste or leachate to surface waters, surface water drainage courses, or groundwater is prohibited.
6. The discharge of groundwater or wastewater to surface water or any surface water drainage courses is prohibited without an NPDES permit authorizing the discharge.

7. The discharge of waste within 100 feet of surface waters is prohibited.

B. FACILITY SPECIFICATIONS

General Specifications

1. The Discharger shall, in a timely manner, remove and relocate any wastes discharged at this facility in violation of this Order.

2. The Discharger shall immediately notify the Regional Board of any flooding, unpermitted discharge of waste off-site, equipment failure, slope failure, or other change in site conditions which could impair the integrity of waste or leachate containment facilities or precipitation and drainage control structures.

3. The Discharger shall maintain in good working order any facility, control system, or monitoring device installed to achieve compliance with the waste discharge requirements.

4. All wells within 500 feet of a waste management unit shall be sealed or abandoned to the satisfaction of the Sacramento County Department of Environmental Health. A record of the sealing and/or abandonment of such wells shall be sent to the Regional Board and to the State Department of Water Resources.

Protection from Storm Events

5. Precipitation and drainage control systems shall be designed, constructed and maintained to accommodate the anticipated volume of precipitation and peak flows from surface runoff under 100-year, 24-hour precipitation conditions.

6. Closed landfill units shall be maintained to promote runoff and to prevent ponding.

7. Surface drainage from on-site and off-site tributary areas and internal site drainage from surface or subsurface sources shall not contact or percolate through wastes.

8. Surface drainage within the waste management facility shall either be contained on-site or be discharged in accordance with applicable storm water regulations.

9. The Discharger shall maintain a *Storm Water Pollution Prevention Plan* and *Monitoring Program and Reporting Requirements* in accordance with State Water Resources Control Board Order No. 97-03-DWG, NPDES No. CAS000001 or retain all storm water on-site.
Landfill Specifications

10. The unclassified fill areas north and west of 28th Street ceased accepting wastes prior to the revision of Chapter 15 in November 1984. Therefore, these areas were not required to close with prescriptive cover materials. However, this does not relieve the Discharger from any more stringent requirements of the CIWMB, nor from the responsibility to take corrective action to prevent or clean up groundwater and/or surface water contamination related to this landfill unit in accordance with Section 20080(g) of Title 27.

11. Methane and other landfill gases shall be adequately vented, removed from the landfill units, or otherwise controlled to prevent the danger of adverse health effects, nuisance conditions, or the impairment of the beneficial uses of surface water or groundwater due to migration through the unsaturated zone.

12. Condensate from the landfill gas collection system shall be discharged to an approved off-site facility capable of receiving these wastes or equivalent treatment system. Any other treatment alternative proposed shall be submitted to the Regional Board for approval.

13. The depth of fluid in any LCRS sump shall be kept at or below six (6) inches, or the minimum needed to ensure efficient pump operation.

14. Vegetation shall be planted and maintained over each closed landfill unit. Vegetation shall be selected to require a minimum of irrigation and maintenance and shall have a rooting depth not in excess of the vegetative layer thickness.

15. Closed landfill units shall be graded to at least a three percent (3%) slope and maintained to prevent ponding.

16. Areas with slopes greater than ten percent (10%), surface drainage courses, and areas subject to erosion by wind or water shall be designed, constructed, and maintained to prevent such erosion.

17. Repair of existing closure construction must, at a minimum, comply with the existing approved Final Closure Plan and construction quality assurance plans and specifications.

C. MONITORING SPECIFICATIONS

1. The Discharger shall conduct groundwater and surface water monitoring, as specified in Monitoring and Reporting Program (MRP) No. R5-2004-0039. Groundwater monitoring shall include background monitoring and corrective action monitoring. Background monitoring shall be conducted for the purpose of monitoring water quality upgradient of the landfill and updating concentration limits, as necessary, as part of the Water Quality Protection Standard per Section 20400(a) of Title 27. Corrective action monitoring shall be conducted for the purpose of monitoring the nature and extent of the release (Section 20425(a)(2)), assessing the
progress of corrective action measures (Section 20430(d)), and designing any necessary additional corrective action measures (Section 20425(a)(2)).

2. The Discharger shall provide Regional Board staff a minimum of one week notification prior to commencing any field activities related to the installation, repair, or abandonment of monitoring devices, and a minimum 48 hour notification prior to the collection of samples associated with a detection monitoring program, evaluation monitoring program, or corrective action program.


4. The Water Quality Protection Standard for organic compounds which are not naturally occurring and not detected in background groundwater samples shall be taken as the detection limit of the analytical method used (i.e., US-EPA methods 8260 and 8270). The repeated detection of one or more non-naturally occurring organic compounds in samples above the Water Quality Protection Standard from detection monitoring wells is evidence of a release from the Unit.

5. The concentrations of the constituents of concern in waters passing the Point of Compliance shall not exceed the concentration limits established pursuant to Monitoring and Reporting Program No. R5-2004-0039. For each monitoring event, the Discharger shall determine whether the landfill is in compliance with the Water Quality Protection Standard using procedures specified in Monitoring and Reporting Program No. R5-2004-0039 and Title 27 CCR Section 20415(e).

6. The Discharger shall have a Sample Collection and Analysis Plan (sampling plan) which includes the following:
   
   a. Sample collection procedures describing purging techniques, sampling equipment, and decontamination of sampling equipment;
   b. Sample preservation information and shipment procedures;
   c. Sample analytical methods and procedures; Sample quality assurance/quality control (QA/QC) procedures; and
   d. Chain of Custody control.

   The sampling plan shall further comply with Monitoring Specifications E.7 through E.14 herein.

7. For any given monitored medium, the samples taken from all monitoring points and background monitoring points to satisfy the data analysis requirements for a given reporting period shall all be taken within a span not to exceed 30 days, unless the Executive Officer approves a longer time period, and shall be taken in a manner that ensures sample independence to the greatest extent feasible. Specific methods of collection and analysis must be identified. Sample collection, storage, and analysis shall be performed according to the
most recent version of USEPA Methods, such as the latest editions, as applicable, of: (1) Methods for the Analysis of Organics in Water and Wastewater (USEPA 600 Series), (2) Test Methods for Evaluating Solid Waste (SW-846, latest edition), and (3) Methods for Chemical Analysis of Water and Wastes (USEPA 600/4-79-020), and in accordance with the approved Sample Collection and Analysis Plan.

8. If methods other than USEPA-approved methods or Standard Methods are used, the exact methodology shall be submitted for review and approval by the Executive Officer prior to use.

9. The methods of analysis and the detection limits used must be appropriate for the expected concentrations. For the monitoring of any constituent or parameter that is found in concentrations which produce more than 90% non-numerical determinations (i.e., “trace” or “ND”) in data from background monitoring points for that medium, the analytical method having the lowest method detection limit (MDL) shall be selected from among those methods which would provide valid results in light of any matrix effects or interferences.

10. “Trace” results - results falling between the MDL and the practical quantitation limit (PQL) - shall be reported as such, and shall be accompanied both by the estimated MDL and PQL values for that analytical run.

11. MDLs and PQLs shall be derived by the laboratory for each analytical procedure, according to State of California laboratory accreditation procedures. These MDLs and PQLs shall reflect the detection and quantitation capabilities of the specific analytical procedure and equipment used by the lab, rather than simply being quoted from USEPA analytical method manuals. In relatively interference-free water, laboratory-derived MDLs and PQLs are expected to closely agree with published USEPA MDLs and PQLs.

12. If the laboratory suspects that, due to a change in matrix or other effects, the true detection limit or quantitation limit for a particular analytical run differs significantly from the laboratory-derived MDL/PQL values, the results shall be flagged accordingly, along with estimates of the detection limit and quantitation limit actually achieved. The MDL shall always be calculated such that it represents the lowest achievable concentration associated with a 99% reliability of a nonzero result. The PQL shall always be calculated such that it represents the lowest constituent concentration at which a numerical value can be assigned with reasonable certainty that it represents the constituent’s actual concentration in the sample. Normally, PQLs should be set equal to the concentration of the lowest standard used to calibrate the analytical procedure.

13. All QA/QC data shall be reported, along with the sample results to which they apply, including the method, equipment, analytical detection and quantitation limits, the percent recovery, an explanation for any recovery that falls outside the QC limits, the results of equipment and method blanks, the results of spiked and surrogate samples, the frequency of quality control analysis, and the name and qualifications of the person(s) performing the analyses. Sample results shall be reported unadjusted for blank results or spike recoveries. In cases where contaminants are detected in QA/QC samples (i.e., field, trip, or lab blanks), the accompanying sample results shall be appropriately flagged.
14. Unknown chromatographic peaks shall be reported, flagged, and tracked for potential comparison to subsequent unknown peaks that may be observed in future sampling events. Identification of unknown chromatographic peaks that recur in subsequent sampling events may be required.

15. The statistical method shall account for data below the PQL with one or more statistical procedures that are protective of human health and the environment. Any PQL validated pursuant to Title 27 CCR Section 20415(e)(7) that is used in the statistical method shall be the **lowest concentration (or value) that can be reliably achieved** within limits of precision and accuracy specified in the WDRs for routine laboratory operating conditions that are available to the facility. The Discharger’s technical report, pursuant to Title 27 CCR Section 20415(e)(7), shall consider the PQLs listed in Appendix IX to Chapter 14 of Division 4.5 of Title 22, CCR, for guidance when specifying limits of precision and accuracy. For any given constituent monitored at a background or down-gradient monitoring point, an indication that falls between the MDL and the PQL for that constituent (hereinafter called a “trace” detection) shall be identified and used in appropriate statistical or nonstatistical tests. Nevertheless, for a statistical method that is compatible with the proportion of censored data (trace and ND indications) in the data set, the Discharger can use the laboratory’s concentration estimates in the trace range (if available) for statistical analysis, in order to increase the statistical power by decreasing the number of “ties”.

16. Background for water samples shall be represented by the data from all samples taken from applicable background monitoring points during that reporting period (at least one sample from each background monitoring point). The Discharger may propose an alternate statistical method [to the methods listed under Title 27 CCR Section 20415(e)(8)(A-D)] in accordance with Title 27 CCR Section 20415(e)(8)(E), for review and approval by the Executive Officer.

17. The Discharger shall use the following trigger for analytes that are detected in 10% or more of the background samples (i.e. naturally occurring constituents):

   a. From the constituent of concern or monitoring parameter list, identify each analyte in the current sample that exceeds its PQL. The Discharger shall conclude that the exceedance provides a preliminary indication [or, for a retest, provides measurably significant evidence] of a release (i.e. new release or a change in the nature or extent of the existing release) at that monitoring point, if the data contains an analyte that exceeds its concentration limit.

   Any analyte that triggers a discrete retest per this method shall be added to the monitoring parameter list such that it is monitored during each regular monitoring event.

18. The Discharger shall use the following trigger for all analytes that are detected in less than 10% of the background samples:

   a. From the constituent of concern or monitoring parameter list, identify each analyte in the current sample that exceeds either its respective MDL or PQL. The Discharger shall conclude that the exceedance provides a preliminary indication [or, for a retest, provides
measurably significant evidence] of a release (i.e. new release or a change in the nature or extent of the existing release) at that monitoring point, if either:

1) The data contains two or more analytes that equal or exceed their respective MDLs; or

2) The data contains one analyte that equals or exceeds its PQL.

Any analyte that triggers a discrete retest per this method shall be added to the monitoring parameter list such that it is monitored during each regular monitoring event.

**Discrete Retest**

19. If the above statistical or non-statistical trigger procedures used for groundwater monitoring data analysis provide a preliminary indication of a release (i.e. a new release or a change in the nature or extent of the existing release), then the Discharger shall immediately notify Regional Board staff by phone or e-mail and, within 30 days of such indication, shall collect two new (retest) samples from the monitoring point where the release is preliminarily indicated.

   a. For any given retest sample, the Discharger shall include, in the retest analysis, only the laboratory analytical results for those analytes detected in the original sample. As soon as the retest data are available, the Discharger shall apply the same tests [i.e. 17.a for statistical constituents, 18.a for non-statistical constituents], to separately analyze each of the two suites of retest data at the monitoring point where the release is preliminarily indicated.

   b. If either (or both) of the retest samples trips either of the above triggers (17.a or 18.a), then the Discharger shall conclude that there is measurably significant evidence of a release at that monitoring point for the analyte(s) indicated in the validating retest sample(s) and shall:

      1) **Immediately** notify the Regional Board about the constituent verified to be present at the monitoring point, and follow up with written notification submitted by certified mail **within seven days** of validation; and

      2) Comply with 20, below.

Constituents that have been previously detected at a given monitoring point due to seasonality or fluctuations in the extent of the groundwater plume or migration of landfill gas shall be considered confirmed without retesting and therefore shall not trigger notification or a retest.

20. If the Discharger determines that there is measurably significant evidence of a new release from the Unit at any monitoring point, the Discharger shall **immediately** implement the requirements of **Response To A Release**, contained in the Standard Provisions and Reporting Requirements.
D. REPORTING REQUIREMENTS

1. The Discharger shall comply with the reporting requirements specified in this Order, in Monitoring and Reporting Program Order No. R5-2004-0039 and in the Standard Provisions and Reporting Requirements dated April 2000.

2. In the event the Discharger does not comply or will be unable to comply with any prohibition or limitation of this Order for any reason, the Discharger shall notify the appropriate Regional Board office by telephone as soon as it or its agents have knowledge of such noncompliance or potential for noncompliance, and shall confirm this notification in writing within two weeks. The written notification shall state the nature, time, and cause of noncompliance, and shall describe the measures being taken to prevent recurrences and shall include a timetable for corrective actions.

3. The Discharger shall retain records of all monitoring information, including all calibration and maintenance records, all original strip chart recordings of continuous monitoring instrumentation, copies of all reports required by this Order, and records of all data used to complete the application for this Order. Records shall be maintained throughout the life of the facility including the post closure period.

Such legible records shall show the following for each sample:

a. Sample identification and the monitoring point or background monitoring point from which it was taken, along with the identity of the individual who obtained the sample;

b. Date, time, and manner of sampling;

c. Date and time that analyses were started and completed, and the name of the personnel and laboratory performing each analysis;

d. Complete procedure used, including method of preserving the sample, and the identity and volumes of reagents used;

e. Calculation of results; and

f. Results of analyses, and the MDL and PQL for each analysis.

4. A transmittal letter explaining the essential points shall accompany each report. At a minimum, the transmittal letter shall identify any violations found since the last report was submitted, and if the violations were corrected. If no violations have occurred since the last submittal, this shall be stated in the transmittal letter. The transmittal letter shall also state that a discussion of any violations found since the last report was submitted, and a description of the actions taken or planned for correcting those violations, including any references to previously submitted time schedules, is contained in the accompanying report.
5. Each monitoring report shall include a **compliance evaluation summary**. The summary shall contain at least:

a. For each monitoring point and background monitoring point addressed by the report, a description of:

   1) The time of water level measurement;

   2) The type of pump - or other device - used for purging and the elevation of the pump intake relative to the elevation of the screened interval;

   3) The method of purging (the pumping rate; the equipment and methods used to monitor field pH, temperature, and conductivity during purging; the calibration of the field equipment; results of the pH, temperature, conductivity, and turbidity testing; and the method of disposing of the purge water) to remove all portions of the water that was in the well bore while the sample was being taken;

   4) The type of pump - or other device - used for sampling, if different than the pump or device used for purging; and

   5) A statement that the sampling procedure was conducted in accordance with the approved Sampling and Analysis Plan.

b. A map or aerial photograph showing the locations of observation stations, monitoring points, and background monitoring points.

c. For each groundwater body, a description and graphical presentation of the gradient and direction of groundwater flow under/around the Unit, and the groundwater flow rate, based upon water level elevations taken prior to the collection of the water quality data submitted in the report.

d. Laboratory statements of results of all analyses evaluating compliance with requirements.

e. An evaluation of the effectiveness of the leachate monitoring and control facilities, and of the run-off/run-on control facilities.

f. A summary and certification of completion of all Standard Observations for the Unit(s), for the perimeter of the Unit, and for the receiving waters. The Standard Observations shall include:

   1) For the Unit:

      a) Evidence of ponded water at any point on the facility (show affected area on map);

      b) Evidence of odors - presence or absence, characterization, source, and distance of travel from source; and
c) Evidence of erosion and/or of day-lighted refuse.

2) Along the perimeter of the Unit:
   a) Evidence of liquid leaving or entering the Unit, estimated size of affected area, and flow rate (show affected area on map);
   b) Evidence of odors - presence or absence, characterization, source, and distance of travel from source; and
   c) Evidence of erosion and/or of day-lighted refuse.

3) For receiving waters:
   a) Floating and suspended materials of waste origin - presence or absence, source, and size of affected area;
   b) Discoloration and turbidity - description of color, source, and size of affected area;
   c) Evidence of odors - presence or absence, characterization, source, and distance of travel from source;
   d) Evidence of water uses - presence of water-associated wildlife;
   e) Flow rate; and
   f) Weather conditions - wind direction and estimated velocity, total precipitation during recent days and on the day of observation.

   g. The quantity and types of wastes discharged and the locations in the Unit where waste has been placed since submittal of the last such report.

6. The Discharger shall report by telephone any seepage from the disposal area immediately after it is discovered. A written report shall be filed with the Regional Board within seven days, containing at least the following information:

   a. A map showing the location(s) of seepage;
   b. An estimate of the flow rate;
   c. A description of the nature of the discharge (e.g., all pertinent observations and analyses);
   d. Verification that samples have been submitted for analyses of the Constituents of Concern and Monitoring Parameters, and an estimated date that the results will be submitted to the Regional Board; and
   e. Corrective measures underway or proposed, and corresponding time schedule.
7. The Discharger shall submit an **Annual Monitoring Summary Report** to the Regional Board covering the reporting period of the previous monitoring year. This report shall contain:

   a. All monitoring parameters and constituents of concern shall be graphed so as to show historical trends at each monitoring point and background monitoring point, for all samples taken within at least the previous five calendar years. Each such graph shall plot the concentration of one or more constituents for the period of record for a given monitoring point or background monitoring point, at a scale appropriate to show trends or variations in water quality. The graphs shall plot each datum, rather than plotting mean values. For any given constituent or parameter, the scale for background plots shall be the same as that used to plot down-gradient data. Graphical analysis of monitoring data may be used to provide significant evidence of a release.

   b. Unless otherwise exempted by the Executive Officer, all monitoring analytical data obtained during the previous two six-month reporting periods, shall be submitted in tabular form as well as in a digital file format acceptable to the Executive Officer. The Regional Board regards the submittal of data in hard copy and in digital format as “…the form necessary for…” statistical analysis [§20420(h)], in that this facilitates periodic review by the Regional Board.

   c. A comprehensive discussion of the compliance record, and the result of any corrective actions taken or planned which may be needed to bring the Discharger into full compliance with the waste discharge requirements.

   d. A map showing the area and elevations in which filling or cover remediation has been completed during the previous calendar year and a comparison to final closure design contours.

   e. A written summary of the monitoring results, indicating any changes made or observed since the previous annual report.

   f. An evaluation of the effectiveness of the leachate monitoring/control facilities.

8. The Discharger shall submit a report on the effectiveness of the corrective action program in accordance with Title 27 CCR Section 20430(h) to the Regional Board semiannually. This report may be included in the Semi-Annual or Annual Monitoring Report submitted under Monitoring and Reporting Program No. R5-2004-0039.

9. The Discharger shall submit a status report regarding the financial assurances for corrective action and post-closure maintenance annually after the date of adoption of these requirements that either validates the ongoing viability of the financial instrument or proposes and substantiates any needed changes.

10. To assume ownership or operation under this Order, the succeeding owner or operator must apply in writing to the Regional Board requesting transfer of the Order within 14 days of assuming ownership or operation of this facility. The request must contain the requesting
entity’s full legal name, the State of incorporation if a corporation, the name and address and telephone number of the persons responsible for contact with the Regional Board, and a statement. The statement shall comply with the signatory requirements contained in Reporting Requirement D.11 and state that the new owner or operator assumes full responsibility for compliance with this Order. Failure to submit the request shall be considered a discharge without requirements, a violation of the California Water Code. Transfer of this Order shall be approved or disapproved by the Regional Board.

11. All reports and transmittal letters shall be signed by persons identified below:

a. For a corporation: by a principal executive officer of at least the level of senior vice-president.

b. For a partnership or sole proprietorship: by a general partner or the proprietor.

c. For a municipality, state, federal or other public agency: by either a principal executive officer or ranking elected or appointed official.

d. A duly authorized representative of a person designated in a, b or c above if;

   1) The authorization is made in writing by a person described in a, b, or c of this provision;

   2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a Unit, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

   3) The written authorization is submitted to the Regional Board.

Any person signing a document under this Section shall make the following certification:

“I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.”

E. PROVISIONS

1. The Discharger shall maintain a copy of this Order at the facility and make it available at all times to facility operating personnel, who shall be familiar with its contents, and to regulatory agency personnel.

2. The Discharger shall comply with all applicable provisions of Title 27 CCR and 40 Code of Federal Regulations Part 258 (Subtitle D) that are not specifically referred to in this Order.
3. The Discharger shall comply with Monitoring and Reporting Program No. R5-2004-0039, which is incorporated into and made part of this Order.

4. The Discharger shall comply with the *Standard Provisions and Reporting Requirements for Title 27 (27 CCR 20005, et seq.) and Part 258 (40 CFR 258)*, dated April 2000, which are hereby incorporated into this Order.

5. The Discharger shall maintain assurances of financial responsibility for initiating and completing corrective action for all known or reasonably foreseeable releases from the landfill in an amount approved by the Executive Officer, and shall submit the financial assurance mechanism to the Financial Assurances Section of the California Integrated Waste Management Board.

6. The Discharger is required to maintain financial assurance mechanisms for closure and post-closure maintenance costs as specified in Chapter 6 of Title 27. The Discharger is required to submit the financial assurance mechanism to the Financial Assurances Section of the California Integrated Waste Management Board, which determines if the mechanism meets the requirements of Chapter 6, Title 27, and if the amount of coverage is adequate.

7. The Discharger shall take all reasonable steps to minimize any adverse impact to the waters of the State resulting from noncompliance with this Order. Such steps shall include accelerated or additional monitoring as necessary to determine the nature, extent, and impact of the noncompliance.

8. The Discharger shall have the continuing responsibility to assure protection of waters of the state from discharged wastes and from gases and leachate generated by discharged waste during the post-closure maintenance period of the Unit(s) as long as the wastes pose a threat to water quality.

9. The fact that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with this Order shall not be regarded as a defense for the Discharger’s violations of the Order.

10. The Regional Board will review this Order periodically and may revise requirements when necessary.

I, THOMAS R. PINKOS, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 19 March 2004.

THOMAS R. PINKOS, Executive Officer

SJY/JDM
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. R5-2004-0039

MONITORING AND REPORTING PROGRAM
FOR
CITY OF SACRAMENTO
28TH STREET LANDFILL FACILITY
CLASS III LANDFILL
POST-CLOSURE MAINTENANCE AND CORRECTIVE ACTION
SACRAMENTO COUNTY

The City of Sacramento (Discharger) shall maintain water quality monitoring systems that are appropriate for background, detection (surface water only), and corrective action monitoring, and that comply with the provisions of Title 27, California Code of Regulations (CCR), Division 2, Subdivision 1, Chapter 3, Subchapter 3.

Compliance with this Monitoring and Reporting Program, with Title 27 CCR, Section 20005, et seq. (hereafter Title 27), and with the Standard Provisions and Reporting Requirements for Title 27 (27 CCR 20005, et seq.) and Part 258 (40 CFR 258), dated April 2000, is ordered by Waste Discharge Requirements (WDRs) Order No. R5-2004-0039. Failure to comply with this Program, or with the Standard Provisions and Reporting Requirements, constitutes non-compliance with the WDRs and with the California Water Code, which can result in the imposition of civil monetary liability.

A. REQUIRED MONITORING PROGRAMS

<table>
<thead>
<tr>
<th>Program</th>
<th>Section</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Groundwater Monitoring</td>
<td>Section D.1</td>
<td>See Table I</td>
</tr>
<tr>
<td>2. Leachate Monitoring</td>
<td>Section D.2</td>
<td>See Table II</td>
</tr>
<tr>
<td>3. Surface Water Monitoring</td>
<td>Section D.3</td>
<td>See Table III</td>
</tr>
<tr>
<td>4. Standard Observations</td>
<td>Section D.4.c</td>
<td>Weekly</td>
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<tr>
<td>5. Facility Monitoring</td>
<td>Per Section D.4</td>
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</tr>
<tr>
<td>6. Response to a Release</td>
<td>Per Standard Provisions and Reporting Requirements</td>
<td></td>
</tr>
</tbody>
</table>

B. REPORTING

The Discharger shall report monitoring data and information as required in this Monitoring and Reporting Program and as required in Order No. R5-2004-0039 and the Standard Provisions and Reporting Requirements, April 2000.
Semiannual Report
Reports shall be submitted semiannually and shall include the following information:

1. A compliance evaluation summary for the monitoring period.
2. A tabular summary of well information from the installation logs, including well name, top-of-casing elevation, total depth, depths/elevations of screened interval, aquifer or zone (i.e. uppermost), and soil type(s) over the screened interval.
3. The results of groundwater elevation monitoring.
4. Tabular summaries of corrective action monitoring data for each unit showing sampling dates, well, constituents, concentrations, and concentration limits. The table shall also clearly show whether new monitoring data exceedances occurred during the monitoring period (i.e. highlight or check exceedances).
5. Plots, graphical summaries and a narrative discussion of the results of correction action monitoring, indicating constituent trends and any changes in the nature or extent of the plume, as specified in Section D.3 herein.
6. Contaminant contour maps of representative corrective action monitoring data, showing the estimated extent of the contaminant plume.
7. Tables of historical monitoring data for each unit showing well, sampling dates, constituents, concentrations, and concentration limits. The data shall be presented so as to clearly show historical concentrations at each well.
8. Field and laboratory tests sheets.

Each semiannual report shall include an evaluation of the effectiveness of the corrective action program in accordance with Title 27 CCR Section 20430(h).

Annual Report
The Discharger shall also submit an Annual Monitoring Summary Report (Annual Report) to the Regional Board covering the previous monitoring year. The annual report shall contain the information specified under Reporting Requirements D.7, WDRs Order No. R5-2004-0039 and a discussion of compliance with the WDRs and the Water Quality Protection Standard.

The data shall be summarized in such a manner so as to illustrate clearly the compliance with WDRs or the lack thereof. Data shall also be submitted in a digital format acceptable to the Executive Officer. Reports which do not comply with the required format will be REJECTED and the Discharger shall be deemed to be in noncompliance with the WDRs Order No. R5-2004-0039.

The Semiannual and Annual monitoring reports shall be submitted to the Regional Board in accordance with the following schedule for the calendar period in which samples were taken or observations made.

<table>
<thead>
<tr>
<th>Report</th>
<th>End of Period</th>
<th>Report Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Semiannual</td>
<td>30 June</td>
<td>31 July</td>
</tr>
<tr>
<td>Second Semiannual</td>
<td>31 December</td>
<td>31 January</td>
</tr>
<tr>
<td>Annual</td>
<td>31 December</td>
<td>31 January</td>
</tr>
</tbody>
</table>
The results of all monitoring conducted at the site shall be reported to the Regional Board in accordance with the reporting schedule above for the calendar period in which samples were taken or observations made.

C. WATER QUALITY PROTECTION STANDARD AND COMPLIANCE PERIOD
For each waste management unit (Unit), the Water Quality Protection Standard shall consist of all constituents of concern, the concentration limit for each constituent of concern, the point of compliance, and all water quality monitoring points.

1. Constituents of Concern
The constituents of concern (COC) include all the waste constituents, their reaction products, and hazardous constituents that are reasonably expected to be in or derived from waste contained in the Unit. The constituents of concern for all Units at the facility are those listed in Tables I through III for the specified monitored medium, and Table IV. The Discharger shall monitor all constituents of concern every five years, or more frequently as required. The COC Report may be combined with a Detection Monitoring Report or an Annual Summary Report having a Reporting Period that ends at the same time.

a. Monitoring Parameters
Monitoring parameters are constituents of concern that are the waste constituents, reaction products, hazardous constituents, and physical parameters that provide a reliable indication of a release from a Unit. The monitoring parameters for all Units are those listed in Tables I through III for the specified monitored medium.

2. Concentration Limits

a. Groundwater
i. Statistical Method - For inorganic (i.e. naturally occurring) COCs for which at least 10% of the data from background samples equal or exceed their respective MDL, concentration limits shall be determined by the Tolerance Interval Procedure using pooled historical background data from wells C-9 and C-10. Except for pH, which will have both an upper and lower limit, the concentration limit shall be the upper control limit, equal to the mean plus three standard deviations. For pH, the concentration limit shall be both the upper and lower control limits (i.e. the mean plus/minus three standard deviations).

Statistically-based concentration limits may also be determined by an alternate statistical method acceptable to the Executive Officer in accordance with Title 27 CCR Section 20415.
ii. Non-Statistical Method – For organic (i.e. non-naturally occurring) COCs and inorganic COCs for which less than 10% of the data from background samples equal or exceed their respective MDL, concentration limits shall be determined by a non-statistical procedure as follows:
   1) The concentration limit for organic compounds (i.e. VOCs) shall be the MDL.
   2) The concentration limit for inorganic COCs for which less than 10% of the data from background samples equal or exceed their respective MDL (i.e. certain dissolved metals) shall be the PQL.

The concentration limits for groundwater monitoring parameters and COCs shall be updated at least every five years.

b. Surface Water
   With the exception of VOCs (for which a non-statistical method is used to determine concentration limits), the concentration limits for surface water monitoring shall be based on historical water quality data at each upstream monitoring point, but shall take into consideration seasonality. The concentration limits shall be updated semi-annually to provide ongoing definition of background surface water quality.

3. Point of Compliance
   The point of compliance for the water standard at each Unit or portion of a Unit is a vertical surface located at the hydraulically down-gradient limit of the Unit that extends through the uppermost aquifer underlying the Unit. All point of compliance monitoring wells established for the detection monitoring program shall constitute the monitoring points for the groundwater Water Quality Protection Standard. The Point of Compliance wells for WMUs A and B are: B-1, B-4, B-6, C-7, and C-8.

4. Compliance Period
   The compliance period for each Unit shall be the number of years equal to the active life of the Unit plus the post-closure period. The monitoring program shall continue throughout the post-closure maintenance period and shall extend as long as the wastes pose a threat to water quality.

5. Water Quality Protection Standard Report
   If subsequent sampling of the background monitoring point(s) indicates significant water quality changes due to either seasonal fluctuations or other reasons unrelated to waste management activities at the site, the Discharger may request modification of the Water Quality Protection Standard. The Executive Officer shall review and approve any changes to the Water Quality Protection Standard for each monitored medium.

D. MONITORING
   The Discharger shall comply with the monitoring program provisions of Title 27 CCR for groundwater and surface water, in accordance with Monitoring Specification C.1 of WDR Order No. R5-2004-0039. For any given monitored medium, a sufficient number of samples shall be taken from all Monitoring Points and Background Monitoring Points to satisfy the data analysis
requirements for a given Reporting Period, and shall be taken in a manner that ensures sample independence to the greatest extent feasible. Method detection limits and practical quantitation limits shall be reported. All peaks shall be reported, including those, which cannot be quantified and/or specifically identified. The Discharger may, with the approval of the Executive Officer, use alternative analytical test methods, including new United States Environmental Protection Agency’s (USEPA) approved methods, provided the methods have method detection limits equal to or lower than the analytical methods specified in this Monitoring and Reporting Program.

All leachate, groundwater, and surface water monitoring points shall be sampled and analyzed for monitoring parameters and COCs as indicated and listed in Tables I through III. Metals shall be analyzed in accordance with the methods listed in Table IV.

1. **Groundwater**
   a. **Elevation Monitoring**
      The groundwater surface elevation in all wells and piezometers shall be measured on a quarterly basis per Table I. Groundwater elevations taken prior to purging the well and sampling for Monitoring Parameters may be used to fulfill this requirement. Groundwater elevations for all upgradient and down gradient wells for a given groundwater body shall be measured within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater gradient and direction. The results of groundwater elevation monitoring shall be displayed on a water table contour map and/or groundwater flow net for the site and included in each monitoring report. The Discharger shall use the groundwater elevation monitoring data to determine the following:
      i. The groundwater flow velocity
      ii. The gradient direction in the upper aquifer, and in any additional zone of saturation monitored pursuant to this MRP
      iii. Times of highest and lowest elevations of the water levels in the wells
      iv. Separation of groundwater from the lowest point of the unit
   
   b. **Sampling**
      Groundwater samples shall be collected from the point-of-compliance wells, background wells, and any additional wells added as part of the approved groundwater monitoring system. All new wells shall be monitored quarterly until at least four quarters of data have been collected to determine a concentration limit. Samples shall be collected and analyzed for the monitoring parameters in accordance with the frequency specified in Table I and methods specified in Table IV. All monitoring parameters shall be graphed so as to show historical trends at each well.

      The monitoring network shall consist of 19 wells including background monitoring wells C-9 and C-10 and corrective action monitoring wells B-1, B-3, B-4, B-6, C-7, C-8, C-11D, C-11S, C-12, C-13, C-14, C-15, D-16, D-17, D-18, D-19, and D-20.
2. **Leachate Monitoring**

Leachate samples shall be collected and analyzed in accordance with Table II and the methods specified in Table IV. The leachate monitoring locations (shown in Attachment B) are as follows:

i. Lined leachate collection and recovery system (LCRS) sump at WMU B
ii. Well DW-1 at WMU B

If there is no flow or discharge at the monitoring points during the monitoring period, or the Discharger is not able to obtain samples of the flow or discharge, the Discharger shall state such facts and circumstances in the monitoring report.

The landfill shall also be monitored for seeps as part of Standard Observations. Any seeps to the surface from the Unit shall be sampled and analyzed for the constituents listed in Table II upon detection and recorded in Standard Observations. The quantity of the leachate seep(s) shall be estimated and reported as Leachate Flow Rate (in gallons/day). Notification and repairs shall be made in accordance with the Standard Provisions and Reporting Requirements. See also Section D.3.b below.

3. **Surface Water Monitoring**

The Discharger shall maintain a surface water monitoring system that complies with the General Industrial Storm Water Permit and applicable provisions of Title 27 CCR Sections 20415 and 20420. For all monitoring points assigned to surface water detection monitoring, samples shall be collected and analyzed for the monitoring parameters in accordance with the frequency specified in Table III and methods specified in Table IV. All monitoring parameters shall be graphed so as to show historical trends at each sample location.

a. **Storm Water**

Storm water monitoring shall be performed at the landfill’s northern detention basin outfall to the American River (SW-1), and the existing 18-inch corrugated metal pipe (SW-2), which drains about 20% of the landfill area to the American River. Storm water samples shall be collected after the first storm of the rainy season that produces significant flow and one other time during the season. Sampling shall be conducted during or shortly after storm events or when water is flowing in the drains. The storm water sampling results shall be included in the semiannual report submitted under this Order for the period in which sampling was conducted. If there is no flow or discharge at the monitoring points during the monitoring period, or the Discharger is not able to obtain samples of the flow or discharge, the Discharger shall state such facts and circumstances in the monitoring report.

b. **Surface Water**

Surface water samples shall be collected from the American River at two locations, R1 and R2. R1 is slightly northeast and upstream of the landfill. R2 is located slightly northwest and downstream of the landfill. The locations of all surface water sampling points are shown in Attachment B.
Surface water samples shall also be collected when leachate seeps are observed that may have impacted surface water quality. If leachate seeps are identified extending out of the disposal area or that potentially impact on-site drainages, those drainages shall be sampled as close to the leachate as possible.

4. Facility Monitoring

a. Facility Inspection

Annually, prior to the anticipated rainy season, but no later than 15 September, the Discharger shall conduct an inspection of the facility. The inspection shall assess damage to the drainage control system and groundwater monitoring equipment (including wells, etc.). By 1 October of each year, the Discharger shall submit to the Regional Board the Inspection Report describing measures planned to prepare the site for the wet season.

Any necessary erosion control measures shall be implemented, and any construction, maintenance, or repairs of precipitation and drainage control facilities to necessary prevent erosion or flooding of the facility and to prevent surface drainage from contacting or percolating through wastes shall be completed by 15 November.

b. Storm Events

The Discharger shall inspect all precipitation, diversion, and drainage facilities for damage within 7 days following major storm events. Necessary interim repairs shall be completed within 10 days of the inspection and permanent repairs shall be completed when feasible. The Discharger shall report any damage and subsequent repairs within 45 days of completion of the repairs, including photographs of the problem and the repairs.

c. Standard Observations

Each monitoring report shall include a summary and certification of completion of all Standard Observations for the Units, for the perimeter of the landfill module, and for the receiving waters. Standard observations shall be performed weekly and shall include all elements identified in the Standard Provisions and Reporting Requirements.

The Discharger shall implement the above monitoring program on the effective date of this Program.

Ordered by: _______________________
THOMAS R. PINKOS, Executive Officer

19 March 2004
(Date)

Attachments
SJY/JDM
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Parameters</td>
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</tr>
<tr>
<td>Groundwater Elevation</td>
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<tr>
<td>pH</td>
<td>pH units</td>
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<td>Turbidity</td>
<td>Turbidity units</td>
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<tr>
<td>Monitoring Parameters</td>
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</tr>
<tr>
<td>Total Dissolved Solids (TDS)</td>
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<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>Semi-Annual</td>
</tr>
<tr>
<td>Sulfate</td>
<td>mg/L</td>
<td>Semi-Annual</td>
</tr>
<tr>
<td>Nitrate as Nitrogen</td>
<td>mg/L</td>
<td>Semi-Annual</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>mg/L</td>
<td>Semi-Annual</td>
</tr>
<tr>
<td>Chemical Oxygen Demand</td>
<td>mg/L</td>
<td>Semi-Annual</td>
</tr>
<tr>
<td>Iron, Total</td>
<td>mg/L</td>
<td>Semi-Annual</td>
</tr>
<tr>
<td>Volatile Organic Compounds(^1)</td>
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<td>Total Alkalinity</td>
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<tr>
<td>Total Organic Carbon</td>
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<td>Inorganics (dissolved)(^1)</td>
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<tr>
<td>Semi-Volatile Organic Compounds(^1)</td>
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\(^1\) See Table IV.
TABLE II
LEACHATE MONITORING PROGRAM

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<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Frequency</th>
</tr>
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<tr>
<td><strong>Field Parameters</strong></td>
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<tr>
<td>Total Flow (LCRS sump/seeps only)</td>
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<td>Flow Rate (LCRS sump/seeps only)</td>
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<td>Depth (DW-1 only)</td>
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<td><strong>Monitoring Parameters</strong></td>
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<tr>
<td>Chloride</td>
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<td>Sulfate</td>
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<td>Bicarbonate</td>
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<td>Carbonate</td>
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</tr>
<tr>
<td>Volatile Organic Compounds¹</td>
<td>µg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Semi-Volatile Organic Compounds¹</td>
<td>µg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Organochlorine Pesticides¹</td>
<td>µg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Polychlorinated Biphenyls (PCBs)¹</td>
<td>µg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Organophosphorus Compounds¹</td>
<td>µg/L</td>
<td>Annual</td>
</tr>
</tbody>
</table>

¹ See Table IV.
### TABLE III

**SURFACE WATER MONITORING PROGRAM**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Field Parameters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>°C</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td>Electrical Conductivity</td>
<td>µmhos/cm</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td>pH</td>
<td>pH units</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td>Turbidity</td>
<td>Turbidity units</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td><strong>Monitoring Parameters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>mg/L</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td>Total Dissolved Solids (TDS)</td>
<td>mg/L</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td>Sulfate</td>
<td>mg/L</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td>Nitrate as Nitrogen</td>
<td>mg/L</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td>Bicarbonate Alkalinity</td>
<td>mg/L</td>
<td>Twice each winter²</td>
</tr>
<tr>
<td>** Constituents of Concern**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbonate</td>
<td>mg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Chemical Oxygen Demand</td>
<td>mg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Total Organic Carbon</td>
<td>mg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>mg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>mg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Oil and Grease</td>
<td>mg/L</td>
<td>Annual</td>
</tr>
<tr>
<td>Inorganics (dissolved)²</td>
<td>mg/L</td>
<td>Annual</td>
</tr>
</tbody>
</table>

1. The Discharger shall collect surface water samples after the first storm of the rainy season that produces significant flow and during at least one other storm event in the wet season.
2. See Table IV
TABLE IV

CONSTITUENTS OF CONCERN & APPROVED USEPA ANALYTICAL METHODS

<table>
<thead>
<tr>
<th>Field Parameters</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>150.1</td>
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<tr>
<td>Electrical Conductivity</td>
<td>2510</td>
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</table>

<table>
<thead>
<tr>
<th>General Minerals</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicarbonate</td>
<td>2310B</td>
</tr>
<tr>
<td>Chloride</td>
<td>300 (anion scan)</td>
</tr>
<tr>
<td>Nitrate – Nitrogen</td>
<td>300 (anion scan)</td>
</tr>
<tr>
<td>Sulfate</td>
<td>300 (anion scan)</td>
</tr>
<tr>
<td>Total Dissolved Solids (TDS)</td>
<td>2540C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inorganics (dissolved):</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Antimony</td>
<td>200.7/7041</td>
</tr>
<tr>
<td>Barium</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Beryllium</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Cadmium</td>
<td>200.7/7131A</td>
</tr>
<tr>
<td>Chromium</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Chromium VI⁺</td>
<td>7199/1636</td>
</tr>
<tr>
<td>Cobalt</td>
<td>200.7/6010</td>
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<tr>
<td>Copper</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Silver</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Tin</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Vanadium</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Zinc</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Iron</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Manganese</td>
<td>200.7/6010</td>
</tr>
<tr>
<td>Arsenic</td>
<td>200.9/200.8</td>
</tr>
<tr>
<td>Lead</td>
<td>200.9/200.8</td>
</tr>
<tr>
<td>Mercury</td>
<td>7470A</td>
</tr>
<tr>
<td>Nickel</td>
<td>200.9/200.8</td>
</tr>
<tr>
<td>Selenium</td>
<td>200.9/200.8</td>
</tr>
<tr>
<td>Thallium</td>
<td>200.9/200.8</td>
</tr>
<tr>
<td>Cyanide</td>
<td>9010</td>
</tr>
<tr>
<td>Sulfide</td>
<td>9030</td>
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</table>

<table>
<thead>
<tr>
<th>Other Parameters</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Organic Carbon</td>
<td>415.1</td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>310.1</td>
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<tr>
<td>Total Suspended Solids</td>
<td>160.1</td>
</tr>
<tr>
<td>Bicarbonate Alkalinity</td>
<td>130.2</td>
</tr>
<tr>
<td>Chemical Oxygen Demand</td>
<td>410.4</td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>360.1/360.2</td>
</tr>
<tr>
<td>Oil and Grease</td>
<td>5520/1664</td>
</tr>
</tbody>
</table>
**Volatile Organic Compounds (Method 8260B):**

- Acetone
- Acetonitrile
- Acrolein
- Acrylonitrile
- Allyl chloride (3-Chloropropene)
- Tert-Amyl ethyl ether
- Tert-Amyl methyl ether
- Benzene
- Bromobenzene
- Bromochloromethane
- Bromodichloromethane
- Bromoform (Trichloromethane)
- Tert-Butyl alcohol
- n-Butylbenzene
- sec-Butylbenzene
- tert-Butylbenzene
- tert-Butyl ethyl ether
- Carbon disulfide
- Carbon tetrachloride
- Chlorobenzene
- Chloroethane (Ethyl chloride)
- Chloroform (Trichloromethane)
- Chloroprene
- Dibromochloromethane (Chlorodibromomethane)
- 1,2-Dibromo-3-chloropropene (DBCP)
- 1,2-Dibromoethane (Ethylene dibromide; EDB)
- o-Dichlorobenzene (1,2-Dichlorobenzene)
- m-Dichlorobenzene (1,3-Dichlorobenzene)
- p-Dichlorobenzene (1,4-Dichlorobenzene)
- trans-1,4-Dichloro-2-butene
- Dichlorodifluoromethane (CFC-12)
- 1,1-Dichloroethane (Ethylidene chloride)
- 1,2-Dichloroethane (Ethylene dichloride)
- 1,1-Dichloroethylene (1,1-Dichloroethene; Vinylidene chloride)
- cis-1,2-Dichloroethylene (cis-1,2-Dichloroethene)
- trans-1,2-Dichloroethylene (trans-1,2-Dichloroethene)
- 1,2-Dichloropropane (Propylene dichloride)
- 1,3-Dichloropropene
- 2,2-Dichloropropene
- 1,1-Dichloropropene
- cis-1,3-Dichloropropene
- trans-1,3-Dichloropropene
- Ethylbenzene
- Ethyl methacrylate
- Hexachlorobutadiene
- Hexachloroethane
- 2-Hexanone (Methyl butyl ketone)
- Iodomethane (Methyl iodide)
- Isobutyl alcohol
- di-Isopropyl ether
- Methacrylonitrile
Methyl bromide (Bromomethene)
Methylene bromide (Dibromomethane)
Methylene chloride (Dichloromethane)
Methyl chloride (Chloromethane)
Methyl ethyl ketone (MEK: 2-Butanone)
4-Methyl-2-pentanone (Methyl isobutylketone)
Methyl tert-butyl ether (MtBE)
Naphthalene
2-Nitropropane
n-Propylbenzene
Propionitrile
Styrene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethylene (Tetrachloroethene; Perchloroethylene)
Toluene
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane (Methylchloroform)
1,1,2-Trichloroethane
Trichloroethylene (Trichlorethene)
Trichlorofluoromethane (CFC- 11)
1,2,3-Trichloropropene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Vinyl chloride
Xylenes (total)

**Semi-Volatile Organic Compounds (Method 8270 - base, neutral, & acid extractables):**

Acenaphthene
Acenaphthylene
Acetophenone
2-Acetylaminofluorene (2-AAF)
4-Aminobiphenyl
Anthracene
Benz[a]anthracene (Benzanthracene)
Benz[b]fluoranthene
Benz[k]fluoranthene
Benz[g,h,i]perylene
Benz[a]pyrene
Benzy alcohol
Bis(2-ethylhexyl) phthalate
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl) ether (Dichloroethyl ether)
Bis(2-chloro-1-methyl) ether (Bis(2-chloroisopropyl) ether; DCIP)
4-Bromophenyl phenyl ether
Butyl benzyl phthalate (Benzyl butyl phthalate)
p-Chloroaniline
p-Chloro-m-cresol (4-Chloro-3-methylphenol)
2-Chloronaphthalene
2-Chlorophenol
4-Chlorophenyl phenyl ether
Chrysene
o-Cresol (2-methylphenol)
m-Cresol (3-methylphenol)
p-Cresol (4-methylphenol)
Dibenz[a,h]anthracene
Dibenzofuran
Di-n-butyl phthalate
3,3'-Dichlorobenzidine
2,4-Dichlorophenol
2,6-Dichlorophenol
Diethyl phthalate
p-(Dimethylamino)azobenzene
7,12-Dimethylbenz[a]anthracene
3,3'-Dimethylbenzidine
2,4-Dimethylphenol (m-Xylenol)
Dimethyl phthalate
m-Dinitrobenzene
4,6-Dinitro-o-cresol (4,6-Dinitro-2-methylphenol)
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-n-octyl phthalate
Diphenylamine
Ethyl methanesulfonate
Famphur
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachloropropene
Indeno(1,2,3-c,d)pyrene
Isophorone
Isosafrole
Kepone
Methapyrilene
3-Methylcholanthrene
Methyl methanesulfonate
2-Methylnaphthalene
1,4-Naphthoquinone
1-Naphthylamine
2-Naphthylamine
o-Nitroaniline (2-Nitroaniline)
m-Nitroaniline (3-Nitroaniline)
p-Nitroaniline (4-Nitroaniline)
Nitrobenzene
o-Nitrophenol (2-Nitrophenol)
p-Nitrophenol (4-Nitrophenol)
N-Nitrosodi-n-butylamine (Di-n-butyl nitrosamine)
N-Nitrosodiethylamine (Diethyl nitrosamine)
N-Nitrosodimethylamine (Dimethyl nitrosamine)
N-Nitrosodiphenylamine (Diphenyl nitrosamine)
N-Nitrosodipropylamine (N-Nitroso-N-dipropylamine; Di-n-propyl nitrosamine)
N-Nitrosomethylamine (Methylethyl nitrosamine)
N-Nitrosopiperidine
N-Nitrosospyrrolidine
5-Nitro-o-toluidine
Pentachlorobenzene
Pentachloronitrobenzene (PCNB)
Pentachlorophenol
Phenacetin
Phenanthrene
Phenol
p-Phenylenediamine
Polychlorinated biphenyls (PCBs; Aroclors)
Pronamide
Pyrene
Safrole
1,2,4,5-Tetrachlorobenzene
2,3,4,6-Tetrachlorophenol
α-Toluidine
2,4,5-Trichlorophenol
0,0,0-Triethyl phosphorothioate
sym-Trinitrobenzene

Organochlorine Pesticides (Method 8081A):

Aldrin
α-BHC
β-BHC
γ-BHC (Lindane)
δ-BHC
Chlorobenzilate
α-Chlordane
γ-Chlordane
Chlordane – not otherwise specified
DBCP
4,4'-DDD
4,4'-DDE
4,4'-DDT
Diallate
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
Endrin ketone
Heptachlor
Heptachlor epoxide
Hexachlorocyclopentadiene
Isodrin
Methoxychlor
Toxaphene
Polychlorinated Biphenyls (PCBs) (Method 8082):
- Aroclor 1016
- Aroclor 1221
- Aroclor 1232
- Aroclor 1242
- Aroclor 1248
- Aroclor 1254
- Aroclor 1260

Organophosphorus Compounds (Method 8141A):
- Chlorpyrifos
- Diazinon
- Dimethioate
- Disulfoton
- Ethion
- Famphur
- Malathion
- Parathion
- Parathion-ethyl
- Parathion-methyl
- Phorate

Chlorinated Herbicides (USEPA Method 8151A):
- 2,4-D (2,4-Dichlorophenoxyacetic acid)
- Dicamba
- Dinoseb (DNBP; 2-sec-Butyl-4,6-dinitrophenol)
- MCPA
- MCPP
- Silvex (2,4,5-Trichlorophenoxypropionic acid; 2,4,5-TP)
- 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)
- Pentachlorophenol
The City of Sacramento owns and has operated the 28th Street Landfill since 1973. The site is located at the northern end of 28th Street, in the northeast area of downtown Sacramento. The landfill is bordered by the American River to the north, Business Interstate 80 to the south, Southern Pacific Railroad tracks to the east, and industrial properties to the west.

**Waste Disposal Areas**
The Class III landfill was used for the disposal of non-hazardous residential, commercial and industrial municipal solid wastes. Refuse filling took place from the early 1960’s until September 1994. The facility includes two classified landfill units and two older, unclassified disposal areas, as follows:

**Classified Units**
- A 79.5-acre area known as WMU A. This area was filled from 1971 until 1986. This cell was constructed without a base liner or leachate collection system, which were not required by regulations at the time. A final cover system was installed in phases and was completed in 1997. The cover consists of one foot of intermediate cover soil over the waste materials, overlain by two feet of concrete and asphalt rubble, overlain by one foot of low-permeability clay, overlain by a one-foot vegetative soil layer.
- A 27.5-acre area, known as WMU B. This area was filled from 1986 until 1994. This cell was constructed with a base liner and leachate collection and removal system. The base liner consists of 1.5 feet of compacted soil/bentonite mix with a maximum permeability of $1 \times 10^{-7}$ cm/s, overlain by an additional 1.5 feet of native compacted soil with permeability ranging between $1 \times 10^{-5}$ and $1 \times 10^{-7}$ cm/s. A final cover system was completed at WMU B in September 1997. The final cover profile is identical to that described above for WMU A.

**Unclassified Disposal Areas (filled during the period 1963 through 1971)**
- Approximately 12.5 unpaved acres west of 28th Street
- Approximately 10 paved acres west of 28th Street
- Approximately 16 paved acres north of 28th Street.

The site also includes approximately 18 acres of non-filled areas including levees and a buffer area between the landfill and the American River, a storm water detention area east of the landfill, buffer areas adjacent to the Southern Pacific Railroad tracks east of the landfill.

**Offsite Acreage**
Significant acreage was historically landfilled west of the facility. This acreage, including the Dellar Property (the name is that of the current owner, Mr. Lincoln Dellar), is privately owned and was not included in the facility closure. Several offsite monitoring wells for the facility are located in this area, however.
Closure
The Discharger submitted the 9 February 1998 Construction Quality Assurance/Completion Report for Landfill Closure, prepared by Harding Lawson Associates. The report documents the installation of the final cover for waste management units (WMU) A and B in accordance with the Final Closure Plan. The Regional Board approved the report in a letter dated 3 June 1998. A final cover for both WMUs consist of, described from top to bottom as, one-foot of soil cover, one-foot of low permeability clay, two-feet of concrete and asphalt rubble, and one-foot of intermediate soil cover. Construction activities were completed and reported in the Construction Quality Assurance/Completion Report for Landfill Closure, dated 9 February 1998.

The 16-acre unclassified disposal area north of 28th Street and northern 10-acres of the unclassified disposal area west of 28th Street were closed with, as described from top to bottom, 3 inches of asphalt concrete (to provide an all weather surface and prevent infiltration of water), 6 inches of asphalt street grinding, two-feet of concrete and asphalt rubble, and one-foot of soil cover. The remaining 12.5-acres of the unclassified disposal area west of 28th Street was graded to drain (3% slope or greater) and received a cover consisting of, from top to bottom, two-feet of soil, 6 inches of asphalt street grinding, two-feet of concrete and asphalt rubble, and 6 inches of foundation soil. The landfill access roads at the site were paved with chip seal, which is reapplied where necessary as part of post-closure maintenance to maintain an impermeable surface.

Post-Closure Uses
WMUs A and B are vegetated with native grass and are currently used only for facility access and LFG collection facilities. The paved disposal area north of 28th Street is now the City’s corporation yard and is used for storage, vehicle parking and facility offices. The City Department of Parks and Recreation has also developed small portions of this area as the Sutter’s Landing Park, including pedestrian/bike trails, paved parking, picnic areas and a skate-park area. The paved portion of the unclassified area west of 28th Street (10 acres) was used for composting operations until 2001. This area and the remaining unpaved 12.5 acres are now vacant and controlled by the City Department of Parks and Recreation, which is considering the areas for incorporation into Sutter’s Landing Park.

Groundwater
SWAT Investigation
An initial Solid Waste Assessment Test (SWAT) investigation conducted in 1985 showed the presence of vinyl chloride and elevated concentrations of inorganic constituents/parameters including electrical conductivity and chloride in groundwater at the facility and south and west of the landfill.

In October 1985, the Discharger installed seven groundwater monitoring wells (B-1, B-3, B-4, C-7, C-8, C-9, and C-10) around WMUs A and B and subsequently confirmed that the shallow groundwater beneath the site had been impacted with volatile organic compounds (VOCs) of which the predominant compound was vinyl chloride. In November and December 1986, the Discharger installed seven (7) more wells to comply with the SWAT Report requirements (B-6, C-11D, C-11S, C-12, C-13, C-14 and C-15). Four of these wells (C-12 though C-15) were located around the inactive disposal areas west of WMU A. Well B-6 was installed north of WMU-A and wells C-11D and C-11S were installed south of WMU B. The last two wells are a shallow and deep pair intended to assess vertical groundwater gradients in the area.
A total of twenty (20) VOCs were detected in the wells tested, with vinyl chloride being detected in five wells (B-3, B-6, C-7, C-13, C-14), including detections of vinyl chloride in the same wells on different sampling dates. Concentrations of vinyl chloride reported in the SWAT Report ranged from 0.22 to 19 µg/L, and in wells B-6 and C-7 vinyl chloride concentrations exceeded the California Department of Health Services action level of 2.0 µg/L. The SWAT Report was produced in June 1987.

Current Monitoring System
After the SWAT Report and tests were completed, the Discharger expanded the groundwater monitoring network to include five (5) more wells, bringing the total to nineteen (19). Monitoring well locations are shown in Attachment D, which is incorporated herein and made part of this Order.

Landfill Gas
Migration of landfill gas from the active site was also identified in 1987. The effects of landfill gas migration include distressed vegetation along the American River and south of the landfill near Interstate Business 80. Elevated levels of ammonia in soil were also found in these areas. As such, the Discharger constructed a passive landfill gas collection trench east of the active site to intercept any landfill gas migrating in that direction.

In addition, a comprehensive landfill gas collection system was installed in 1990 and has been upgraded in phases. Landfill gas extraction helps prevent migration of gas-borne contaminants, principally VOCs that could otherwise migrate to groundwater.

Under a lease agreement with the Discharger, Gas Recovery Systems, Incorporated (GRS) captures the landfill gas generated at the landfill for use as an alternate energy source. GRS and the Discharger operate a series of 100 landfill gas extraction wells installed in refuse fill throughout WMU A and WMU B (WMU A – 82 landfill gas wells operated by GRS; WMU B – 18 landfill gas wells operated by the Discharger). Wells extend into the refuse mass to depths ranging from approximately 40 to 60 feet below ground surface (bgs). Collected landfill gas is sold as fuel to fire a small process boiler at an off-site industrial location. Excess recovered landfill gas that is not sold as fuel is combusted in one of two ground flares maintained by GRS and the Discharger.

The Discharger maintains a separate landfill gas collection system for migration control purposes. The system consist of 66 extraction wells installed in a soil levee/berm along the southern fill perimeter. Landfill gas extracted from the perimeter system is combined with excess landfill gas from WMU A and WMU B and combusted in one of two flares. Gas extraction well and collection header piping layout for the landfill gas system are shown in Attachment C, which is incorporated herein and made part of this Order.
**ABBREVIATIONS:**

**SYMBOL LEGEND:**
A6. INSTALLATION OF ANCHORS MUST STRICTLY FOLLOW MANUFACTURER’S INSTRUCTIONS.

A7. CONCRETE MUST CURSE FOR A MINIMUM OF 7 DAYS BEFORE INSTALLATION OF ANCHORS.

A8. FOUNDATIONS (SAT UNIFORMED SIDS AND ENDS AND BOTTOMS IN CONTACT WITH EARTH) 2" OVER TOP OF ELE.

A9. SEISMIC LOADS AND BUILDING CODES ALONE. SEE DRAWINGS FOR CONDITIONS NOT COVERED.

A10. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A11. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A12. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A13. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A14. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A15. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A16. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A17. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A18. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A19. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A20. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A21. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A22. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A23. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A24. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A25. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A26. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A27. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A28. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A29. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A30. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A31. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A32. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A33. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A34. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A35. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A36. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A37. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

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A39. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A40. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A41. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A42. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A43. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

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A45. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A46. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A47. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A48. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A49. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.

A50. FOUNDATIONS TO BE ALTERED IN THE FIELD BY THE STRUCTURAL ENGINEERS STAMP.
500 KW INVERTER STATION
INV B

C-1B

C-2B

DOG PARK EQUIPMENT SITE PLAN

SCALE: N.T.S.
(1) 375KW INVERTER STATION

CARPORT EQUIPMENT SITE PLAN

SCALE: S.T.S.
RACK SOUTH ELEVATION
SCALE: 1/8' = 1'-0"

RACK EAST ELEVATION
SCALE: 3/16" = 1'-0"

RACK DETAIL SOUTH ELEVATION
SCALE: 1/8' = 1'-0"

RACK DETAIL EAST ELEVATION
SCALE: 3/8" = 1'-0"
1. **Dog Park Plain View**
   - Scale: 1" = 1'-0"  
   - Empty space, no module present

2. **Dog Park Elevation**
   - Scale: 1" = 1'-0"
   - Footing detail (TYP)

3. **Carport Elevation**
   - Scale: 1" = 20'-0"
   - Footing detail (TYP)
STEEL COLUMN—PER PLAN

24" DIA. CONCRETE CAP SLOPE AWAY FROM COLUMN FOR DRAINAGE

3/4" DIA. ANCHOR BOLT W/ 12" EMBEDMENT

3" COVER

2500 PSI CONCRETE FOOTING W/#4 BARS @ 6" O.C. EACH WAY

18"x18"x1" BASE PLATE

1'-4" MAX 3' MAX

6'-3" SQUARE

COMPACTED SUBGRADE

FINISHED GRADE

© CONERGY PROJECTS GROUP
3550 WATI AVE. SUITE 140
SACRAMENTO, CA 95821
TEL# 916-979-7068 FAX# 866-436-6114

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BY HK

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FACILITY NAME: SACRAMENTO'S SOLAR PROJECT AT SUTTER'S LANDING
FACILITY LOCATION: SACRAMENTO, CA
SIZE

FILENAME: STRUCTURAL FOOTING DETAILS
DRAWING NO.: PV.4.02
REV.: A

SCALE: N.T.S.

DESIGNED PER
FEBRUARY 23, 2005
FEASIBILITY REPORT

NOTES:

ENGINEERS STAMP:

NOTES:

DESIGNED PER
FEBRUARY 23, 2005
FEASIBILITY REPORT

NOTES:

DESIGNED PER
FEBRUARY 23, 2005
FEASIBILITY REPORT

NOTES:
**DETAIL NOTES:**

1. INSTALL UNDERGROUND CONDUITS BEFORE POURING FOUNDATION.
2. HEIGHT IS APPROXIMATE. FIELD VERIFY.
3. FIELD VERIFY PLACEMENT OF INVERTERS, TRANSFORMERS, ETC.
4. ALL CONCRETE IS SIX BAG MIX
5. INSTALL UNDERGROUND UNDER PAD.
6. CONDUIT QUANTITY SHOWN WITH LEADER LINE
7. USE SCHEDULE 80 PVC RISERS, SCHEDULE 40 U.G. OR DB120 U.G.
8. USE WIRE PULLIN BELLS

**INVERTER PAD - NORTH ELEVATION**

ANCHOR INVERTER WITH 1/2" Ø SIMPSON STRONG BOLTS EMBEDDED TO A DEPTH OF 3 3/4" PER THE 6 INVERTER MOUNTING HOLES, AND SPECIFIED PER INVERTER MANUFACTURER INSTALLATION MANUAL.

**INVERTER PAD - EAST ELEVATION**

SENTALIS MOUNTED ON UNISTRUT

SHARK METER MOUNTED ON UNISTRUT

GROUND ROD IN CHRISTY BOX (TYP) (1/PV4.05 FOR GROUND RING)

CAD-WELD TO WELDED WIRE MESH, OR REBAR

**INVERTER - NORTH ELEVATION**

**INVERTER - EAST ELEVATION**
Detail Notes:
1. Install underground conduits before pouring foundation.
2. Height is approximate. Field verify.
3. Field verify placement of inverters, transformers, etc.
4. All concrete is six bag mix.
5. Install Ufer ground under pad.
6. Conduit quantity shown with leader line.
7. Use schedule 80 PVC risers, schedule 40 U.G. or DB120 U.G.
8. Use wire pullin bells.

Inverter pad - North Elevation

Anchor inverter with 1/2" Ø Simpson Strong Bolts embedded to a depth of 3 3/4" per the 6 inverter mounting holes, and specified per inverter manufacturer installation manual.

Inverter Pad - East Elevation

Solar contactor box mounted on Unistrut.

Inverter - North Elevation

Sentalis mounted on Unistrut.

Inverter - East Elevation

CAD-weld to welded wire mesh, or rebar.
1. CAD-WELD TO WELDED WIRE MESH, OR REBAR & GROUNDING ROD TO GROUND RING

2. #2 AWG CU GROUND RING

GROUND ROD 2 TOTAL, ON OPPOSITE CORNERS OF PAD

8'-0"

INVERTER PAD GROUNDING DETAIL PLAIN VIEW

SCALE: N.T.S.

2'.-6"

2'

CONCRETE UTILITY
CHRISTY BOX OR EQUIVALENT
PER FEBRUARY 23, 2005
FEASIBILITY REPORT

GROUNDING ROD
INSTALLED PER 250.53(E)

3. CAD-WELD GROUNDING ROD TO GROUND RING

4. #2/0 AWG CU GROUND RING

INVERTER PAD GROUNDING DETAIL SECTION

SCALE: N.T.S.
USE GALVANIZED UNISTRUT HARDWARE TO BUILD EQUIPMENT RACK TYP

AMTECH STRING COMBINER BOX WITH BUILT IN DC DISCONNECT

HOMERUN STRINGS FROM RACK TO COMBINER ZIP TIE EVERY 1'-0" TYPICAL

MAKE SURE COMBINER BOX IS CLEAR OF ALL RAILS AND SUPPORTS

AMTECH COMBINER BOX WITH BUILT IN DC DISCONNECT

WEATHER PROOF WIRE CONNECTOR

CONDUIT TYP

POINT OF INTERconnection Elevation T.B.D.

SCALE: N.T.S.

COMBINER & DISCONNECT @ GROUND MOUNT

SCALE: 1/4" = 1'-0"

COMBINER & DISCONNECT - EAST ELEVATION

SCALE: 1/4" = 1'-0"
Mounting Systems

STRUCTURAL ENGINEERING CALCULATIONS FOR:

MS JOB#: ENUS12-052

Sutter Landing Park - Solar Linea D 20° - 2x14P

Sacramento, California

June 11, 2012
TABLE OF CONTENTS

Project Overview Page 1

Design Loads Page 2

RSTAB Model / Support Reactions Page 6

Footing Design
DESIGN OBJECTIVE:
Provide structural calculations for the "Solar Linea D" framing system to withstand vertical and lateral loads.

WIND DESIGN CRITERIA:
ASCE 7-05, Section 6.5.13 w/ Figure 6-18A, Method 2 - Main Wind Force Resisting Systems, Open Building with Monoslope Roof.

Basic Wind Design Speed (V) = 85 mph
Exposure Category = C
Importance Factor (I) = 1.0
Roof Slope = 20°

SEISMIC DESIGN CRITERIA:
ASCE 7-05, Section 15.4, Structural Design Requirements for Nonbuilding Structures.

Latitude = 38.584136
Longitude = -121.468191
OR
Zipcode =

S_S = 0.569     S_1 = 0.238
S_M = 0.766     S_M1 = 0.459
S_D = 0.510     S_D1 = 0.306

R = 1.25 (Cantilever System with Piles) ASCE 7-05 Table 15.4-2
Importance Factor (I) = 1.0

SNOW DESIGN CRITERIA:
ASCE 7-05, Section 7.4, Sloped Roof Snow Loads.

Ground Snow Load (p_g) = 0 psf
Roof Slope = 20°
Importance Factor (I) = 1.0

CODE REFERENCES:
International Building Code (IBC) 2009
American Society of Civil Engineers (ASCE) 7-05 and/or 7-10
Aluminum Design Manual (ADM) 2010
American Institute of Steel Construction (AISC) Steel Construction Manual, 14th Edition
California Building Code (CBC) 2010
**Design Loads**

**LC1: Dead Load, D**

<table>
<thead>
<tr>
<th>Pitch</th>
<th>20.0°</th>
<th>Module Portrait</th>
<th>1640 mm x 994 mm x 46 mm</th>
<th>Weight</th>
<th>20.0 kg</th>
</tr>
</thead>
</table>

| Weight per m^2 | = | 0.12 kN/m^2 |
| Weight per ft^2 | = | 2.51 psf |

**Dead Load Per Module Rail Support:**

| DL | 0.12 kN/m^2 x 1.64 m / 2 = 0.10 kN/m |
| DL | 2.51 psf x 5.38 ft / 2 = 6.75 psf |

**LC2: Snow Load, S** *Not Applicable*

\[ ps = 0.70 \times C_e \times C_t \times I \times C_s \times pg \]

- \( C_e = 0.90 \) Exposure Factor
- \( C_t = 1.20 \) Thermal Factor
- \( I = 1.00 \) Importance Factor
- \( C_s = 0.73 \) Slope Factor
- \( pg = 0 \) Ground Snow Load

\[ ps = 0.00 \text{ psf} \times 0.00 \text{ kN/m}^2 \]

**Snow Load Per Module Rail Support:**

| S | 0.00 kN/m^2 x 1.64 m / 2 = 0.00 kN/m |
| S | 0.00 psf x 5.38 ft / 2 = 0.00 psf |

**LC3-6: Wind Load, W**

\[ p = q_h \times G \times C_n \]

\[ q_h = 0.00256 \times K_s \times K_{st} \times K_d \times V_x \times V_y \times I \]

- \( K_s = 0.85 \) Velocity Pressure Exposure Coefficient
- \( K_{st} = 1.00 \) Topographic Factor
- \( K_d = 0.85 \) Directionality Factor
- \( I = 1.00 \) Importance Factor

\[ q_h = 13.36 \text{ psf} \times 0.64 \text{ kN/m}^2 \]

\[ G = 0.85 \] Gust Effect Factor

\[ C_n = \text{Net pressure Coefficient} \]

**Angle**

<table>
<thead>
<tr>
<th>Load</th>
<th>( \gamma = 0^\circ )</th>
<th>( \gamma = 180^\circ )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case</td>
<td>( C_{NW} )</td>
<td>( C_{NL} )</td>
</tr>
<tr>
<td>A</td>
<td>-1.30</td>
<td>-1.50</td>
</tr>
<tr>
<td>B</td>
<td>-2.23</td>
<td>-0.20</td>
</tr>
</tbody>
</table>

\[ V = 85 \text{ mph} \]

\[ \text{Exposure} = \text{C} \]

\[ q_h = 13.36 \text{ psf} \times 0.64 \text{ kN/m}^2 \]

\[ G = 0.85 \]

\[ C_n = \text{Net pressure Coefficient} \]

\[ \text{Angle} = 20.0^\circ \]
LC3: Wind Direction 0° Load Case A

\[ P_{NW} = q_h \times G \times C_{NW} = -14.77 \text{ psf} \]
\[ P_{NL} = q_h \times G \times C_{NL} = -17.04 \text{ psf} \]

Wind Load per Module Rail Support
\[ P_{NW} = -14.77 \text{ psf} \times 5.38 \text{ ft} / 2 = -39.7 \text{ plf} - 0.58 \text{ kN/m} \]
\[ P_{NL} = -17.04 \text{ psf} \times 5.38 \text{ ft} / 2 = -45.8 \text{ plf} - 0.67 \text{ kN/m} \]

LC4: Wind Direction 180° Load Case A

\[ P_{NW} = q_h \times G \times C_{NW} = 17.83 \text{ psf} \]
\[ P_{NL} = q_h \times G \times C_{NL} = 19.65 \text{ psf} \]

Wind Load per Module Rail Support
\[ P_{NW} = 17.83 \text{ psf} \times 5.38 \text{ ft} / 2 = 48.0 \text{ plf} - 0.70 \text{ kN/m} \]
\[ P_{NL} = 19.65 \text{ psf} \times 5.38 \text{ ft} / 2 = 52.9 \text{ plf} - 0.77 \text{ kN/m} \]

LC5: Wind Direction 0° Load Case B

\[ P_{NW} = q_h \times G \times C_{NW} = -25.33 \text{ psf} \]
\[ P_{NL} = q_h \times G \times C_{NL} = -2.27 \text{ psf} \]

Wind Load per Module Rail Support
\[ P_{NW} = -25.33 \text{ psf} \times 5.38 \text{ ft} / 2 = -68.1 \text{ plf} - 0.99 \text{ kN/m} \]
\[ P_{NL} = -2.27 \text{ psf} \times 5.38 \text{ ft} / 2 = -6.1 \text{ plf} - 0.09 \text{ kN/m} \]

LC6: Wind Direction 180° Load Case B

\[ P_{NW} = q_h \times G \times C_{NW} = 23.85 \text{ psf} \]
\[ P_{NL} = q_h \times G \times C_{NL} = 7.61 \text{ psf} \]

Wind Load per Module Rail Support
\[ P_{NW} = 23.85 \text{ psf} \times 5.38 \text{ ft} / 2 = 64.2 \text{ plf} - 0.94 \text{ kN/m} \]
\[ P_{NL} = 7.61 \text{ psf} \times 5.38 \text{ ft} / 2 = 20.5 \text{ plf} - 0.30 \text{ kN/m} \]
LC7: Seismic Load, E

SEISMIC DESIGN REQUIREMENTS FOR NONBUILDING STRUCTURES (GROUND MOUNT)

Reference ASCE 7-05, Chapter 12 and 15

| Design short period spectral response acceleration | 0.51 |
| Mapped 1 second spectral response acceleration | 0.238 |
| Response modification coefficient (Cantilever System w/ Piles) | 1.25 |
| Importance Factor | 1.00 |
| Effective seismic weight of structure | 2000 lbs |

HORIZONTAL COMPONENT (Strength Level)

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_s$</td>
<td>0.408</td>
</tr>
<tr>
<td>$C_{S\text{MIN}}$</td>
<td>0.03</td>
</tr>
</tbody>
</table>

$C_s = S_{DS}/(R/I)$, Section 12.8.1.1

$C_{S\text{MIN}} = 0.03$ or $C_{S\text{MIN}} = (0.8*S_1)/(R/1)$ for $S_1 > 0.6g$, Section 15.4.2

VERTICAL COMPONENT (Strength Level)

<table>
<thead>
<tr>
<th>Force</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F_{x\text{VERT}}$</td>
<td>0.102</td>
</tr>
</tbody>
</table>

$F_{x\text{VERT}} = +/- 0.2*S_{DS}$, Section 12.4.2.2

SEISMIC BASE SHEAR (Service Level, ASD)

<table>
<thead>
<tr>
<th>Shear</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{HORIZ}$</td>
<td>571 lbs</td>
</tr>
</tbody>
</table>

$V = 0.7*C_s*W$, Section 12.8.1

SEISMIC VERTICAL COMPONENT (Service Level, ASD)

<table>
<thead>
<tr>
<th>Force</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F_{x\text{VERT}}$</td>
<td>143 lbs</td>
</tr>
</tbody>
</table>

$F_{x\text{VERT}} = +/- 0.2*0.7*S_{DS}*W$, Section 12.4.2.2

UNIFORM LOAD PER MODULE RAIL (Service Level, ASD)

<table>
<thead>
<tr>
<th>Area</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area ($A_t$)</td>
<td>491.0 ft²</td>
</tr>
<tr>
<td>Module Length ($L$)</td>
<td>5.38 ft</td>
</tr>
<tr>
<td>$w_{HORIZ}$</td>
<td>3.13 plf</td>
</tr>
<tr>
<td>$w_{VERT}$</td>
<td>0.78 plf</td>
</tr>
</tbody>
</table>

$w_{HORIZ} = (V_{HORIZ}/A_t)*(L/2)$

$w_{VERT} = (F_{x\text{VERT}}/A_t)*(L/2)$
**LOAD COMBINATIONS**

LCo 1: DEAD LOAD  
LC1

LCo 2: DEAD LOAD + SNOW LOAD  
LC1 + LC2

LCo 3: DEAD LOAD + WIND LOAD 180° (pressure on modules)  
LC1 + LC4 or LC6

LCo 4: DEAD LOAD + 0.75(SNOW LOAD + WIND LOAD 180°)  
LC1 + 0.75(LC2 + LC4 or LC6)

LCo 5: 0.6DEAD LOAD + WIND LOAD 0° (suction on modules)  
0.6 LC1 + LC3 or LC5

LCo 6: DEAD LOAD +/- EARTHQUAKE LOAD  
LC1 + LC7 or - LC7
### Support Reactions

#### Front Leg (Node 11)
- **Uplift**: -1.42 kN (-0.32 Kips)
- **Pressure**: 4.45 kN (1.00 Kips)
- **Horizontal Trans**: 0.30 kN (0.07 Kips)
- **Horizontal Long**: 0.93 kN (0.21 Kips)

#### Front Leg (Node 19)
- **Uplift**: -2.09 kN (-0.47 Kips)
- **Pressure**: 6.39 kN (1.44 Kips)
- **Horizontal Trans**: 0.46 kN (0.10 Kips)
- **Horizontal Long**: 0.29 kN (0.07 Kips)

#### Front Leg (Node 27)
- **Uplift**: -2.11 kN (-0.47 Kips)
- **Pressure**: 6.40 kN (1.44 Kips)
- **Horizontal Trans**: 0.46 kN (0.10 Kips)
- **Horizontal Long**: 0.29 kN (0.07 Kips)

#### Front Leg (Node 35)
- **Uplift**: -1.41 kN (-0.32 Kips)
- **Pressure**: 4.45 kN (1.00 Kips)
- **Horizontal Trans**: 0.34 kN (0.08 Kips)
- **Horizontal Long**: 0.84 kN (0.19 Kips)

#### Rear Leg (Node 7)
- **Uplift**: 6.84 kN (1.54 Kips)
- **Pressure**: 7.07 kN (1.59 Kips)
- **Horizontal Trans**: 2.58 kN (0.58 Kips)
- **Horizontal Long**: 0.83 kN (0.19 Kips)

#### Rear Leg (Node 15)
- **Uplift**: -10.03 kN (-2.25 Kips)
- **Pressure**: 10.38 kN (2.33 Kips)
- **Horizontal Trans**: 3.81 kN (0.86 Kips)
- **Horizontal Long**: 0.02 kN (0.00 Kips)

#### Rear Leg (Node 23)
- **Uplift**: -10.00 kN (-2.25 Kips)
- **Pressure**: 10.35 kN (2.33 Kips)
- **Horizontal Trans**: 3.83 kN (0.86 Kips)
- **Horizontal Long**: 0.02 kN (0.00 Kips)

#### Rear Leg (Node 31)
- **Uplift**: 6.89 kN (1.55 Kips)
- **Pressure**: 7.08 kN (1.59 Kips)
- **Horizontal Trans**: 2.51 kN (0.56 Kips)
- **Horizontal Long**: 0.81 kN (0.18 Kips)
mounting systems

Footing Design

PLAN VIEW

- Pay 7'x2'x1'-0" deep concrete footing
  \( f_0 = 2800 \text{ psi} \)

1. \( P_1 = 1440 \text{ kips} \)
2. \( P_2 = 2335 \text{ kips} \)
3. \( R = 3775 \text{ kips} \)
4. \( x = \frac{P_1 (7') + P_2 (6')}{2} = 4.1' \)
5. Check for tension
6. \( e = x - \frac{d}{2} = 0.0' \)
7. Total distance (k)
8. \( k = \frac{d}{2} = 7/4 = 1.167 > 0.1' \)
9. \( \theta = 0 \) tension

- Check bending resistance
  \( A_{min} = 1500 \text{ kips} \)
  \( \frac{B_{min}}{A} = -\frac{M}{E} \)
1. \( B_{min} = \frac{3775 (7')}{2 (7')^2} = 134 \text{ kips} \)
2. \( B_{min} = \frac{3775 (7')}{2 (7')^2} = 134 \text{ kips} \)

- Check for uplift resistance
  \( \text{Uplift Load} = 2259 + 470 = 2729 \text{ kips} \)
  \( \text{Resistive Load (Concrete Dead Weight):} \ 7 (2) (1.5) (145 \text{pcf}) = 8045 > 2729 \text{ kips} \)
  \( \Rightarrow \text{OK} \)

the base for solar power
Project Information

Solar Support Structure
Sutter's Landing
28th Street
Sacramento, CA


Design Winds Loads:

Equation (6-15) \( q_z = 0.00256 K_z K_t V^2 \) = \( (0.00256)(0.9)(1.0)(0.85)(90^2)(1.0) = 15.86 \) \( \text{#/ft}^2 \)

Equation (6-25) \( p = q_h G C_N \) = \( (15.66)(0.85)C_N \rightarrow C_N \) from Figure 6-18A - ave. of \( C_{NW} \& C_{NH} \)

MWFRS Wind Loads: 10 psf (Min. Uplift) - 6.6 psf Actual Uplift
10 psf (Min. Downward)
Phase II

Occupancy Category

Occupancy Category of Building or Other Structure: "II": All Buildings and other structures except those listed as Category I, III, and IV

Occupancy Importance Factor = 1

Gridded S_s & S_1 values from ASCE 7-05, 2006/09

Max. Ground Motions, 5% Damping:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S_s</td>
<td>0.5777 g, 0.2 sec response</td>
</tr>
<tr>
<td>S_1</td>
<td>0.2401 g, 1.0 sec response</td>
</tr>
</tbody>
</table>

Latitude = 38.572 deg North
Longitude = 121.468 deg West

Site Classification "D": Shear Wave Velocity 600 to 1,200 ft/sec = D

Site Coefficients Fa & Fv

(using straight-line interpolation from table values)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fa</td>
<td>1.34</td>
</tr>
<tr>
<td>Fv</td>
<td>1.92</td>
</tr>
</tbody>
</table>

Maximum Considered Earthquake Acceleration

S_{MS} = Fa*S_s = 0.773
S_{MI} = Fv*S_1 = 0.461

Site Classification "D": Shear Wave Velocity 600 to 1,200 ft/sec = D

Design Spectral Acceleration

S_{D_s} = S_{MS} = 0.515
S_{D_1} = S_{MI} = 0.307

Seismic Design Category

Resisting System

Basic Seismic Force Resisting System

Response Modification Coefficient *R* = 1.25
System Overstrength Factor *Wo* = 1.25
Deflection Amplification Factor *Cd* = 1.25

NOTES: See ASCE 7-05 for all applicable footnotes.

Redundancy Factor

Seismic Design Category of D, E, or F therefore Redundancy Factor *p* = 1.3

Lateral Force Procedure

Equivalent Lateral Force Procedure

The "Equivalent Lateral Force Procedure" is being used according to the provisions of ASCE 7-05 12.8

Determine Building Period

Use ASCE 12.8-7

Structure Type for Building Period Calculation: STEEL 100% Moment Resisting Frame

* C_t* value = 0.026
* h_n* : Height from base to highest level = 15.0 ft
* x* value = 0.80
* T_a* : Approximate fundamental period using Eq. 12.8-7:
  T_a = C_t*(h_n* x)* = 0.244 sec
* T_L*: Long-period transition period per ASCE 7-05 Maps 22-15 -> 22-20
  8,000 sec

Building Period * T_a* Calculated from Approximate Method selected = 0.244 sec

ASCE 7-05 Section 12.8.1.1

S_{D_s} Short Period Design Spectral Response = 0.515
* R*: Response Modification Factor = 1.25
* I*: Occupancy Importance Factor = 1

From Eq. 12.8-2, Preliminary Cs = 0.412
From Eq. 12.8-3 & 12.8-4, Cs need not exceed = 1.06
From Eq. 12.8-5 & 12.8-6, Cs not be less than = 0.023
Cs : Seismic Response Coefficient = 0.4122
General Footing

Lic. #: KW-06009168
Description: Dog Park

Code References
Calculations per ACI 318-08, IBC 2009, CBC 2010, ASCE 7-05
Load Combinations Used: 2006 IBC & ASCE 7-05

General Information

Material Properties
- f_c: Concrete 28 day strength = 2.50 ksi
- f_y: Rebar Yield = 60.0 ksi
- E_c: Concrete Elastic Modulus = 3,122.0 ksi
- Concrete Density = 144.0 pcf
- k: Values (Flexure) = 0.90
- k: Shear = 0.750

Analysis Settings
- Min Steel % Bending Rein.: 0.00140
- Min Allow % Temp Rein.: 0.00180
- Min. Overturning Safety Factor = 1.50
- Min. Sliding Safety Factor = 1.50
- Add Fig. Wt for Soil Pressure: No
- Use fig. wt for stability, moments & shears: Yes
- Include Pedestal Weight as DL: No

Soil Design Values
- Allowable Soil Bearing = 2.0 ksf
- Increase Bearing by Footing Weight = No
- Soil Passive Resistance (for Sliding) = 250.0 pcf
- Soil/Concrete Friction Coeff. = 0.30

- Increases based on footing depth
- Footing base depth below soil surface = 3.0 ft
- Allowable pressure increase per foot of depth = ksf
- when footing base is below = ft

Dimensions
- Width parallel to X-X Axis = 6.250 ft
- Length parallel to Z-Z Axis = 6.250 ft
- Footing Thickness = 16.0 in

Pedestal dimensions:
- p_x: parallel to X-X Axis = in
- p_z: parallel to Z-Z Axis = in
- Height = in
- Rebar Centerline to Edge of Concrete, at Bottom of footing = 3.0 in

Reinforcing
- Bars parallel to X-X Axis
  - Number of Bars = 11.0
  - Reinforcing Bar Size = # 4
- Bars parallel to Z-Z Axis
  - Number of Bars = 11.0
  - Reinforcing Bar Size = # 4

Bandwidth Distribution Check (ACI 15.4.4.2)
- Direction requiring closer separation = n/a
- # Bars required within zone = n/a
- # Bars required on each side of zone = n/a

Applied Loads

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>P: Column Load</td>
<td>13.060</td>
<td></td>
<td></td>
<td>32.420</td>
<td>3.180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O.B.: Overburden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-xx</td>
<td></td>
<td></td>
<td>6.30</td>
<td>36.855</td>
<td>k-R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-zz</td>
<td></td>
<td></td>
<td>36.855</td>
<td>k-R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V-x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>k</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V-z</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>k</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## DESIGN SUMMARY

<table>
<thead>
<tr>
<th>Min. Ratio</th>
<th>Item</th>
<th>Applied</th>
<th>Capacity</th>
<th>Governing Load Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASS 0.9330</td>
<td>Soil Bearing</td>
<td>1.866 ksf</td>
<td>2.0 ksf</td>
<td>+0.6D+0.7E+H</td>
</tr>
<tr>
<td>PASS 1.768</td>
<td>Overturning - X-X</td>
<td>25.799 k-ft</td>
<td>45.604 k-ft</td>
<td>0.6D+0.7E</td>
</tr>
<tr>
<td>PASS 1.768</td>
<td>Overturning - Z-Z</td>
<td>25.799 k-ft</td>
<td>45.604 k-ft</td>
<td>0.6D+0.7E</td>
</tr>
<tr>
<td>PASS n/a</td>
<td>Sliding - X-X</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>No Sliding</td>
</tr>
<tr>
<td>PASS n/a</td>
<td>Sliding - Z-Z</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>No Sliding</td>
</tr>
<tr>
<td>PASS n/a</td>
<td>Uplift</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>No Uplift</td>
</tr>
<tr>
<td>PASS 0.2531</td>
<td>Z Flexure (+X)</td>
<td>5.045 k-ft</td>
<td>19.936 k-ft</td>
<td>+0.9D+E+1.60H</td>
</tr>
<tr>
<td>PASS 0.04261</td>
<td>Z Flexure (-X)</td>
<td>0.8495 k-ft</td>
<td>19.936 k-ft</td>
<td>+0.9D+E+1.60H</td>
</tr>
<tr>
<td>PASS 0.4071</td>
<td>X Flexure (+Z)</td>
<td>8.115 k-ft</td>
<td>19.936 k-ft</td>
<td>+1.2D+0.5Lr+0.50L+1.60W</td>
</tr>
<tr>
<td>PASS 0.04261</td>
<td>X Flexure (-Z)</td>
<td>0.8495 k-ft</td>
<td>19.936 k-ft</td>
<td>+0.9D+E+1.60H</td>
</tr>
<tr>
<td>PASS 0.2956</td>
<td>1-way Shear (+X)</td>
<td>19.994 psi</td>
<td>75.0 psi</td>
<td>+1.2D+0.5Lr+0.50L+1.60W</td>
</tr>
<tr>
<td>PASS 0.2956</td>
<td>1-way Shear (-X)</td>
<td>19.994 psi</td>
<td>75.0 psi</td>
<td>+1.2D+0.5Lr+0.50L+1.60W</td>
</tr>
<tr>
<td>PASS 0.2960</td>
<td>1-way Shear (+Z)</td>
<td>22.199 psi</td>
<td>75.0 psi</td>
<td>+1.2D+0.5Lr+0.50L+1.60W</td>
</tr>
<tr>
<td>PASS 0.2372</td>
<td>1-way Shear (-Z)</td>
<td>17.788 psi</td>
<td>75.0 psi</td>
<td>+1.2D+0.5Lr+0.50L+1.60W</td>
</tr>
<tr>
<td>PASS 0.5594</td>
<td>2-way Punching</td>
<td>83.912 psi</td>
<td>150.0 psi</td>
<td>+1.2D+0.5Lr+0.50L+1.60W</td>
</tr>
</tbody>
</table>
General Footing

Lic. #: KW-06009168
Description: Parking Lot

Code References
Calculations per ACI 318-08, IBC 2009, CBC 2010, ASCE 7-05
Load Combinations Used: 2006 IBC & ASCE 7-05

General Information

Material Properties
- $f_c$: Concrete 28 day strength = 2.50 ksi
- $f_y$: Rebar Yield = 60.0 ksi
- $E_c$: Concrete Elastic Modulus = 3,122.0 ksi
- Concrete Density = 145.0 pcf
- $\varphi$: Values
  - Flexure = 0.90
  - Shear = 0.750

Analysis Settings
- Min Steel % Bending Reinf. = 0.00140
- Min Allow % Temp Reinf. = 0.00180
- Min. Overturning Safety Factor = 1.50 : 1
- Min. Sliding Safety Factor = 1.50 : 1
- Add Ftg Wt for Soil Pressure: No
- Use ftg wt for stability, moments & shears: Yes
- Include Pedestal Weight as DL: No

Dimensions
- Width parallel to X-X Axis = 11.0 ft
- Length parallel to Z-Z Axis = 11.0 ft
- Footing Thickness = 16.0 in

Pedestal dimensions...
- $p_x$: parallel to X-X Axis = in
- $p_z$: parallel to Z-Z Axis = in
- Height = in
- Rebar Centerline to Edge of Concrete at Bottom of footing = 3.0 in

Reinforcing
- Bars parallel to X-X Axis
  - Number of Bars = 20.0
  - Reinforcing Bar Size = # 4
- Bars parallel to Z-Z Axis
  - Number of Bars = 20.0
  - Reinforcing Bar Size = # 4

Bandwidth Distribution Check (ACI 15.4.4.2)
- Direction Requiring Closer Separation = n/a
- # Bars required within zone = n/a
- # Bars required on each side of zone = n/a

Applied Loads

<table>
<thead>
<tr>
<th>Load Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>P: Column Load</td>
<td>12.780</td>
</tr>
<tr>
<td>OB: Overburden</td>
<td></td>
</tr>
<tr>
<td>M-xx</td>
<td>5.950</td>
</tr>
<tr>
<td>M-zz</td>
<td></td>
</tr>
<tr>
<td>V-x</td>
<td></td>
</tr>
<tr>
<td>V-z</td>
<td></td>
</tr>
<tr>
<td>$D$</td>
<td>31.290</td>
</tr>
<tr>
<td>$L_r$</td>
<td>3.320</td>
</tr>
<tr>
<td>$L$</td>
<td>k</td>
</tr>
<tr>
<td>$S$</td>
<td>k-ft</td>
</tr>
<tr>
<td>$W$</td>
<td>73.710</td>
</tr>
<tr>
<td>$E$</td>
<td>k-ft</td>
</tr>
<tr>
<td>$H$</td>
<td>k</td>
</tr>
</tbody>
</table>
### DESIGN SUMMARY

<table>
<thead>
<tr>
<th>Min. Ratio</th>
<th>Item</th>
<th>Applied</th>
<th>Capacity</th>
<th>Governing Load Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASS</td>
<td>Soil Bearing</td>
<td>1.670 ksf</td>
<td>2.0 ksf</td>
<td>+0.6D+0.7E</td>
</tr>
<tr>
<td>PASS</td>
<td>Overturning - X-X</td>
<td>51.597 k-ft</td>
<td>132.154 k-ft</td>
<td>0.6D+0.7E</td>
</tr>
<tr>
<td>PASS</td>
<td>Overturning - Z-Z</td>
<td>51.597 k-ft</td>
<td>132.154 k-ft</td>
<td>0.6D+0.7E</td>
</tr>
<tr>
<td>PASS n/a</td>
<td>Sliding - X-X</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>No Sliding</td>
</tr>
<tr>
<td>PASS n/a</td>
<td>Sliding - Z-Z</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>No Sliding</td>
</tr>
<tr>
<td>PASS n/a</td>
<td>Uplift</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>No Uplift</td>
</tr>
<tr>
<td>PASS 0.1976</td>
<td>Z Flexure (+X)</td>
<td>4.064 k-ft</td>
<td>20.573 k-ft</td>
<td>+0.9D+E+1.60H</td>
</tr>
<tr>
<td>PASS 0.1729</td>
<td>Z Flexure (-X)</td>
<td>2.631 k-ft</td>
<td>20.573 k-ft</td>
<td>+0.9D+E+1.60H</td>
</tr>
<tr>
<td>PASS 0.2671</td>
<td>X Flexure (+Z)</td>
<td>5.496 k-ft</td>
<td>20.573 k-ft</td>
<td>+0.9D+E+1.60H</td>
</tr>
<tr>
<td>PASS 0.1297</td>
<td>X Flexure (-Z)</td>
<td>2.631 k-ft</td>
<td>20.573 k-ft</td>
<td>+0.9D+E+1.60H</td>
</tr>
<tr>
<td>PASS 0.1259</td>
<td>1-way Shear (+X)</td>
<td>9.443 psi</td>
<td>75.0 psi</td>
<td>+0.9D+1.60W+1.60H</td>
</tr>
<tr>
<td>PASS 0.1259</td>
<td>1-way Shear (-X)</td>
<td>9.443 psi</td>
<td>75.0 psi</td>
<td>+0.9D+1.60W+1.60H</td>
</tr>
<tr>
<td>PASS 0.1356</td>
<td>1-way Shear (+Z)</td>
<td>10.170 psi</td>
<td>75.0 psi</td>
<td>+0.9D+1.60W+1.60H</td>
</tr>
<tr>
<td>PASS 0.1162</td>
<td>1-way Shear (-Z)</td>
<td>8.717 psi</td>
<td>75.0 psi</td>
<td>+0.9D+1.60W+1.60H</td>
</tr>
<tr>
<td>PASS 0.3960</td>
<td>2-way Punching</td>
<td>59.407 psi</td>
<td>150.0 psi</td>
<td>+0.9D+1.60W+1.60H</td>
</tr>
</tbody>
</table>
Steel Base Plate

**Lic. #: KW-06009168**

**Description:** Dog Park

---

### Code References

Calculations per AISC 360-05 & Design Guide # 1, IBC 2009, CBC 2010, ASCE 7-05

Load Combination Set: 2006 IBC & ASCE 7-05

---

### General Information

**Material Properties**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Plate Fy</td>
<td>36.0 ksi</td>
</tr>
<tr>
<td>Concrete Support fc</td>
<td>3.0 ksi</td>
</tr>
<tr>
<td>Assumed Bearing Area</td>
<td>Full Bearing</td>
</tr>
</tbody>
</table>

---

### Column & Plate

**Steel Section:** W12x50

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>12.2 in</td>
</tr>
<tr>
<td>Width</td>
<td>8.08 in</td>
</tr>
<tr>
<td>Flange Thickness</td>
<td>0.64 in</td>
</tr>
<tr>
<td>Web Thickness</td>
<td>0.37 in</td>
</tr>
</tbody>
</table>

**Plate Dimensions**

- **N:** Length: 18.0 in
- **B:** Width: 18.0 in
- **Thickness:** 1.0 in

Column assumed welded to base plate.

---

### Column Properties

**Area**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ly</td>
<td>391 in^4</td>
</tr>
<tr>
<td>lxx</td>
<td>56.3 in^4</td>
</tr>
</tbody>
</table>

**Support Dimensions**

- **Width along "X":** 75.0 in
- **Length along "Z":** 75.0 in

---

### Applied Loads

<table>
<thead>
<tr>
<th>Load</th>
<th>P-Y</th>
<th>V-Z</th>
<th>M-X</th>
</tr>
</thead>
<tbody>
<tr>
<td>D: Dead Load</td>
<td>13.060 k</td>
<td>k</td>
<td>k-ft</td>
</tr>
<tr>
<td>L: Live</td>
<td>k</td>
<td>k</td>
<td>k-ft</td>
</tr>
<tr>
<td>Lr: Roof Live</td>
<td>k</td>
<td>k</td>
<td>k-ft</td>
</tr>
<tr>
<td>S: Snow</td>
<td>k</td>
<td>k</td>
<td>k-ft</td>
</tr>
<tr>
<td>W: Wind</td>
<td>20.520 k</td>
<td>k</td>
<td>6.30 k-ft</td>
</tr>
<tr>
<td>E: Earthquake</td>
<td>3.100 k</td>
<td>k</td>
<td>36.855 k-ft</td>
</tr>
<tr>
<td>H: Lateral Earth Pressure</td>
<td>k</td>
<td>k</td>
<td>k-ft</td>
</tr>
</tbody>
</table>

*P* = Gravity load, *+* sign is downward.

**Note:** Moments create higher soil pressure at +Z edge.

---

**Support Dimensions:**

- **Width along "X":** 75.0 in
- **Length along "Z":** 75.0 in

---

**Code References:**

- AISC Design Method: Allowable Stress Design
- Steel Plate Fy = 36.0 ksi
- Concrete Support fc = 3.0 ksi
- Assumed Bearing Area: Full Bearing
- ASIF: Allowable Stress Increase Factor: 1.0
- ABIF: Allowable Bearing Increase Factor: 1.0
- \( \Omega_c \): ASD Safety Factor: 2.50
- Allowable Bearing Fp per J8: 5.10 ksi

---

**Applied Loads:**

- **P-Y:** 13.060 k
- **V-Z:** 20.520 k
- **M-X:** 3.100 k

---

**Support Dimensions:**

- **Width along "X":** 75.0 in
- **Length along "Z":** 75.0 in

---

**Diagram:**

- **+X** towards "X" edge.
- **+P** towards "P" edge.
- **+Z** towards "Z" edge.
- **+Mx** towards "Mx" edge.

---

**Not for Construction**
## Governing Design Load Case Summary

<table>
<thead>
<tr>
<th>Plate Design Summary</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Method</td>
<td>Allowable Stress Design</td>
<td>4.008 k-in</td>
</tr>
<tr>
<td>Governing Load Combination</td>
<td>Axial + Moment, L/2 &lt; Eccentricity, Tension on Bc</td>
<td>16.032 ksi</td>
</tr>
<tr>
<td>Design Plate Size</td>
<td>1'-6&quot; x 1'-6&quot; x 1&quot;</td>
<td>21.557 ksi</td>
</tr>
<tr>
<td>Pa : Axial Load</td>
<td>15.286 k</td>
<td>25.799 k-ft</td>
</tr>
<tr>
<td>Ma : Moment</td>
<td>0.000 ksi</td>
<td>21.557 ksi</td>
</tr>
<tr>
<td>Fv : Allowable</td>
<td>0.000 ksi</td>
<td>0.000</td>
</tr>
<tr>
<td>Shear Stress Ratio</td>
<td>Shear Stress OK</td>
<td>Shear Stress OK</td>
</tr>
</tbody>
</table>

The table below calculates the allowable stress design and bending stress ratio for the plate design:

| Mu : Max. Moment      | 4.008 k-in |
| fb : Max. Bending Stress | 16.032 ksi |
| Fb : Allowable        | 21.557 ksi |
| Fy * ASIF / Omega     | 0.744 |

### Bending Stress OK

| fz : Max. Plate Bearing Stress | 2.040 ksi |
| Fp : Allowable               | 2.040 ksi |
| min(0.85*fc*sqrt(A2/A1), 1.7*fc)/Omega | 1.000 |

Bearing Stress OK

| Tension in each Bolt | 5.598 |
| Allowable Bolt Tension | 0.000 |
| Tension Stress Ratio  | 0.000 |

Tension Stress OK
Steel Base Plate

License: KW-06009168

Description: Parking Lot

Code References
Calculations per AISC 360-05 & Design Guide #1, IBC 2009, CBC 2010, ASCE 7-05
Load Combination Set: 2006 IBC & ASCE 7-05

General Information

Material Properties
AISC Design Method Allowable Stress Design
Steel Plate Fy = 36.0 ksi
Concrete Support fc = 3.0 ksi
Assumed Bearing Area: Full Bearing

Column & Plate

Column Properties
Steel Section: W12x50
Depth 12.2 in
Width 8.08 in
Flange Thickness 0.64 in
Web Thickness 0.37 in
Area 14.6 in²
Ixx 391 in⁴
Iyy 56.3 in⁴

Plate Dimensions
N: Length 18.0 in
B: Width 18.0 in
Thickness 1.50 in

Support Dimensions
Width along "X" 75.0 in
Length along "Z" 75.0 in

Column assumed welded to base plate.

Applied Loads

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>P-Y</th>
<th></th>
<th>V-Z</th>
<th></th>
<th>M-X</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Dead Load</td>
<td>12,780 k</td>
<td>0.0 k</td>
<td>0.0 k-ft</td>
<td>0.0 k-ft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>Live</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>0.0 k-ft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lr</td>
<td>Roof Live</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>0.0 k-ft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Snow</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>0.0 k-ft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>Wind</td>
<td>31,290 k</td>
<td>0.0 k</td>
<td>5,950 k-ft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Earthquake</td>
<td>3,320 k</td>
<td>0.0 k</td>
<td>73,710 k-ft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Lateral Earth</td>
<td>0.0 k</td>
<td>0.0 k</td>
<td>0.0 k-ft</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* P = Gravity load, *+* sign is downward. *+* Moments create higher soil pressure at +Z edge. *+* Shears push plate towards +Z edge.

PRELIMINARY NOT FOR CONSTRUCTION
# GOVERNING DESIGN LOAD CASE SUMMARY

<table>
<thead>
<tr>
<th>Plate Design Summary</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Method</td>
<td>Allowable Stress Design</td>
</tr>
<tr>
<td>Governing Load Combination</td>
<td>( +0.60D - 0.70E + H )</td>
</tr>
<tr>
<td>Governing Load Case Type</td>
<td>Axial + Moment, ( L/2 ) (&lt;) Eccentricity, Tension on Be</td>
</tr>
<tr>
<td>Design Plate Size</td>
<td>1'-6&quot; x 1'-6&quot; x 1'-1/2&quot;</td>
</tr>
<tr>
<td>Pa : Axial Load</td>
<td>9.992 k</td>
</tr>
<tr>
<td>Ma : Moment</td>
<td>51.597 k-ft</td>
</tr>
<tr>
<td>fy : Actual</td>
<td>0.000 ksi</td>
</tr>
<tr>
<td>Fv : Allowable</td>
<td>( 0.60 \times Fy / 1.5 ) (per G2)</td>
</tr>
<tr>
<td>Shear Stress Ratio</td>
<td>21.557 ksi</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Shear Stress OK</td>
</tr>
</tbody>
</table>

| Mu : Max. Moment     | 8.557 k-in |
| fb : Max. Bending Stress | 15.212 ksi |
| Fb : Allowable       | 21.557 ksi |
| Fy * ASIF / Omega    | Bending Stress Ratio | 0.706 |
|                      | Bending Stress OK |

| fu : Max. Plate Bearing Stress | 2.040 ksi |
| Fp : Allowable               | 2.040 ksi |
| min(0.85\( f_c \)\sqrt{A2/\( A1 \)}, 1.7\( f_c \))/Omega | Bearing Stress Ratio | 1.000 |
| Bearing Stress OK |

| Tension in each Bolt  | 17.113 |
| Allowable Bolt Tension | 0.000 |
| Tension Stress Ratio  | 0.000 |
| Tension Stress OK     |  |
### Anchor Calculations

**Anchor Selector (Version 4.5.1.0)**

**Job Name:** Sutter's Landing - Dog Park  
**Date/Time:** 6/14/2012 4:31:39 PM

**Calculation Summary - ACI 318 Appendix D For Uncracked Concrete per ACI 318-05**

#### Anchor

<table>
<thead>
<tr>
<th>Anchor</th>
<th>Steel</th>
<th># of Anchors</th>
<th>Embedment Depth (in)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot; Heavy Hex Bolt</td>
<td>F1554 GR. 36</td>
<td>4</td>
<td>12</td>
<td>N/A</td>
</tr>
</tbody>
</table>

#### Concrete

<table>
<thead>
<tr>
<th>Condition</th>
<th>Thickness (in)</th>
<th>Suppl. Edge Reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>2500.0</td>
<td></td>
</tr>
</tbody>
</table>

#### Factored Loads

<table>
<thead>
<tr>
<th>Load Type</th>
<th>Sample 1 (lb)</th>
<th>Sample 2 (lb)</th>
<th>Sample 3 (lb)</th>
<th>Sample 4 (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N_u (lb)</td>
<td>239.20</td>
<td>239.20</td>
<td>239.20</td>
<td>239.20</td>
</tr>
<tr>
<td>V_u (lb)</td>
<td>13727.78</td>
<td>13727.78</td>
<td>13727.78</td>
<td>13727.78</td>
</tr>
</tbody>
</table>

#### Individual Anchor Tension Loads

<table>
<thead>
<tr>
<th>Anchor Load</th>
<th>Sample 1 (lb)</th>
<th>Sample 2 (lb)</th>
<th>Sample 3 (lb)</th>
<th>Sample 4 (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N_u1</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>N_u2</td>
<td>239.20</td>
<td>239.20</td>
<td>239.20</td>
<td>239.20</td>
</tr>
<tr>
<td>N_u3</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>N_u4</td>
<td>239.20</td>
<td>239.20</td>
<td>239.20</td>
<td>239.20</td>
</tr>
</tbody>
</table>

#### Individual Anchor Shear Loads

<table>
<thead>
<tr>
<th>Shear Load</th>
<th>Sample 1 (lb)</th>
<th>Sample 2 (lb)</th>
<th>Sample 3 (lb)</th>
<th>Sample 4 (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_u1</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>V_u2</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>V_u3</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>V_u4</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

#### Tension Strengths

<table>
<thead>
<tr>
<th>Steel (I = 0.75)</th>
<th>N_u (lb)</th>
<th>N_u/ N_u= (lb)</th>
<th>N_u / N_u=</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19370</td>
<td>14527.50</td>
<td>13727.78</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concrete Breakout (I = 0.70)</th>
<th>N_u (lb)</th>
<th>N_u/ N_u= (lb)</th>
<th>N_u / N_u=</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25508.00</td>
<td>17855.60</td>
<td>13727.78</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pullout (I = 0.70)</th>
<th>N_u (lb)</th>
<th>N_u/ N_u= (lb)</th>
<th>N_u / N_u=</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25508.00</td>
<td>17855.60</td>
<td>13727.78</td>
</tr>
</tbody>
</table>

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about:blank
Side-Face Blowout does not apply

Shear Strengths

Steel ($I = 0.65$)

<table>
<thead>
<tr>
<th>$V_{sa}(lb)$</th>
<th>$V_{us}(lb)$</th>
<th>$V_{ua}/V_{sa}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>11625</td>
<td>7556.25</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Concrete Breakout (case 1) ($I = 0.70$)

<table>
<thead>
<tr>
<th>$V_{cdbg}(lb)$</th>
<th>$V_{cdbg}(lb)$</th>
<th>$V_{uax}(lb)$</th>
<th>$V_{ua}/V_{cdbg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>33558.81</td>
<td>23491.16</td>
<td>0.00</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Concrete Breakout (case 2) ($I = 0.70$)

<table>
<thead>
<tr>
<th>$V_{cdbg}(lb)$</th>
<th>$V_{uax}(lb)$</th>
<th>$V_{ua}/V_{cdbg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>33558.81</td>
<td>23491.16</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Concrete Breakout (case 3) ($I = 0.70$)

$c_{x1}$ edge

<table>
<thead>
<tr>
<th>$V_{cdbg}(lb)$</th>
<th>$V_{uax}(lb)$</th>
<th>$V_{ua}/V_{cdbg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>67117.61</td>
<td>46982.33</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

$c_{y1}$ edge

<table>
<thead>
<tr>
<th>$V_{cdbg}(lb)$</th>
<th>$V_{uax}(lb)$</th>
<th>$V_{ua}/V_{cdbg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>67117.61</td>
<td>46982.33</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

$c_{x2}$ edge

<table>
<thead>
<tr>
<th>$V_{cdbg}(lb)$</th>
<th>$V_{uax}(lb)$</th>
<th>$V_{ua}/V_{cdbg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>67117.61</td>
<td>46982.33</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

$c_{y2}$ edge

<table>
<thead>
<tr>
<th>$V_{cdbg}(lb)$</th>
<th>$V_{uax}(lb)$</th>
<th>$V_{ua}/V_{cdbg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>67117.61</td>
<td>46982.33</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Pryout ($I = 0.70$)

<table>
<thead>
<tr>
<th>$V_{cpg}(lb)$</th>
<th>$V_{uax}(lb)$</th>
<th>$V_{ua}/V_{cpg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>23569.62</td>
<td>164987.34</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Interaction check

$V_{Max}(0) <= 0.2$ and $T_{Max}(0.95) <= 1.0$ [Sec D.7.1]

Interaction check: PASS

Use 3/4" diameter F1554 GR. 36 Heavy Hex Bolt anchor(s) with 12 in. embedment
Anchor Calculations

Anchor Selector (Version 4.5.1.0)

Job Name: Sutter's Landing - Parking Lot

Calculation Summary - ACI 318 Appendix D For Uncracked Concrete per ACI 318-05

<table>
<thead>
<tr>
<th>Anchor</th>
<th>Steel</th>
<th># of Anchors</th>
<th>Embedment Depth (in)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; Heavy Hex Bolt</td>
<td>F1554 GR. 55</td>
<td>4</td>
<td>12.5</td>
<td>N/A</td>
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</tbody>
</table>

Concrete

<table>
<thead>
<tr>
<th>Condition</th>
<th>Thickness (in)</th>
<th>Suppl. Edge Reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight</td>
<td>No</td>
<td>2500.0</td>
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</tbody>
</table>

Factored Loads

<table>
<thead>
<tr>
<th>$N_{u,a}$ (in)</th>
<th>$V_{u,a}$ (lb)</th>
<th>$V_{u,b}$ (lb)</th>
<th>$M_{u,x}$ (lb*ft)</th>
<th>$M_{u,y}$ (lb*ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>73710</td>
<td>0</td>
</tr>
</tbody>
</table>

Individual Anchor Tension Loads

<table>
<thead>
<tr>
<th>$V_{u,a}$ (lb)</th>
<th>$V_{u,b}$ (lb)</th>
<th>$M_{u,x}$ (lb*ft)</th>
<th>$M_{u,y}$ (lb*ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.00</td>
<td>27705.93</td>
<td>27705.93</td>
</tr>
</tbody>
</table>

Individual Anchor Shear Loads

<table>
<thead>
<tr>
<th>$V_{u,a}$ (lb)</th>
<th>$V_{u,b}$ (lb)</th>
<th>$V_{u,c}$ (lb)</th>
<th>$V_{u,d}$ (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Tension Strengths

Steel ($I = 0.75$)

<table>
<thead>
<tr>
<th>$N_{u,a}$ (lb)</th>
<th>$N_{u,b}$ (lb)</th>
<th>$N_{u,c}$ (lb)</th>
<th>$N_{u,d}$ (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45450</td>
<td>34087.50</td>
<td>27705.93</td>
<td>0.8128</td>
</tr>
</tbody>
</table>

Concrete Breakout ($I = 0.70$)

<table>
<thead>
<tr>
<th>$N_{c,b}$ (lb)</th>
<th>$N_{c,b}$ (lb)</th>
<th>$V_{u,a}$ (lb)</th>
<th>$V_{u,b}$ (lb)</th>
<th>$V_{u,c}$ (lb)</th>
<th>$V_{u,d}$ (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>84085.13</td>
<td>58845.59</td>
<td>55411.86</td>
<td>0.9416</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pullout ($I = 0.70$)

<table>
<thead>
<tr>
<th>$N_{p,a}$ (lb)</th>
<th>$N_{p,b}$ (lb)</th>
<th>$N_{p,c}$ (lb)</th>
<th>$N_{p,d}$ (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>42028.00</td>
<td>29419.60</td>
<td>27705.93</td>
<td>0.9418</td>
</tr>
</tbody>
</table>
Side-Face Blowout does not apply

**Shear Strengths**

**Steel (I = 0.65)**

<table>
<thead>
<tr>
<th>$V_{sb}$ (lb)</th>
<th>$V_{uax}$ (lb)</th>
<th>$V_{uay}$</th>
<th>$V_{uax}/I$ $V_{sb}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>27270</td>
<td>17725.50</td>
<td>0.00</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**Concrete Breakout (case 1) (I = 0.70)**

<table>
<thead>
<tr>
<th>$V_{cpg}$ (lb)</th>
<th>$V_{uax}$ (lb)</th>
<th>$V_{uay}$</th>
<th>$V_{uax}/I$ $V_{cpg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>38750.37</td>
<td>27125.26</td>
<td>0.00</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**Concrete Breakout (case 2) (I = 0.70)**

<table>
<thead>
<tr>
<th>$V_{cpg}$ (lb)</th>
<th>$V_{uax}$ (lb)</th>
<th>$V_{uay}$</th>
<th>$V_{uax}/I$ $V_{cpg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>38750.37</td>
<td>27125.26</td>
<td>0.00</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**Concrete Breakout (case 3) (I = 0.70)**

<table>
<thead>
<tr>
<th>$V_{cpg}$ (lb)</th>
<th>$V_{uax}$ (lb)</th>
<th>$V_{uay}$</th>
<th>$V_{uax}/I$ $V_{cpg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>38750.37</td>
<td>27125.26</td>
<td>0.00</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**Pryout (I = 0.70)**

<table>
<thead>
<tr>
<th>$V_{cpg}$ (lb)</th>
<th>$V_{uax}$ (lb)</th>
<th>$V_{uay}$</th>
<th>$V_{uax}/I$ $V_{cpg}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>241230.36</td>
<td>168861.25</td>
<td>0</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**Interaction check**

$V_{Max(0)} <= 0.2$ and $T_{Max}(0.94) <= 1.0$ [Sec D.7.1]

Interaction check: PASS

Use 1" diameter F1554 GR. 55 Heavy Hex Bolt anchor(s) with 12.5 in. embedment
FOOTING DETAIL @ DOG PARK

2500 PSI CONCRETE FOOTING W/ #4 BARS @ 6" O.C. EACH WAY

24" DIA. CONCRETE CAP - SLOPE AWAY FROM COLUMN FOR DRAINAGE

3/4" DIA. ANCHOR BOLT W/ 12" EMBEDMENT

18"x18"x1" BASE PLATE

FINISHED GRADE

STEEL COLUMN PER PLAN

3" COVER

6'-3" SQUARE

1 1/4" MIN.

CERTIFIED BUILDING PAD

NOT FOR CONSTRUCTION

SCALE: 3/4" = 1'-0"
2500 PSI CONCRETE FOOTING W/ #4 BARS @ 6" O.C. EACH WAY

1" DIA. ANCHOR BOLT W/ 12-1/2" EMBEDMENT

24" DIA. CONCRETE CAP - SLOPE AWAY FROM COLUMN FOR DRAINAGE

18"x18"x1-1/2" BASE PLATE

FINISHED GRADE

18"x18"x1-1/2" BASE PLATE

CERTIFIED BUILDING PAD

11'-0" SQUARE

2500 PSI CONCRETE FOOTING W/ #4 BARS @ 6" O.C. EACH WAY

STEEL COLUMN PER PLAN

3" COVER

3'-0" MIN.

1'-4"

11'-0" SQUARE

FINISHED GRADE

FOOTING DETAIL @ PARKING LOT

SCALE: 3/4"=1'-0"
Appendix G-F
Results of Landfill Settlement Analysis
RESULTS OF LANDFILL SETTLEMENT ANALYSIS

F1.0 INTRODUCTION

The SWAT (1987) indicates landfill operations at the inactive waste units of the 28th Street Landfill began many years prior to 1949 and terminated in 1973. The total amount of solid waste disposed at the site was approximately 2,900,000 tons; consisting of 41 percent municipal garbage, 41 percent street cleaning waste, and 18 percent public dumping waste. The existing cover at the site was placed between 1983 and 1988. T&R anticipates the proposed development will require the placement of new fill at the site.

Refuse settles under its self-weight and as external loads are placed. External loads include daily cover, additional waste layers, final covers, and possible structures and park improvements, such as building and roads. Settlement of underlying refuse will impact the design of underground utilities, surface drainage, and new buildings and structures. The objective of performing landfill settlement analyses is to evaluate the amount of future total and differential settlement at the site due to existing conditions, and the weight of new fill and park improvements.

F2.0 SETTLEMENT ANALYSES

Refuse settlement under its self-weight and external loads consists of primary settlement and secondary compression. Primary settlement, due to consolidation of refuse under self-weight and external loads has been typically occurs between 1 and 5 years after load application. Secondary compression, due to decomposition and creep processes, decreases with time and depth of waste fill. The majority of secondary compression is completed within 50 years after load application (Sharma and Lewis, 1994).

T&R performed settlement analyses to evaluate additional future settlement at 13 boring locations (TR-1 to TR-8, E-11 to E-13, E-16, and E-17). Settlement was calculated at each of the 13 locations for three loading conditions: 1) refuse self-weight, 2) existing cover, and 3) new fill, using the Gibson and Lo model. In addition, refuse settlement due to the weight of new fill at each of the 13 locations was evaluated using Sowers method. A discussion of soil profiles, loading conditions, settlement model, and selection of settlement parameters is presented below.
F2.1 Generalize Soil Profiles

Generalized soil profiles were developed for each of the 13 boring locations (TR-1 to TR-8, E-11 to E-13, E-16, and E-17) based on information presented on boring logs prepared by T&R in 2004 and Espana Geotechnical in 2001 (CH2M Hill, 2002).

F2.2 Load Cases

Settlement was calculated at each of the 13 locations for three loading conditions: 1) refuse self-weight, 2) existing cover, and 3) new fill. Placement of refuse at the site was terminated about 31 years ago in 1973. T&R concluded primary settlement of refuse under self-weight was completed and estimated the amount of remaining secondary settlement of refuse under self-weight between 2004 and 2023 (50 years since load application).

The existing cover was placed between 1983 and 1988. For the analysis, T&R assumed the existing cover was placed in 1986. T&R concluded primary settlement of refuse due to the weight of the existing soil cover was completed. Subsequently, T&R evaluated the amount of remaining secondary settlement of refuse due to the weight of the existing soil cover between 2004 and 2036 (50 years since load application).

For the proposed development, T&R assumed an external load of four feet of new fill, approximately 500 pounds per square foot (24 kilo pascal) will be placed across the inactive waste units site. T&R calculated settlement from the primary settlement of refuse between 2004 and 2009 (5 years since load application) and secondary compression between 2004 and 2054 (50 years since load application).

F2.3 Gibson and Lo Model

T&R evaluated the settlement of refuse using the Gibson and Lo model (Edil et al., 1990). The Gibson and Lo model is a rheological model found to be useful in predicting the settlement of peat. The Gibson and Lo model consists of two springs in a series. The first spring in the series represents primary compression. The second spring in the series, which is parallel to a viscous dashpot, represents secondary compression. When a stress increment acts on the model, the first spring in the series compresses instantaneously; this is analogous to primary compression. The initial compression of the second spring in the series is retarded by the dashpot. The sustained load is transferred progressively from the dashpot to the second spring; this is similar to the continuous process of secondary compression under a sustained effective stress. After a long
period of time (i.e., in the secondary compression range), the full effective stress will be taken by
the two springs, thus the dashpot will sustain no load.

The equation for refuse settlement based on the Gibson and Lo model is

$$S(t) = H(Δδ)(a+b[1-exp(-λ/bt)])$$

where “S(t)” is settlement at time “t”, “H” is the initial height of refuse, “Δδ” is change in
overburden pressure, “a” is primary compressibility parameter, “b” is secondary compressibility
parameter, “λ/b” is the rate of secondary compression, and “t” is time since load application.

Settlement parameters a, b, and λ/b were selected based on the type of landfill constituents
described on the logs of test borings drilled at the site, and the refuse site settlement data used
in the Gibson and Lo model (Edil et al., 1990). T&R estimated settlement parameters based on
settlement data from a site in southern Michigan (Site B) where refuse placement conditions
consist of fresh refuse with active filling and old refuse with no filling. For computing the
settlement of refuse under self-weight, settlement parameters were selected for the placement
of fresh refuse with active filling. For computing the settlement of refuse under the weight of
existing cover and proposed development fill, settlement parameters were selected from Site B,
where placement conditions were modeled as “old refuse with no filling”. A summary of the
settlement parameters is presented in Table F-1.

| Table F-1 |
| Settlement Parameters for Gibson and Lo Model |
|---|---|---|
| | a (1/kPa) | b (1/kPa) | λ/b (1/day) |
| Self-weight | - | 0.00006 | 0.002 |
| Existing Cover | - | 0.00049 | 0.00075 |
| New Fill | 0.000016 | 0.00049 | 0.00075 |

F2.4 Sowers Method

T&R estimated refuse settlement due to primary and secondary compressions caused by to the
weight of new fill using the Sowers method. The Sowers method is based on consolidation
theory and has separate equations to calculate primary settlements and secondary compression.
To calculate primary settlements, the following equation is used:

$$S = (H)C_\infty \{\log[(P_0+dP)/P_o}\}$$
Where “S” is primary compression occurring in the layer under consideration, “H” is the initial thickness of the waste layer under consideration, “C_a” is the primary compression ratio, “P_o” is the existing overburden pressure acting at the midlevel of the layer, and “dP” is the increment of overburden pressure at the midlevel of the layer.

For older landfills (10 to 15 years) which are subjected to external loads, primary compression ratio values range from 0.1 to 0.4 (U.S. Dept. of the Navy, 1982). The primary compression ratio values of 0.1 and 0.4 are representative of older landfills with low and high organic content, respectively. For settlement analyses, T&R selected primary compression ratio values of 0.1, 0.2, and 0.3 for low, medium, and high estimates of refuse settlement due to new fill, respectively. Secondary compression is estimated using

$$S_s = H[C_a/(1+e_o)][\log(t_2/ t_1)]$$

where “S_s” is the secondary compression occurring in layer under consideration, “H” is the initial thickness of waste layer under consideration, “C_a” is the secondary compression index, “e_o” is the initial void ratio of the layer, “t_1” is the starting time for the long-term time period under consideration, and “t_2” is the ending time for the long-term time period under consideration.

NAVFAC DM7.3 (U.S. Dept. of the Navy, 1982) recommends secondary compression index values ranging from 0.02 to 0.07 for landfills between 10 and 15 years old. Oweis and Khera (1990) recommend secondary compression index values between 0.01 and 0.04. For settlement analyses, T&R selected secondary compression index values of 0.02, 0.03, and 0.04 for low, medium, and high estimates of refuse settlement due to new fill, respectively.

**F3.0 CONCLUSIONS**

Results from the settlement analyses using the Gibson and Lo model indicate primary and secondary settlement of refuse from self-weight is essentially complete. T&R estimates less than 1/2 inch of additional refuse settlement will occur due to the weight of the existing cover material. About 1.8 to 4.8 inches of additional refuse settlement is expected due to the placement of four feet of new fill. A summary of landfill settlement due to the self-weight of landfill material, weight of the existing cover materials, and the weight of four feet of new fill is presented on Table F-2. Based on limited data analyzed, Edil et al. estimates the model predicts settlement within 2 to 20 percent of the actual settlements. Therefore, computed landfill settlements have been increased by 20 percent to accommodate the predictive capabilities of the Gibson and Lo analyses procedure. Contours showing total settlement due to: 1) the self-weight
of landfill materials, 2) the weight of existing cover soil, 3) the weight of four feet of new fill, plus 4) a 20 percent increase in the settlement value due to predictive uncertainties associated with Gibson and Lo model, are presented in Figure 6. The total settlements are estimated to range between about 2.2 and 5.7 inches and are expected to occur over a 30-year period after the initial placement of the 4-foot-thick layer of new fill.

Low, medium, and high estimates of refuse settlement due to the weight of four feet of new fill were evaluated using Sowers method. A summary of landfill settlement due to the weight of four feet of new fill is presented on Table F-2. Contours showing low, medium, and high estimates of total settlements are presented in Figures 7, 8, and 9, respectively. Low, medium, and high estimates of total settlement range between about 1.4 and 7.3, 2.7 and 14.2, and 4.0 and 21.1 inches, respectively.
## Table F-2
### Summary of Landfill Settlement

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<th>Refuse Thickness (feet)</th>
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Sutter's Landing Park  
Project No. 3866.01  
7/20/2004
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Summary of Landfill Settlement

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Sutter's Landing Park  
Project No. 3865.01  
7/20/2004
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</tbody>
</table>

Sutter's Landing Park
Project No. 3866.01

7/20/2004
<table>
<thead>
<tr>
<th></th>
<th>Parking</th>
<th>Dog Park</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Weight</td>
<td>3.36 IN</td>
<td>3.36 IN</td>
</tr>
<tr>
<td>Existing Cover</td>
<td>6.05 IN</td>
<td>6.05 IN</td>
</tr>
<tr>
<td>Primary Added Load</td>
<td>20.6 IN</td>
<td>12.5 IN</td>
</tr>
<tr>
<td>Secondary Added Load</td>
<td>1.2 IN</td>
<td>1.2 IN</td>
</tr>
<tr>
<td>Max Settlement</td>
<td>31.2 IN</td>
<td>23.1 IN</td>
</tr>
<tr>
<td>Differential Settlement</td>
<td>21.8 IN</td>
<td>13.7 IN</td>
</tr>
</tbody>
</table>
Dog Park and Parking Lot

Primary Settlement

\[ S = \frac{(H)C_{ec} \log \left( \frac{P_o + \Delta P}{P_o} \right)}{P_o} \] (Sours)

\[ S = \text{settlement} \]
\[ H = \text{layer thickness in feet} \]
\[ C_{ec} = \text{primary compression ratio} \ (\text{Max} = 0.3) \]
\[ P_o = \text{overburden pressure at } H/2 \]
\[ \Delta P = \text{increase in load at } H/2 \]

\[ H_{\text{avg}} = 20.0 \text{ ft} \]
\[ P_o = \frac{H}{2} \times (45 \text{ lbs/ft}^3) = 10 \text{ ft} \times 45 \frac{\text{lbs}}{\text{ft}^3} = 450 \frac{\text{lbs}}{\text{ft}^2} \]

Design Bearing = 2,000 lbs

Load projection at 10 ft = 576 ft² (Parking)

Load projection at 10 ft = 356 ft² (Dog Park)

\[ S_{\text{avg}} = 3.36 \text{ in} \ (T & R) \]
\[ \text{Cover} = 0.05 \text{ in} \ (T & R) \]

Parking

\[ S = (20 \text{ ft}) (0.3) \left( \log \frac{450 + 420}{450} \right) \]
\[ = 1.72 \text{ ft} \]
\[ = 20.6 \text{ in} \]

Dog Park

\[ S = (20 \text{ ft}) (0.3) \left( \log \frac{450 + 220}{450} \right) \]
\[ = 1.04 \text{ ft} \]
\[ = 12.5 \text{ in} \]
Secondary Settlement

\[ S = H \left( \frac{C_0}{1 + E_0} \right) \log \left( \frac{t_2}{t_1} \right) \]

- \( S \) = Settlement
- \( H \) = Layer Thickness in feet
- \( C_0 \) = Secondary Compression factor
- \( E_0 \) = Waste Void Ratio
- \( t_1 \) = 40 years
- \( t_2 \) = 60 years

\[ H = 20.0 \text{ FT} \]
\[ C_0 = 0.04 \text{ (Max)} \]
\[ E_0 = 0.40 \]

\[ S = (20 \text{ FT}) \left( \frac{0.04}{1+0.4} \right) ( \log \frac{60}{40} ) \]
\[ = 0.18 \text{ FT} \]
\[ = 1.2 \text{ IN} \text{ (Same for Parking and Dog Park)} \]
1 MAINTENANCE PLAN

1.1 Introduction

A maintenance program will be implemented at the 28th Street Landfill after installation of the solar arrays and will continue for the life of the solar array system, approximately 20 years. This section describes the responsibilities, resources, and inspection frequency for carrying out the maintenance plan. Specific inspection and maintenance activities are detailed in subsequent Sections 1.1 through 1.5.

1.2 Inspection, Monitoring, and Maintenance Program

1.2.1 Landfill Cover

27 CCR 21090

A maintenance program will be conducted at the 28th Street Landfill to verify that the landfill final cover retains its integrity and effectiveness. The final cover, including perimeter access road, will be routinely evaluated and inspected quarterly for any evidence of:

- Soil erosion
- Settlement and subsidence
- Exposed refuse
- Cracks
- Ponded water
- Vegetation stress
- Odor
- Slope failure
- Leachate seeps

Deficiencies such as cracks, erosion damage, or settlement in the final cover will be evaluated regarding their extent and depth. The evaluation will include determining the severity of the problem, prioritizing their repair, and determining the best method of repair. Repairs and restoration will be consistent with the final cover construction specifications.
Column Supports – If cracks or damage occur around the column supports, the asphalt seal will be re-established by removing and replacing asphalt and soil that are damaged or settled.

Ground Supported – If settlement or damage to the cover occurs beneath a pavement supported solar arrays, the support structure and arrays will be temporarily moved out of the way until repairs are complete and then returned to their proper location.

Areas that have ponded water or have settled will be filled with clean onsite soil, free of deleterious material. After filling and re-grading, the areas will be resurfaced.

Should a failure in the cover area occur, the area will be closed off to prevent damage to equipment or harm to individuals. A licensed civil engineer will be notified to assess the failure and recommend appropriate corrective action. Specific corrective action will depend on the extent, nature, and location of the failure. Corrective action measures will be developed by the civil engineer.  
A record of final cover maintenance activities will be kept by the City. The record will include the date, location, and extent and nature of the maintenance activity. Regulatory agencies will be notified as required by the site’s permit and approvals.

Grass control will not be associated with Array No. 1 in the Parking Area and Array No. 3 in the Compost Area. For Array 2, grass will be controlled by periodic mowing beneath the solar arrays. Array 2 will be best maintained by using a manual weed trimming type of device that allows selective grass removal in planter areas and near the support footings of the solar arrays. Annual mowing in early summer after plants turn brown is recommended at minimum.

1.3 Drainage System

27 CCR 21090(b)(3), 20365, and 21150

A maintenance program will be implemented to maintain the integrity and effectiveness of the final drainage system throughout the post-closure maintenance period. The final drainage system will be inspected and evaluated on an ongoing basis for:

- Evidence of erosion
- Standing water
- Formation of gullies
- Settlement, blockage, and damage to drainage channels, structures, swales, and culverts

Damage to the drainage system will be addressed prior to the wet season once damage is identified. If damage is identified during the wet season, then repairs will be made as soon as access with equipment is possible. The reason for the damage will be determined, if possible.
Permanent repairs and restoration will be made consistent with final closure construction
specifications. Temporary repairs may be utilized until permanent repairs can be scheduled.
Culverts and inlet and outlet structures will be cleaned of sediment regularly before their flow
capacities are impaired. Drainage inlet grates will be kept free of debris, and drainage channels
will be maintained to permit free flow.

Results of the inspection and summary of maintenance performed will be compiled and included
in the quarterly monitoring report following the inspection.

1.4 Landfill Gas Monitoring and Control Systems

27 CCR 20921 et seq. and 21180 (a)(2)

The LFG migration monitoring system will be inspected on an ongoing basis, consistent with the
requirements and 27 CCR 20933. System components will be repaired and replaced as required
to maintain full system capabilities, as intended at initial installation.

The gas monitoring system inspection and maintenance program will be the responsibility of the
City for the duration of the maintenance period, or until an operating exemption is granted by the
CIWMB and the LEA as allowed per 27 CCR 20921 (d).

1.5 Emergency Response

1.5.1 Earthquakes

The 28th Street Landfill is located in an area of low to moderate seismic activity. Ground motion
resulting from faults in the region is expected to be low to moderate. The landfill final grades
and cover system have been designed based on a seismic slope stability analysis specific to site
conditions and anticipated ground motion. Final cover system and solar equipment are expected
to be stable under anticipated seismic conditions.

The solar arrays will be visually inspected within 12 hours after a moderate or strong earthquake
event. The inspection will assess the condition of final cover on the side slopes, benches and top
deck; drainage structures; and the surface water detention basin. Areas where the cover layer
appears compromised, or refuse has day-lighted, will be identified.

Necessary landfill repairs will be prioritized in accordance with other earthquake response needs
at the landfill. Corrective landfill repairs will generally be made as described in Section 1.2 of
this Maintenance Plan. If necessary, a remediation plan and/or corrective action construction
plans and specifications will be prepared.

1.5.2 Floods

The closed modules lie at an elevation that is not within the 100-year flood plain as depicted in
the Federal Emergency Management Agency flood insurance map for the region. No flood
hazard is anticipated.
1.5.3 Collapse of Cover Surface

The areas where the solar arrays are located are flat with minimum slope. The slopes are expected to be stable under the anticipated site conditions, including seismic events.

1.5.4 Surface Drainage Problems

The proposed surface water drainage system will handle runoff from the site with only minor instances of erosion expected. The system has been designed for 100-year rainfall event, which will provide adequate protection for the landfill. Routine inspections and corrective landfill repairs will be made as described in Section 1.3 of this Maintenance Plan. Drainage structure repairs will be made annually prior to the start of the rain season.

1.5.5 Environmental Monitoring Systems

The proposed solar arrays are not located near existing environmental monitoring systems. Installation and operation of the solar arrays will be performed in a manner that will not impact the existing environmental monitoring systems.

1.5.6 Emergency Coordination

If an emergency situation develops at 28th Street Landfill, the site employee will immediately contact a member of the City’s Emergency Response Team. These personnel have the authority to commit all resources of the City in the event of an emergency.

TABLE 1-1. 28th Street Emergency Response Personnel
(as of September 2012)

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Olesen</td>
<td>Site Superintendent</td>
<td>916-264-7132</td>
</tr>
<tr>
<td>Steve Harriman</td>
<td>Integrated Waste General Manager</td>
<td>916-808-4949</td>
</tr>
</tbody>
</table>

1.5.7 Corrective Action

Occurrences which could require corrective action and their corresponding measures are described above. If extensive damage occurs to the landfill cover or associated structures (such as drainage control features), corrective action alternatives will be assessed by a registered civil engineer, and appropriate repair measures implemented.
Any repairs to the final cover, drainage system or environmental monitoring systems will be reviewed by a civil engineer or certified engineering geologist, and certified that the integrity of the original cover has been maintained.

1.5.8 Emergency Equipment

A list outlining the general availability and types of emergency mitigation equipment is presented in Table 1-2. All heavy equipment operated at 28th Street Landfill is equipped with fire extinguishers.

1.5.9 Regulatory Notifications

If a failure or release occurs which requires emergency response action, the agencies listed below will be contacted:

Sacramento County Environmental Health Services
10590 Armstrong Avenue
Mather, California 95655
(916) 875-8550

CalRecycle
1001 “I” Street
Sacramento, California 95814
(916) 255-2200

State of California Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, Suite 200
Sacramento, California 95670
(916) 464-3291
# TABLE 1-2. Availability of Emergency, Mitigation Equipment

<table>
<thead>
<tr>
<th>EMERGENCY</th>
<th>TYPE OF EQUIPMENT REQUIRED</th>
<th>AVAILABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vandalism</td>
<td>Landfill Operation Equipment Onsite Personnel</td>
<td>D A</td>
</tr>
<tr>
<td>Fire</td>
<td>Fire Fighting Operations</td>
<td>B A</td>
</tr>
<tr>
<td>Explosion/LFG Mitigation</td>
<td>Onsite Personnel LFG Containment</td>
<td>A, B D</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Landfill Operation Equipment</td>
<td>C</td>
</tr>
<tr>
<td>Floods</td>
<td>Not anticipated</td>
<td></td>
</tr>
<tr>
<td>Collapse of landfill</td>
<td>Landfill Operation Equipment</td>
<td>A, D</td>
</tr>
<tr>
<td>Surface drainage problem</td>
<td>Landfill Operation Equipment</td>
<td>A</td>
</tr>
<tr>
<td>Waste release</td>
<td>Varies</td>
<td>A, D</td>
</tr>
</tbody>
</table>

Key:
- A  Available onsite during landfill operating hours
- B  Available from local fire response facilities
- C  Inspection available in less than 12 hours
- D  Availability dependent on type of mitigation measure
Table 1-3. Post-closure Inspection Schedule

<table>
<thead>
<tr>
<th>Activities</th>
<th>Ongoing(^3)</th>
<th>Monthly(^4)</th>
<th>Quarterly</th>
<th>Semiannually(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final cover areas</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Drainage system</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Paved cover</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Landfill gas monitoring system</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Security</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Emergency response events</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 - Comprehensive inspection conducted by the City of Sacramento
2 - Quarterly during the first year
3 – When accessible
4 – At minimum monthly during the first year

For each inspection, any damage discovered and repairs should be documented and included in the quarterly monitoring report following the inspection. Photographs should also be taken of the damage and the photographs labeled with the location of the damage and the time and date taken.
2 MAINTENANCE COST ESTIMATES

This section presents the maintenance cost estimates and associated supporting documentation for the solar arrays at 28th Street Landfill. The cost estimates were prepared consistent with 27 CCR, Sections 21780(a)(2).

2.1 Maintenance Cost Estimate

27 CCR 21840 and 21769(b)(2)(A)

The maintenance cost estimate was prepared by SCS Engineers based on the activities described in this Maintenance Plan. The maintenance cost estimate includes the cost of materials, equipment, labor and administration.

The estimate is based on 2013 dollars and the hiring of a third party to maintain, monitor, and inspect the solar system. Table 2-1 summarizes the estimated additional annual maintenance cost. A breakdown of these costs is provided in attached Exhibit 1. These costs should be added to the current post closure maintenance financial assurance costs.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspections</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>Cover Repair</td>
<td>$3,480.00</td>
</tr>
<tr>
<td>Drainage Clearing</td>
<td>$500.00</td>
</tr>
<tr>
<td>Landfill Gas Monitoring</td>
<td>$500.00</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$6,980.00</td>
</tr>
</tbody>
</table>
EXHIBIT 1
ANNUAL POSTCLOSURE COST ESTIMATE
SOLAR INSTALLATION at 28th LANDFILL
CITY OF SACRAMENTO

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspections</td>
<td>4 EA</td>
<td>$625.00 EA</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>Cover Repair</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column Seals $^{(1)}$</td>
<td>10 EA</td>
<td>$18.00 EA</td>
<td>$180.00</td>
</tr>
<tr>
<td>Repair Paving $^{(1)}$</td>
<td>500 SF</td>
<td>$6.40 SF</td>
<td>$3,200.00</td>
</tr>
<tr>
<td>Soil Cover</td>
<td>100 SF</td>
<td>$1.00 SF</td>
<td>$100.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$3,480.00</td>
</tr>
<tr>
<td>Drainage Clearing</td>
<td>1 EA</td>
<td>$500.00 EA</td>
<td>$500.00</td>
</tr>
<tr>
<td>LFG Monitoring</td>
<td>4 EA</td>
<td>$125.00 EA</td>
<td>$500.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>$6,980.00</strong></td>
</tr>
</tbody>
</table>

(1) Cost per square foot for Asphalt Installation from Granite Construction 2013