附錄二　參訪及拜會資料

HUNTINGTON BEACH SPORTS COMPLEX
LANDFILL GAS TREATMENT SYSTEM

Location: Huntington Beach, California

Reference:
City of Huntington Beach
Public Works Department
2000 Main Street
Huntington Beach, California 92648
Douglas S. Stack, P.E.,
Deputy City Engineer
(714) 375-5078

BACKGROUND

The former City of Huntington Beach Landfill consists of about 45 acres to the south of the Huntington Beach Central Library. This development is located between Golden West Street, Talbert Avenue, Gothard Street, and Ellis Avenue in the City of Huntington Beach, California.

Historically, the Central Park Sports Complex was used for agriculture and livestock grazing. Several previous use areas are identified within the project site. These use areas include the Hanson Inert Construction Debris Processing Plant, and a field office for the Orange County Sewer District Golden Waste trunk sewer. Both facilities are or were located along the south border of the Talbert Avenue area. A paved construction materials storage area is located next to the Huntington Beach Central Library parking lot, approximately half way between Golden West Street and Gothard Street.

A large portion of the project site consists of former municipal refuse and construction debris landfills. The landfill area extends to the north and southeast beyond the limits of the project site. The site can be divided into two distinct landfill areas: one area used for mixed municipal refuse disposal, and another for disposal of inert construction debris and miscellaneous landfill material.

The County operated the site as a burn dump from September 1947 through September 1956. At this date, the site was reportedly operated as a spread and cover operation. County records indicate that approximately 1.1 million cubic yards of refuse were deposited at the site before its closure in June 1962.

The site development is divided into three areas according to the facility layout. The northeast portion of the property (Area 1) is proposed to be utilized for baseball and soccer fields, a toddler playground, and a concession/restroom facility with a building footprint of approximately 30 feet wide and 60 feet long. The second area is located in the northwest segment of the property (Area 2). A large portion of this area will be utilized for parking. The remaining portion of this area is used for sporting facilities, including four roller hockey rinks and a batting cage, with turf areas in between. The southwest portion of the property (Area 3) is baseball and soccer fields, a toddler playground, and a concession/restroom facility (approximate footprint of 30-foot by 60-foot).

SCS ENGINEERS PROJECT ELEMENTS

The existing treatment system consists of one blower, a water knockout vessel combined with a fuel filter, a set of two carbon adsorption canisters, an air compressor assembly, and a control panel for control and operation of the system. As LFG is drawn through the extraction system by the blower, it is routed through the fuel filter/water knockout vessel, and then through the lead carbon absorber.

SCS ENERGY

Mountaingate Gas Plant

Owner: SCS Renewable Energy
Location: Los Angeles, California

The Mountaingate Gas Plant cleans and compresses 2.0 mmscfd (1,400 scfm) of landfill gas. The processed gas is delivered to the University of California at Los Angeles (UCLA) via a 5.5 mile pipeline where it is co-fired with natural gas at UCLA's 40 MW on-campus cogeneration plant.

The gas plant consists of the following major components:

- Two 450 hp, 100 psi landfill gas compressors;
- Moisture removal through air-to-gas and chilled water-to-gas heat exchangers;
- Hydrogen sulfide removal and non-methane hydrocarbon removal through chemical scrubbing (proprietary solvent) in a tray tower, followed by activated carbon polishing;
- Solvent regeneration in a stripper tower and disposal of the off gas in a thermal oxidizer; and
- Wastewater treatment consisting of hydrocarbon separation and pH adjustment.

SCS Responsibilities:

Feasibility Study	☐
Grantsmanship	☐
Power Sales Agreement	☐
Environmental Permits	☒
Interconnection Application	☐
Detailed Design	☐
Equipment Procurement	☐
Construction QA/QC	☐
Construction	☐
Plant Startup	☐
Ongoing Operation	☒

The gas plant is located adjacent to the Mountaingate Country Club. A closed landfill, under the golf course, supplies feedstock to the gas plant.

SCS is responsible for the operation/maintenance of the gas plant and the pipeline, environmental permitting and reporting, liaison with the Mountaingate Country Club, and coordination of day-to-day operation with the UCLA cogeneration plant.

INDUSTRY HILLS RECREATION CENTER
LANDFILL GAS CONTROL FACILITY DEVELOPMENT

Location: Industry Hills, California

Contract Amount: $135,000/Year

Construction Cost: $450,000

Reference: City of Industry
15651 E. Staffort Street
City of Industry, California 91744
John Ballas
(626) 333-2211

BACKGROUND

The Industry Hills Civic-Recreation-Conservation Area, located in the City of Industry Hills, California, is the site of major development that provided SCS and SCS Field Services (SCS-FS) with an opportunity to design, build, and maintain landfill gas (LFG) control, drainage and flood control, and recreational facilities that have benefited the community for more than 20 years. The city designated this project the Outstanding Civil Engineering Achievement of 1981.

The Industry Hills Convention Center, including a 400-room Sheraton Hotel, was built over and adjacent to a municipal waste landfill that contains 1,000,000 tons and was closed in the mid-1970s. Two championship golf courses, a tennis center, and parking structure were developed on old waste disposal areas. Gas from the landfill is used in on-site boilers for space and water heating. SCS-FS currently operates this site.

SCS ENGINEERS AND SCS FIELD SERVICES PROJECT ELEMENTS

Present operation at the site provides an approximate peak LFG fuel supply of 300 to 400 scfm at 42 to 45 percent methane. The LFG recovery and migration control systems include the following components:

- LFG collection system, with 30 recovery wells, 4 parking structure LFG control wells, and 4 laundry building LFG control wells.
- LFG recovery process plant, featuring a Hoffman Compressor (maximum flow 500 scfm), a gas-to-gas heat exchanger, an air-cooled heat exchanger, and moisture separators/knock-out vessels.
- LFG migration control blower/flare station, consisting of a McGill Flare (maximum flow 700 scfm), a New York Blower (maximum flow 500 scfm), and a moisture separator.
- LFG migration monitoring systems, including above- and below-membrane monitoring probes, continuous sensor monitoring systems, and continuous sensor monitoring systems.
- LFG fuel usage at the swim/tennis facility; two Kewanee Boilers that heat Olympic and therapeutic pools; two heavy-duty water heaters for shower facilities; and two heavy-duty water heaters for hot water use.

SCS ENGINEERS

WESTPORT OFFICE PARK REDEVELOPMENT

Location: 1100 - 1300 Island Drive, Redwood City, California
Client: Vance Brown, Inc. (General Contractor)
Dates: 1996 - 2001

BACKGROUND

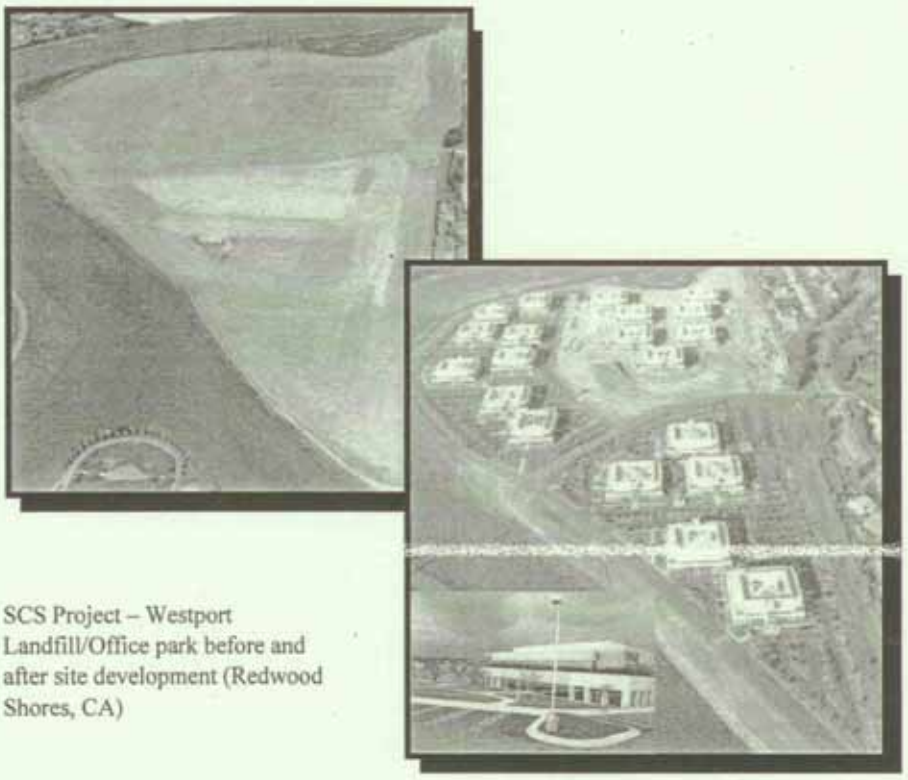
Westport Office Park is a 20-building, 980,000-square-foot project in a park-like, campus-style setting used for research and development, office, and biotech uses. The 85-acre site was used as a municipal waste landfill from the 1940s until 1970. The presence of underlying refuse created challenging engineering issues for site development, including protection of structures from explosive gases, special foundation design to mitigate differential settlement, and preservation of the landfill clay liner. With construction costs in excess of $150 million, the Westport development is one of the most ambitious projects ever undertaken on a former landfill site. Construction was completed in late year 2000.

SCS SERVICES

The general contractor retained SCS to provide landfill engineering, landfill gas protection system design, construction management, and permitting services. We prepared design plans and specifications for protecting site structures from potential explosive hazards associated with landfill gas infiltration. Construction observation services were provided to verify that the protection features were installed per the design plans and agency requirements. SCS also prepared a comprehensive landscaping and drainage plan. The objective was to protect the landfill cap from water infiltration and root damage, and to promote healthy long-term plant growth in a distressed environment. This design saved the client several hundred thousand dollars.

Key protection/monitoring features designed by SCS and incorporated into the development included:

- Subfloor HDPE membrane, passive-gas venting system, and continuous, automated combustible gas sensors installed at each building. The design included provisions to fasten the HDPE membrane to the bottom of the structural slab, to mitigate future damage from landfill settlement.
- Subsurface gas migration barriers installed in site utility corridors.
- A venting system to relieve gas pressure buildup in parking lot areas overlying the deeper portions of the landfill.
- A leachate cut-off trench and subsurface gas venting/monitoring system installed at the property line.



SCS Project – Westport Landfill/Office park before and after site development (Redwood Shores, CA)

SCS ENGINEERS

LANDFILL ENGINEERING SERVICES
COLMA HOME DEPOT RETAIL CENTER
(FORMER JUNIPERO SERRA DISPOSAL SITE)

Location: 2 Colma Boulevard, Colma (San Mateo County), California
Clients: Cole Company / Home Depot Corporation

BACKGROUND

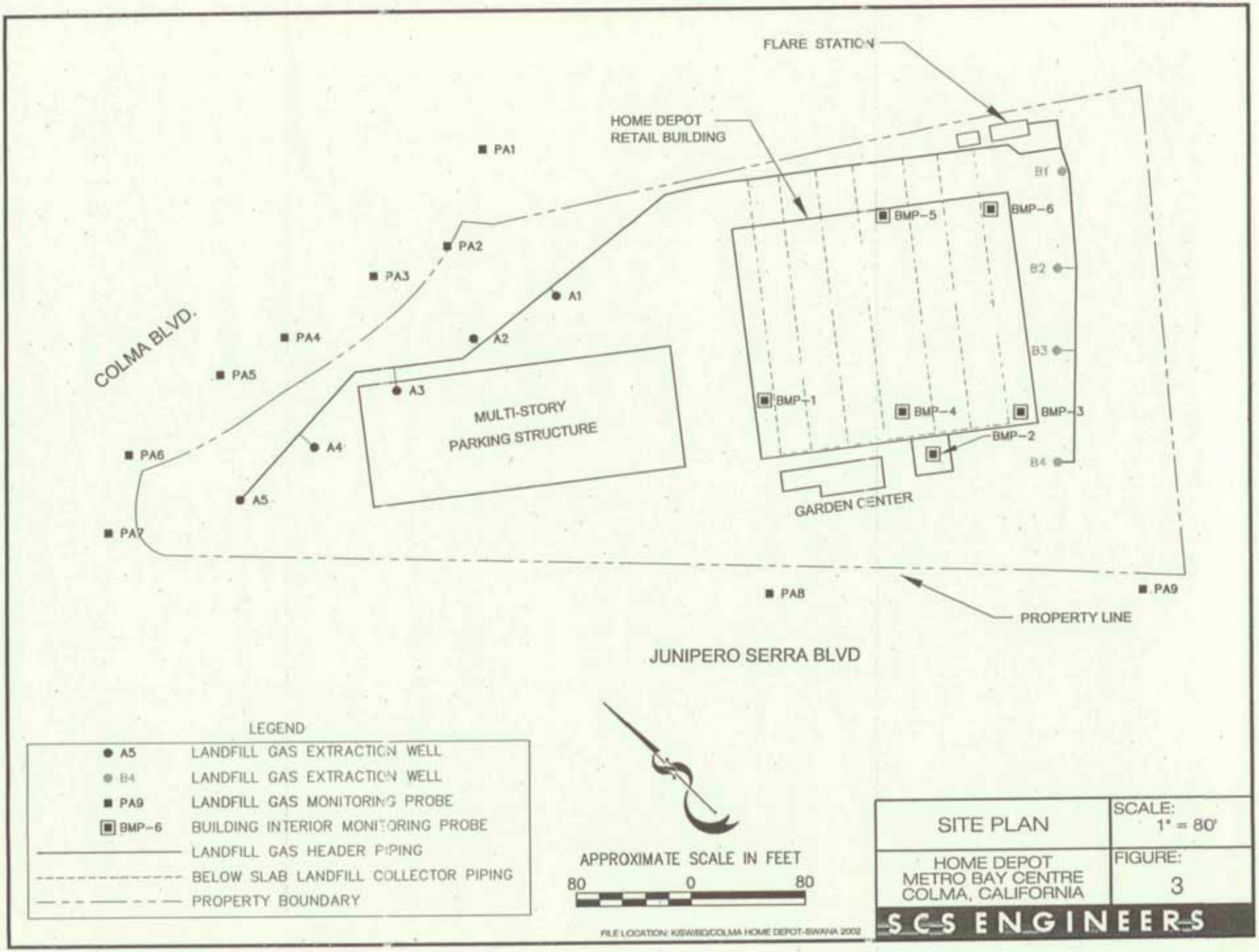
The Colma Home Depot retail center was constructed at the site of closed landfill in San Mateo County, California. Refuse depths at the landfill vary up to 135 feet. The 89,000 sq ft retail building is supported on 160-ft length steel piles driven through the landfill into underlying native soils. The Colma facility has been Home Depot's highest revenue-grossing store in the U.S., on a square footage basis.

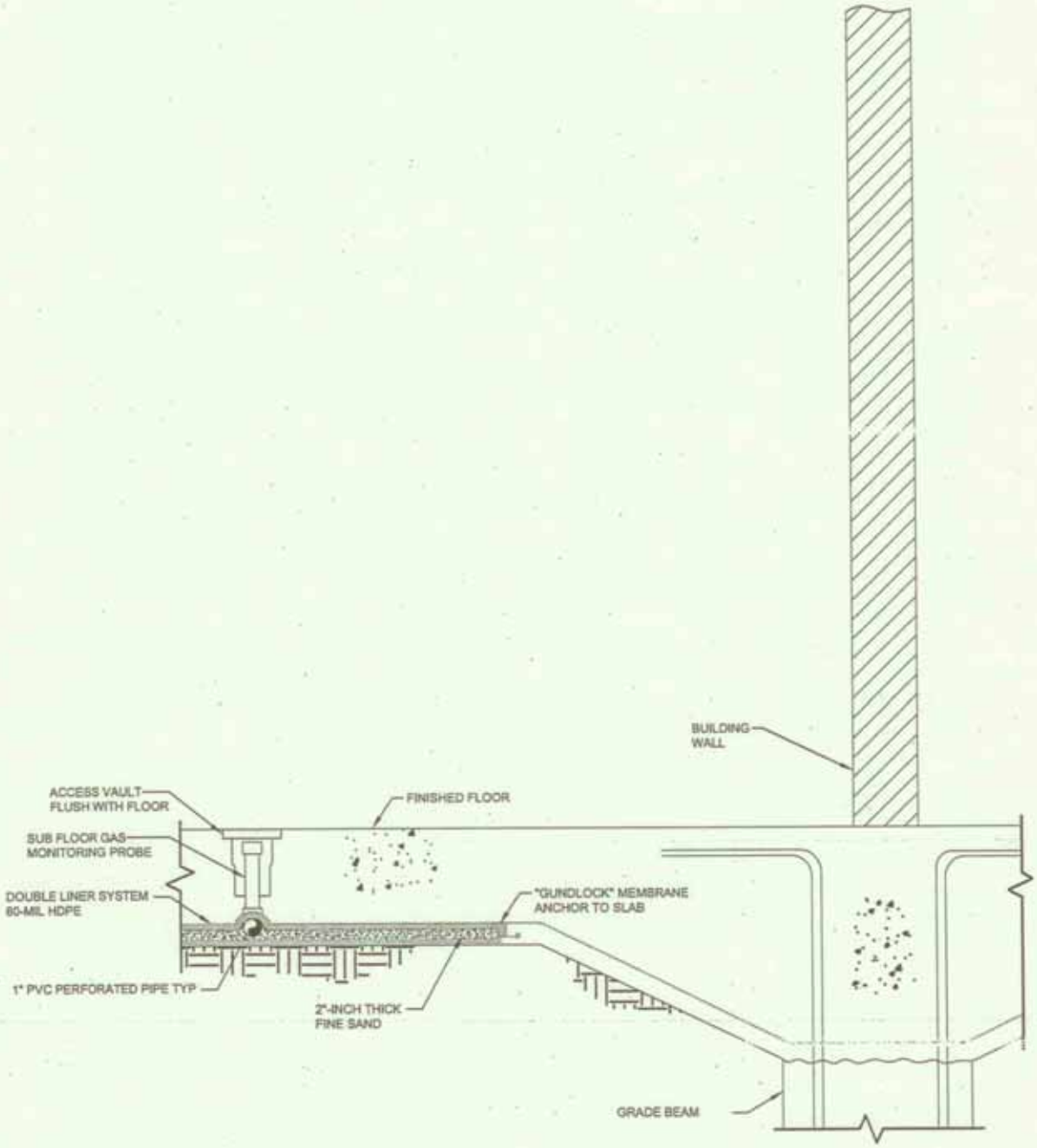
Site development included several LFG protection features for the buildings and infrastructure (designed by others). These include an active gas extraction and flare system, below-slab membranes, and automated combustible gas sensors installed in the building interior.

SCS SERVICES

SCS Engineers has provided various engineering, permitting and gas system operation and maintenance services, including:

- Engineering evaluation of potential combustible gas hazards affecting the retail store, third-party review of existing gas protection features, and recommendations for upgrades.
- Prepare civil, mechanical and electrical plans and specifications, obtain permits and install a new 250 scfm LFG flare. The flare was constructed by SCS under a design/build contract.
- Prepare a health and safety plan and provide construction oversight for below-grade repair of site utilities and store entrance facilities, which had been affected by landfill settlement.
- Provide operation, monitoring and maintenance services for the gas extraction and combustible gas sensor systems.


FLARE STATION
HOME DEPOT
RETAIL BUILDING
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PA8
PA9
COLMA BLVD.
A1
A2
A3
A4
A5
MULTI-STORY
PARKING STRUCTURE
B1
B2
B3
B4
BMP-1
BMP-2
BMP-3
BMP-4
BMP-5
BMP-6
GARDEN CENTER
PROPERTY LINE
JUNIPERO SERRA BLVD
LEGEND
A5 LANDFILL GAS EXTRACTION WELL
B4 LANDFILL GAS EXTRACTION WELL
PA9 LANDFILL GAS MONITORING PROBE
BMP-6 BUILDING INTERIOR MONITORING PROBE
LANDFILL GAS HEADER PIPING
BELOW SLAB LANDFILL COLLECTOR PIPING
PROPERTY BOUNDARY
APPROXIMATE SCALE IN FEET
80 0 80
FILE LOCATION: K:\SW\BG\COLMA HOME DEPOT-BWANA 2002
SITE PLAN
SCALE: 1" = 80'
HOME DEPOT
METRO BAY CENTRE
COLMA, CALIFORNIA
FIGURE: 3
SCS ENGINEERS

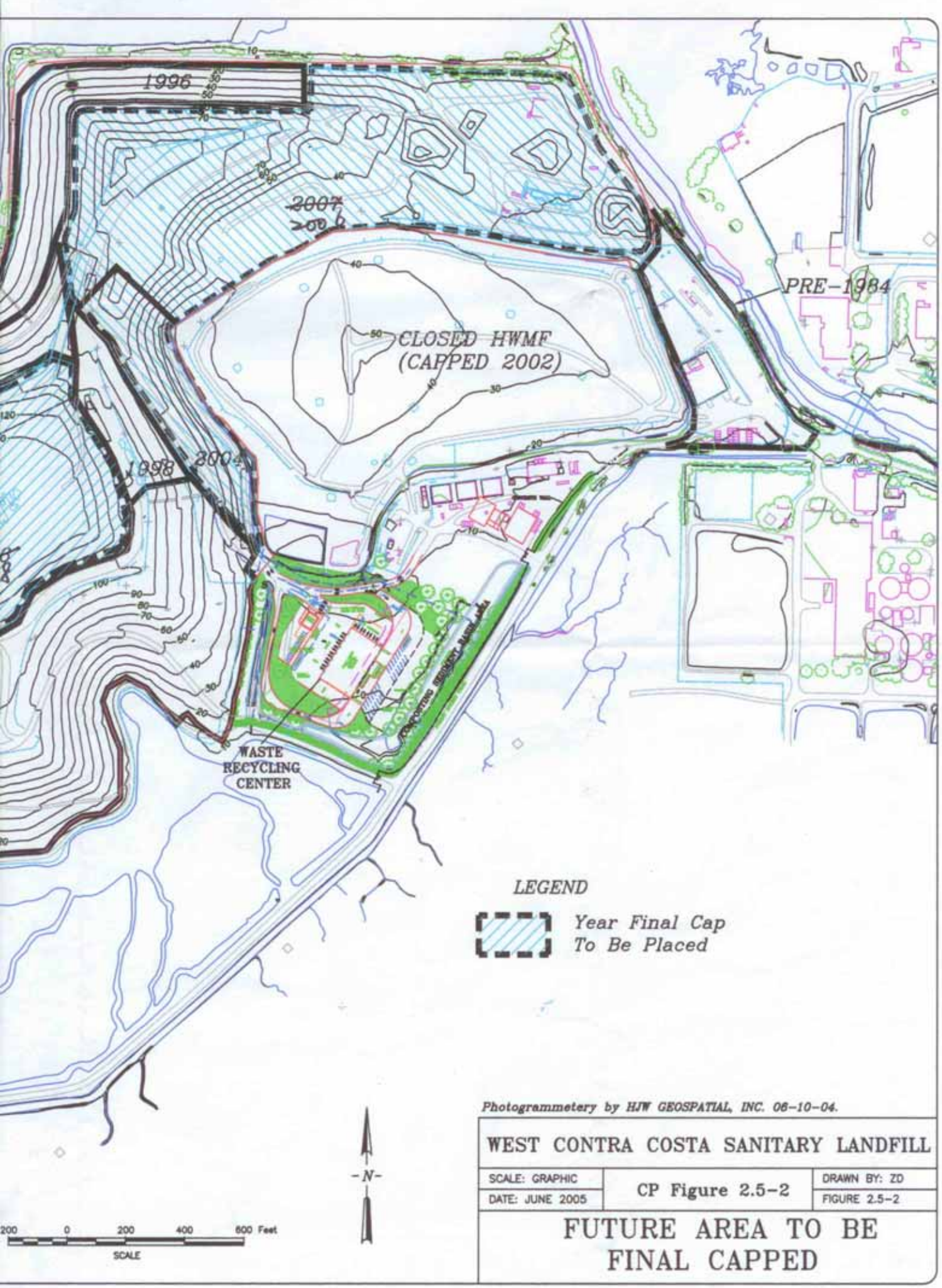


SUB FLOOR MEMBRANE BARRIER	ACAD FILE: 04 Gas Detect Detail.dwg
HOME DEPOT METRO BAY CENTRE COLMA, CALIFORNIA	FIGURE: 4

SCS ENGINEERS

BASE: DILIP PATEL & ASSOCIATES, INC.
DWG # 0267-G-003 8-14-93
FILE LOCATION: K/SW/BD/COLMA HOME DEPOT-SWANA 2002

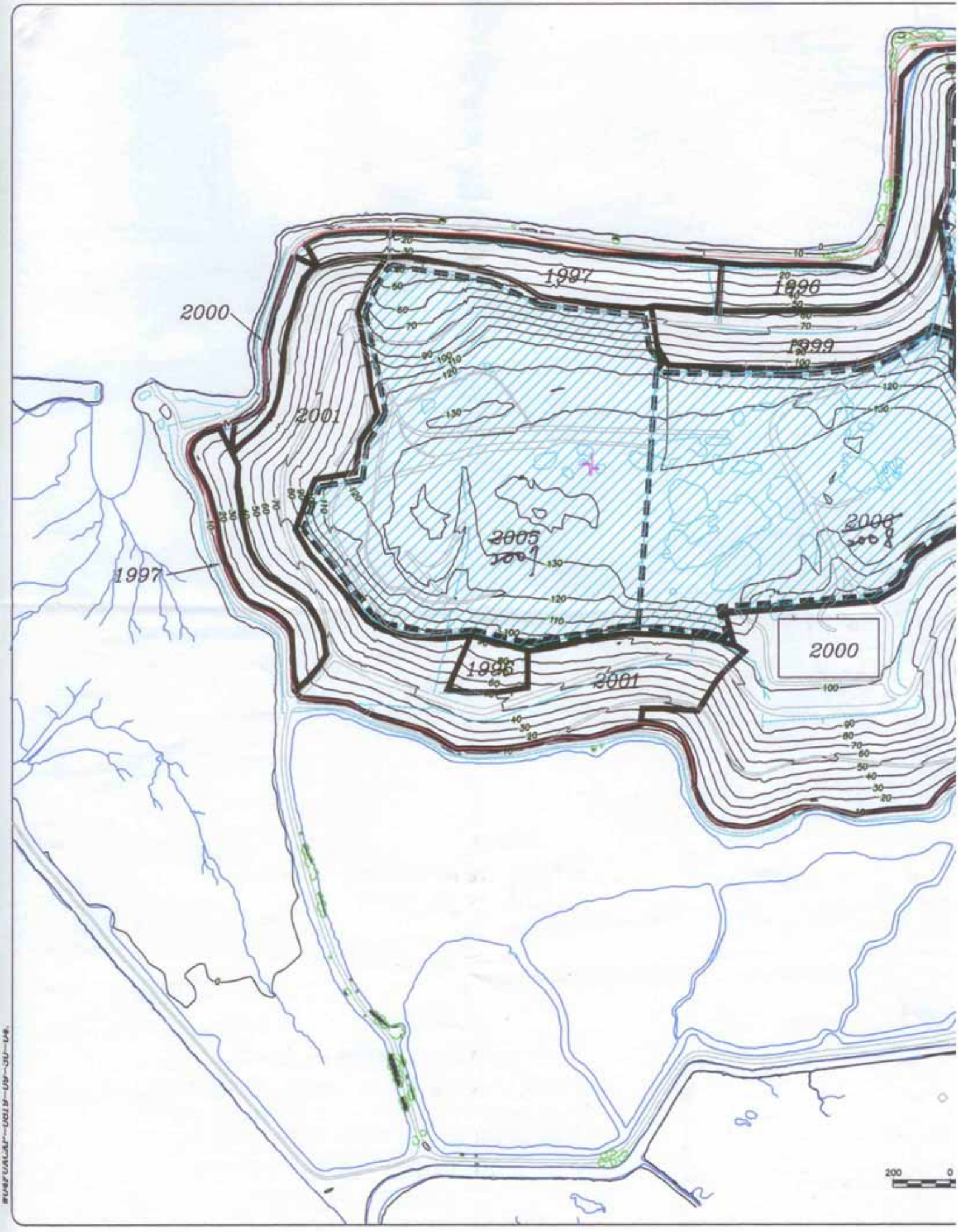
NOT TO SCALE



Photogrammetery by HJW GEOSPATIAL, INC. 06-10-04.

WEST CONTRA COSTA SANITARY LANDFILL		
SCALE: GRAPHIC	CP Figure 2.5-2	DRAWN BY: ZD
DATE: JUNE 2005		FIGURE 2.5-2

FUTURE AREA TO BE FINAL CAPPED


2000
1997
1996
1999
2001
2005
2006
2008
1997
2000
1996
2001
200
0

CITY LANDFILLS
FACTSHEETS
October 2006

Lopez Canyon

Address: 11950 Lopez Canyon Road
Lake View Terrace, California 91342
Size: Property-399 acres Landfill Area-166 acres
Date opened: October 1975
Date closed: July 1, 1996
Type of refuse: Class III; residential, street sweepings, construction and demolition materials
Total capacity: 19,200,000 tons or 30,720,000 cubic yards
Remaining capacity at closing date: 2,600,000 tons or 4,160,000 cubic yards
Average depth of fill: 200 feet
Gas management system: 450 horizontal and vertical extraction wells; approximately 5 miles of header line; flare station at a capacity of 8750 cubic feet per minute; present landfill gas generation is 7,000,000 cubic feet per day.
Community outreach program: Periodic meetings with the community; circulation of periodic newsletters; adoption of Fenton Avenue school and providing environmental education.
Additional expansion area: None
- Potential future use: Low intensity open space and a Green recycling Facility.

Currently the site is undergoing closure construction. The final cover used is a monolithic cover. Monolithic soil covers are being used with increasing frequency in southern California as an alternative to the Title 27 prescriptive cover for California Class III municipal solid waste landfills.

Also, through a public/private partnership, we built two Gas to Energy facilities at the site. The facilities produce 6.0 MW of power enough to provide electricity to 6,000 homes. The facilities consist of state of the art equipment using best available control technology.

Toyon Canyon

Address: 5050 Mt. Hollywood Dr.
Griffith Park, LA, CA 90027
Size: 90 acres
Date opened: 1957
Date closed: November 1985
Type of refuse: Class III; residential, street sweepings, construction and demolition materials
Total capacity: 16,000,000 tons
Average depth of fill: 290 feet
Gas management system: Vertical extraction wells; gas to energy facility in operation producing approximately 4 MW of power; present landfill gas generation is 3,500,000 cubic feet per day
Community outreach program: Sporadic meetings with the community, friends of Griffith

park and Griffith Park Resources Board.
Additional expansion area: None
- Potential future use: Low intensity open meadow area intended for passive recreational activities.

Currently Toyon is also undergoing closure construction using the monolithic cover concept.

Bishop Canyon

Address: 929 Academy Road
Los Angeles, CA, 90012
Size: 40 acres
Date opened: 1966
Date closed: 1969
Type of refuse: Class III; residential, street sweepings, construction and demolition materials
Total capacity: 1,700,000 tons
Average depth of fill: 130 feet
Gas management system: An active ventilation system consisting of a several wells connected to a blower to control gas migration is presently in operation
Community outreach program: Sporadic meetings with the community.
Additional expansion area: none
- Current use: Open space for active recreation, including multi-use athletic fields. Open meadows or various forms of free play, extensive covered and open air picnic areas, four children's play lots and interconnecting trails.

Sheldon/Arleta

Address: 12455 Wicks street
Sun Valley, Los Angeles, CA 91352
Size: 41 acres
Date opened: 1962
Date closed: July 1974
Type of refuse: Class III; residential, street sweepings, construction and demolition materials
Total capacity: 5,500,000 tons
Average depth of fill; 130 feet
Gas management system: Gas generated at the landfill is collected and conveyed to a nearby gas to energy facility. Present gas generation is 800,000 cubic feet per day
Additional expansion area: None
- Future use: Active recreational and sport activities.

Branford

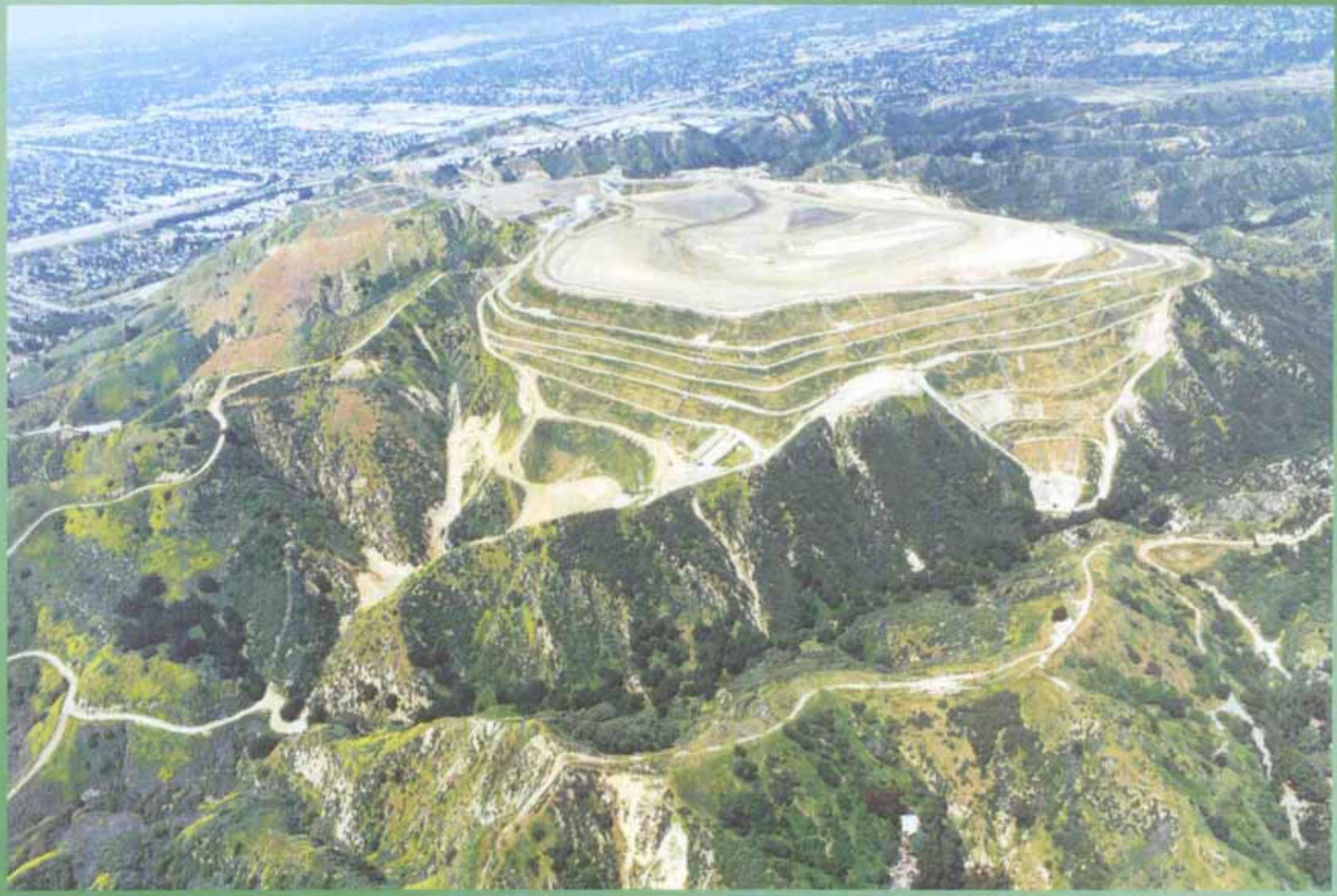
Address: 9701 San Fernando Road
Sun Valley, CA
Size: 21 acres
Date opened: 1957
Date closed: 1961

Type of refuse: Class III; residential, street sweepings and construction and demolition materials
Total capacity: 435,000 tons
Average depth of fill: 60 feet
Gas management system: Passive collection system
Additional expansion area: None
✗ Future use: Industrial/commercial. The landfill was sold to Sunquest Development , Inc for development into industrial park.

Gaffey Street

Address: 1400 North Gaffey Street
San Pedro, CA 90731
Size: 30 Acres, Fill Area- 17 Acres
Date opened: 1955
Date closed: 1963
Type of refuse: Class III; residential, street sweepings, construction and demolition materials
Total capacity: 900,000 tons
Average depth of fill: 50 feet
Gas management system: None
Additional expansion area: None
✓ Current use: Open space for active recreational activities, including multi-use athletic fields.

Lopez Canyon Landfill



Toyon Canyon Landfill

Bishops Canyon Landfill

NEW AND IMPROVED BISHOPS CANYON PARK AND RECREATION FACILITY

Bishops Canyon Landfill

The Bishops Canyon Landfill, sited on Department of Recreation and Parks (DRP) property, is uniquely situated in the higher elevations of Elysian Park, creating spectacular views of Los Angeles. The southern portion of the site overlooks Dodger Stadium and the breathtaking Los Angeles skyline. The northern portion of the site overlooks the San Fernando Valley.

In 1993, Sanitation, DRP, and Council District No. 1 held community meetings to create a plan for the development of this old landfill into an integral part of Elysian Park. From these meetings, plans to develop the site into an active recreational area with landscaping were created.

Because funding for this project was limited, it was decided to implement the park development in two phases. The First Phase was funded by Capital Improvement Funds (CIP); the Second Phase was by both CIP and Proposition A – Safe Neighborhood Parks Proposition enacted by voters in 1992 and 1996.

Phase I included a new restroom/snack bar facility, softball and little league fields, a parking area, site grading and drainage, landscaping and irrigation, and hiking trails for a cost of $5.3 million. Construction for Phase I began in January 1996 and was completed in July 1997.

Phase II included another restroom facility, covered group picnic shelters, scattered picnic tables and grills, covered cooking pavilions, tot play lots, and additional landscaping and irrigation improvements. The cost for the Second Phase was $2.6 million. With the completion of Phase construction, Sanitation turned over a state of the art recreational facility to the DRP to operate and maintain.

Before the project, the site was mainly used as open space in Elysian Park and for storage of heavy construction equipment. After Phase I construction, the improved portions of the site were turned over to DRP for management. DRP currently has the Northeast Los Angeles Little League using their facility during the little league season. The other field is also being utilized for other organized sports throughout the year. Besides the organized sports, the site is also used by the local community for active recreation. Residents are walking their dogs and hiking up the trails on the front face and children are enjoying the vast array of tot lots and playground equipment.

From the beginning of the project, disabled access was an integral part of the design. A fully accessible sidewalk winds from above the baseball fields, to the main entrance, and down to the baseball fields. In addition, the parking lot adjacent to the baseball field has four disable accessible parking stalls out of 16 total stalls. Two of the 10 restroom stalls are disabled accessible. The hiking trails mentioned earlier have also been designed with disabled access in mind. The slopes on the trail were limited to 8.33% utilizing benches and switchbacks.

What had been an unused or underutilized site has been turned into a beautiful and functional recreational facility to be enjoyed by the residents of Los Angeles for years to come.

Facts about Bishop:

Address: 929 Academy Road
Los Angeles, CA, 90012
Size: 40 acres
Date opened: 1966
Date closed: 1969
Type of refuse: Class III; residential, street sweepings, construction and demolition materials
Total capacity: 1,700,000 tons
Average depth of fill: 130 feet
Gas management system: An active ventilation system consisting of a several wells connected to a blower to control gas migration is presently in operation
Community outreach program: Sporadic meetings with the community.
Additional expansion area: none
Present and future use: Open space for active recreation, including multi-use athletic fields. Open meadows or various forms of free play, extensive covered and open air picnic areas, four children's play lots and interconnecting trails.

BISHOP'S CANYON SANITARY LANDFILL

LANDSCAPE MASTER PLAN

PLAN MAESTRO DE LA ARQUITECTURA DEL PAISAJE

City of Los Angeles Bureau of Sanitation • Department of Recreation & Parks
iTroller • Mayeri Associates • SCS Engineers

Sheldon/Arleta Landfill

FUTURE CESAR CHAVEZ RECREATION COMPLEX

- 7 Soccer Fields
- 1 Baseball Field
- 1 Softball Field
- 2 Basketball Courts
- Walking/Jogging Path
- Passive Play Area
- Children's Play Area
- Restroom/Office Bldg
- Picnic Area
- Landscaping
- Seating Area


86.5 2

Gaffey Field of Dreams

Gaffey Street Landfill

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

OCTOBER 19, 2006

THE U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 9

WELCOMES THE DELEGATION FROM

THE ENVIRONMENTAL PROTECTION ADMINISTRATION TAIWAN (EPAT)

MR ALEX LIN
SENIOR EXECUTIVE OFFICER

MR YI CHANG HUNG
SENIOR SPECIALIST

MR CHYI ING SU
ASSISTANT SPECIALIST

MR YI HSING LAI
ENGINEER
SINOTECH ENGINEERING CONSULTANTS

AGENDA

INTRODUCTIONS AND WELCOME..... MELANIE BLAHA
International Activities

OVERVIEW..... LATHA RAJAGOPALAN
Environmental Engineer

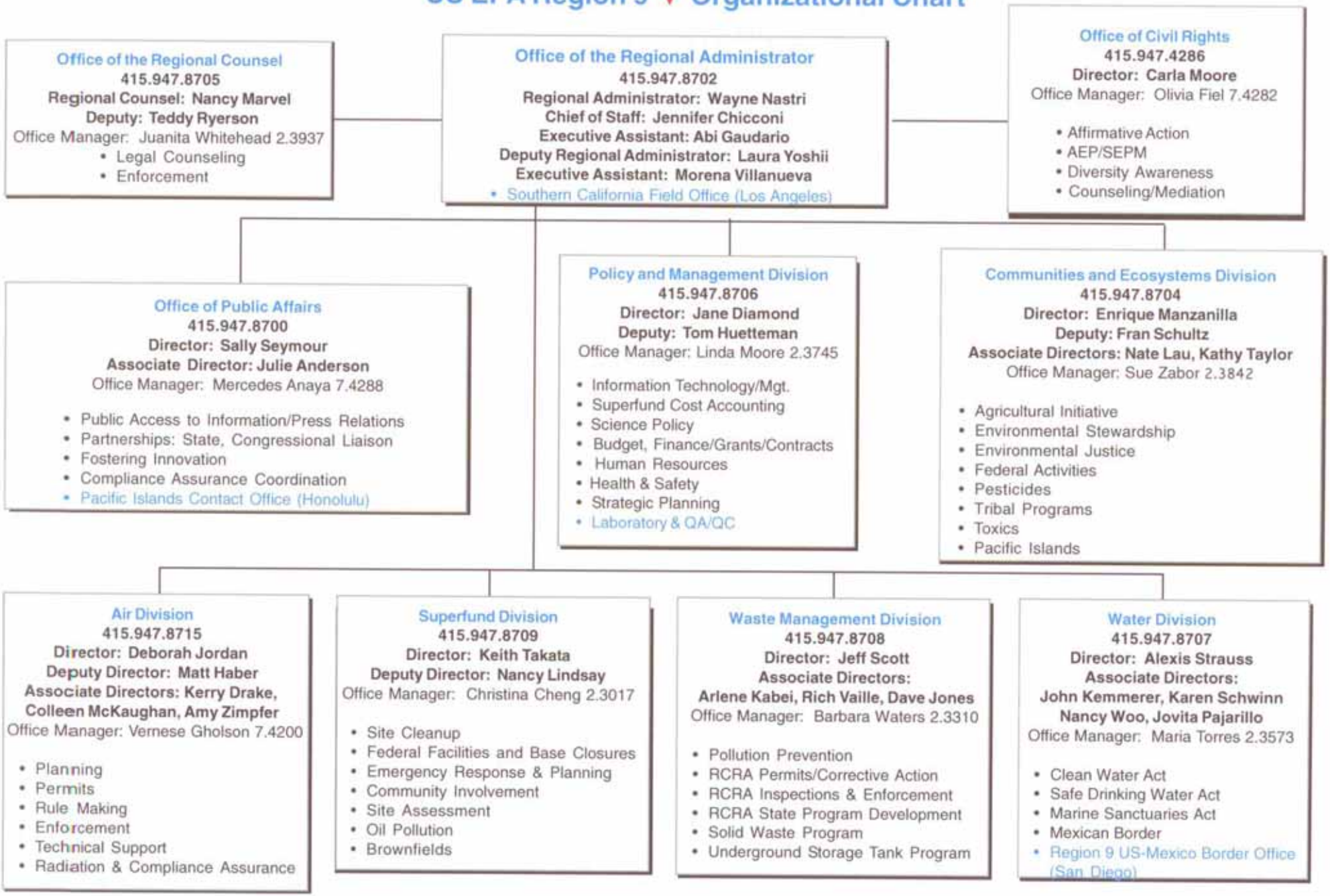
LANDFILL REGULATIONS.....STEVE WALL
Environmental Engineer

LANDFILL HEALTH RISK ASSESSMENT.....PATRICK WILSON
Toxicologist

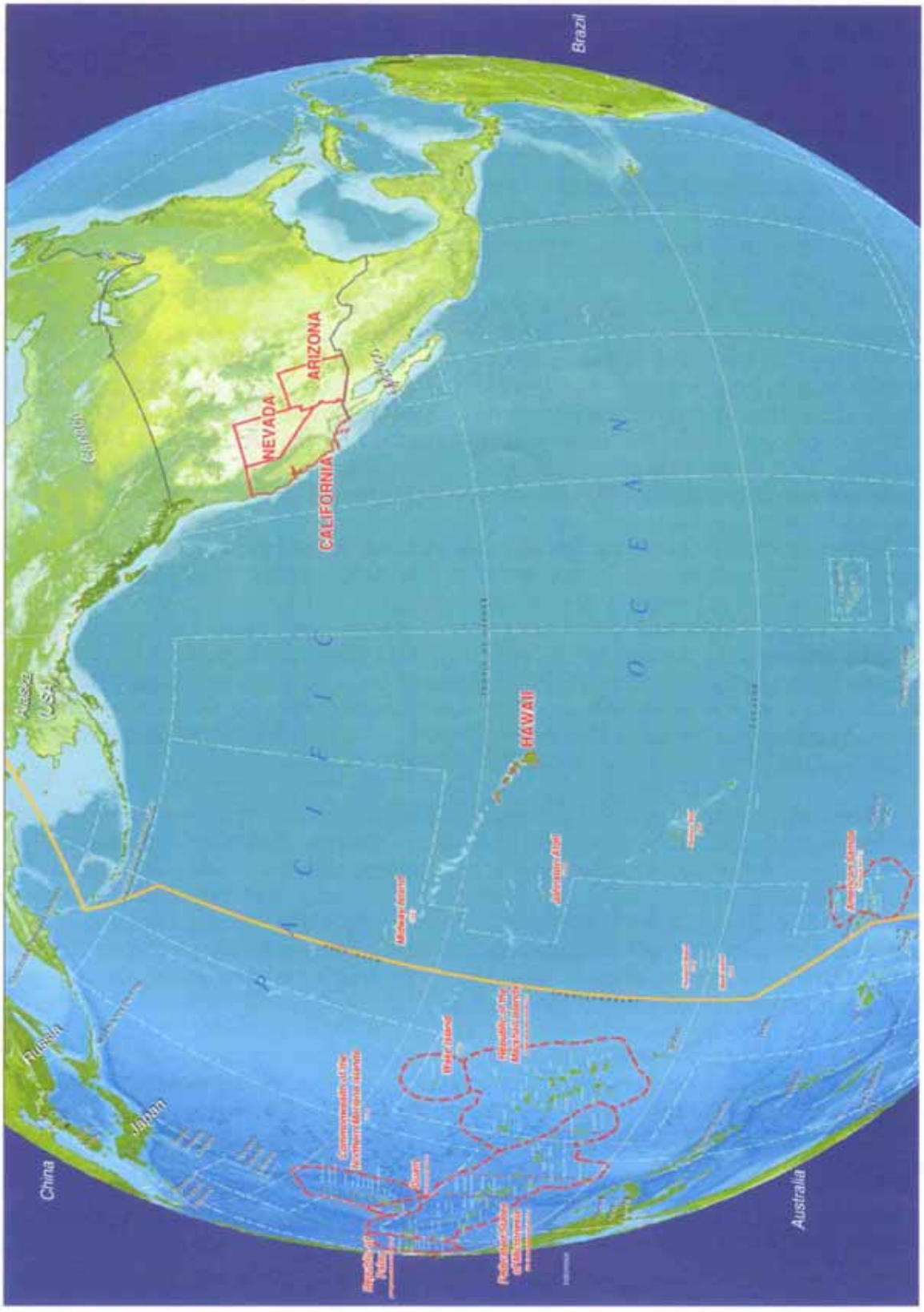
JOINT DISCUSSION ON LANDFILL SAFETY REQUIREMENTS.....ALL

REDEVELOPMENT OF LANDFILL SITES.....S.J. CHERN
Remedial Project Officer

US EPA Region 9 ✧ Organizational Chart



Pacific Southwest/Region 9
US Environmental Protection Agency



17 May 2004

Pacific Southwest/Region 9
US Environmental Protection Agency

Welcome to Region 9 of the US Environmental Protection Agency – The Pacific Southwest Region. Our mission is to protect public health and the environment in the states of Arizona, California, Hawaii, and Nevada; 146 federally recognized tribes; and Pacific Island areas consisting of the Territories of Guam and American Samoa, Commonwealth of the Northern Mariana Islands, and US Possessions of Wake Island and Johnston Atoll. Pursuant to treaty obligations, Region 9 also works with the Republic of Palau, Republic of the Marshall Islands, and the Federated States of Micronesia.

Region 9's landscapes and cultures are the most diverse of any EPA region. The region encompasses the deserts of the Great Basin, as well as California's Mojave Desert and Death Valley. At the other extreme are tropical islands and atolls stretching from Hawaii to Guam, nearly half a world away. Region 9 has more coral reef habitat than all other US states and territories combined. Biologically, California, Hawaii, and the Pacific Islands are among the most diverse areas on earth, with hundreds of habitat types harboring thousands of species which exist nowhere else. Hundreds of these species are officially listed as threatened or endangered.

Culturally, Region 9 includes the indigenous peoples of 146 Indian communities, ranging from the vast Navajo Reservation in the Four Corners area to small California Indian "rancherias" with only a few dozen members; and Native Hawaiians and Pacific Islanders. Region 9's urban areas are home to people from every nation and ethnicity. The 2000 census data shows that ethnic minorities now make up more than half of California's population. Region 9's largest ethnic groups, numerically, are Hispanic, Asian-Pacific, and African-American. There is incredible diversity within these major groupings, as well as those of European ancestry. Region 9's rich tapestry of cultures and landscapes pose many challenges for the EPA.

Protecting human health and the environment is particularly challenging in the context of explosive population and economic fluctuation that has characterized Region 9 in recent years. The region includes four of the fastest growing areas in the US: the five-county southern California area, and the Cities of Phoenix, Las Vegas, and Sacramento. California has the largest state economy, and the Los Angeles/Long Beach Port accounts for 40% of the nation's imports/exports. The region also includes the fast-growing US/Mexico border region, where poverty, lack of infrastructure, and language differences complicate binational cooperation.

In fulfilling our mandate for implementation and enforcement of federal laws, we must maintain effective working relationships with other federal agencies, and state and local governments. Region 9 also has the responsibility of overseeing the cleanup of 35 military bases which closed in the 1990's – nearly a third of the nation's total base closures.

This is the context in which our EPA Pacific Southwest Region, together with state, local, federal, and tribal agency partners, has achieved remarkable progress in the past 30 years.

Municipal Solid Waste Regulatory Overview

Our Mission

Our mission is:

- foster environmentally sound management of solid waste by working with states, territories, and tribes to improve solid waste programs and

State and Federal Role

- The solid waste program is overseen by the states, and compliance is assured through state-issued permits.

- Each state must receive EPA approval for its program. This assures state programs comply with federal criteria under RCRA Subtitle D. All of Region 9's states have approved programs.

Federal Regulations

- Design and operation of municipal solid waste landfills is covered under RCRA Subtitle D, 40 CFR 258.
- States can have requirements that are more stringent than the federal requirements.
- EPA's responsibility to the states is to provide information and guidance on policy and regulations

Subtitle D Regulates: . (Regulations in 40 CFR Part 258, became effective on Oct. 9, 1993.)

Landfill Minimum Criteria include:

- No landfills in unstable or seismic areas.
- Composite liners (usually polyethylene plus clay) and leachate collection systems for new landfills.
- Newly disposed waste covered each night with six inches of dirt.
- Landfill gas and groundwater monitoring plus corrective action if needed.
- Closure and post-closure plans.
- Financial assurance requirements to assure that adequate funds will be available to perform closure, post-closure, and corrective action.

How can I get additional information about solid waste?

Steve Wall
Office of Pollution Prevention and Solid Waste (WST-7)
US EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105
415-972-3381 phone/415-947-3530 fax
wall.steve@epa.gov

Web Sites:

U.S. EPA Region 9 Solid Waste Program: http://www.epa.gov/region09/waste/solid/index.htm

U.S. EPA Office of Solid Waste: http://www.epa.gov/osw/

RCRA Subtitle D, 40 CFR 258. MSW Landfill Regulations:

Part 258 — Criteria For Municipal Solid Waste Landfills
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=dca0278b925c46e01eecbb039efce787&rgn=div5&view=text&node=40:24.0.1.4.38&idno=40

Subpart F——Closure and Post-Closure Care:
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=18a03b717db5d932e8fff0e574fc8378&rgn=div6&view=text&node=40:24.0.1.4.38.6&idno=40

Criteria for Solid Waste Disposal Facilities: A Guide for Owners/Operators
http://www.epa.gov/epaoswer/non-hw/muncpl/criteria.htm

Municipal Solid Waste Landfill Criteria——Technical Manual
http://www.epa.gov/epaoswer/non-hw/muncpl/landfill/techman/index.htm

Solid Waste Association of North America: http://www.swana.org/

Association of State and Territorial Solid Waste Management Officials (ASTSWMO):
http://www.astswmo.org/

Code of Federal Regulations (CFR)

TITLE 40--Protection of Environment

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER I--SOLID WASTES

PART 258--CRITERIA FOR MUNICIPAL SOLID WASTE LANDFILLS

http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=01d70efd40e1ad3843f185428feebf99&tpl=/ecfrbrowse/Title40/40cfr258_main_02.tpl

---

Subpart A--GENERAL

Subpart B--LOCATION RESTRICTIONS

Subpart C--OPERATING CRITERIA

§258.20	Procedures for excluding the receipt of hazardous waste.
§258.21	Cover material requirements.
§258.22	Disease vector control.
§258.23	Explosive gases control.
§258.24	Air criteria.
§258.25	Access requirements.
§258.26	Run-on/run-off control systems.
§258.27	Surface water requirements.
§258.28	Liquids restrictions.
§258.29	Recordkeeping requirements.
§§258.30-258.39	[Reserved]

Subpart D--DESIGN CRITERIA

§258.40	Design criteria.
§258.41	Project XL Bioreactor Landfill Projects.
§§258.42-258.49	[Reserved]

Subpart E--GROUND-WATER MONITORING AND CORRECTIVE ACTION

§258.50	Applicability.
§258.51	Ground-water monitoring systems.
§258.52	[Reserved]
§258.53	Ground-water sampling and analysis requirements.
§258.54	Detection monitoring program.
§258.55	Assessment monitoring program.

Subpart F--CLOSURE AND POST-CLOSURE CARE

Subpart G--FINANCIAL ASSURANCE CRITERIA

Electronic Code of Federal Regulations (e-CFR)

BETA TEST SITE

e-CFR Data is current as of October 17, 2006

Title 40: Protection of Environment
PART 258—CRITERIA FOR MUNICIPAL SOLID WASTE LANDFILLS

Browse Previous | Browse Next

Subpart F—Closure and Post-Closure Care

§ 258.60 Closure criteria.

(a) Owners or operators of all MSWLF units must install a final cover system that is designed to minimize infiltration and erosion. The final cover system must be designed and constructed to:

(1) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less, and

(2) Minimize infiltration through the closed MSWLF by the use of an infiltration layer that contains a minimum 18-inches of earthen material, and

(3) Minimize erosion of the final cover by the use of an erosion layer that contains a minimum 6-inches of earthen material that is capable of sustaining native plant growth.

(b) The Director of an approved State may approve an alternative final cover design that includes:

(1) An infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (a)(1) and (a)(2) of this section, and

(2) An erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in paragraph (a)(3) of this section.

(3) The Director of an approved State may establish alternative requirements for the infiltration barrier in a paragraph (b)(1) of this section, after public review and comment, for any owners or operators of MSWLFs that dispose of 20 tons of municipal solid waste per day or less, based on an annual average. Any alternative requirements established under this paragraph must:

(i) Consider the unique characteristics of small communities;

(ii) Take into account climatic and hydrogeologic conditions; and

(iii) Be protective of human health and the environment.

(c) The owner or operator must prepare a written closure plan that describes the steps necessary to close all MSWLF units at any point during their active life in accordance with the cover design requirements in §258.60(a) or (b), as applicable. The closure plan, at a minimum, must include the following information:

(1) A description of the final cover, designed in accordance with §258.60(a) and the methods and procedures to be used to install the cover;

(2) An estimate of the largest area of the MSWLF unit ever requiring a final cover as required under §258.60(a) at any time during the active life;

(3) An estimate of the maximum inventory of wastes ever on-site over the active life of the landfill facility; and

(4) A schedule for completing all activities necessary to satisfy the closure criteria in §258.60.

(d) The owner or operator must notify the State Director that a closure plan has been prepared and placed in the operating record no later than the effective date of this part, or by the initial receipt of waste, whichever is later.

(e) Prior to beginning closure of each MSWLF unit as specified in §258.60(f), an owner or operator must notify the State Director that a notice of the intent to close the unit has been placed in the operating record.

(f) The owner or operator must begin closure activities of each MSWLF unit no later than 30 days after the date on which the MSWLF unit receives the known final receipt of wastes or, if the MSWLF unit has remaining capacity and there is a reasonable likelihood that the MSWLF unit will receive additional wastes, no later than one year after the most recent receipt of wastes. Extensions beyond the one-year deadline for beginning closure may be granted by the Director of an approved State if the owner or operator demonstrates that the MSWLF unit has the capacity to receive additional wastes and the owner or operator has taken and will continue to take all steps necessary to prevent threats to human health and the environmental from the unclosed MSWLF unit.

(g) The owner or operator of all MSWLF units must complete closure activities of each MSWLF unit in accordance with the closure plan within 180 days following the beginning of closure as specified in paragraph (f) of this section. Extensions of the closure period may be granted by the Director of an approved State if the owner or operator demonstrates that closure will, of necessity, take longer than 180 days and he has taken and will continue to take all steps to prevent threats to human health and the environment from the unclosed MSWLF unit.

(h) Following closure of each MSWLF unit, the owner or operator must notify the State Director that a certification, signed by an independent registered professional engineer or approved by Director of an approved State, verifying that closure has been completed in accordance with the closure plan, has been placed in the operating record.

(i)(1) Following closure of all MSWLF units, the owner or operator must record a notation on the deed to the landfill facility property, or some other instrument that is normally examined during title search, and notify the State Director that the notation has been recorded and a copy has been placed in the operating record.

(2) The notation on the deed must in perpetuity notify any potential purchaser of the property that:

(i) The land has been used as a landfill facility; and

(ii) Its use is restricted under §258.61(c)(3).

(j) The owner or operator may request permission from the Director of an approved State to remove the notation from the deed if all wastes are removed from the facility.

[56 FR 51016, Oct. 9, 1991; 57 FR 28628, June 26, 1992, as amended at 62 FR 40713, July 29, 1997]

§ 258.61 Post-closure care requirements.

(a) Following closure of each MSWLF unit, the owner or operator must conduct post-closure care. Post-closure care must be conducted for 30 years, except as provided under paragraph (b) of this section, and consist of at least the following:

(1) Maintaining the integrity and effectiveness of any final cover, including making repairs to the cover as

necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;

(2) Maintaining and operating the leachate collection system in accordance with the requirements in §258.40, if applicable. The Director of an approved State may allow the owner or operator to stop managing leachate if the owner or operator demonstrates that leachate no longer poses a threat to human health and the environment;

(3) Monitoring the ground water in accordance with the requirements of subpart E of this part and maintaining the ground-water monitoring system, if applicable; and

(4) Maintaining and operating the gas monitoring system in accordance with the requirements of §258.23.

(b) The length of the post-closure care period may be:

(1) Decreased by the Director of an approved State if the owner or operator demonstrates that the reduced period is sufficient to protect human health and the environment and this demonstration is approved by the Director of an approved State; or

(2) Increased by the Director of an approved State if the Director of an approved State determines that the lengthened period is necessary to protect human health and the environment.

(c) The owner or operator of all MSWLF units must prepare a written post-closure plan that includes, at a minimum, the following information:

(1) A description of the monitoring and maintenance activities required in §258.61(a) for each MSWLF unit, and the frequency at which these activities will be performed;

(2) Name, address, and telephone number of the person or office to contact about the facility during the post-closure period; and

(3) A description of the planned uses of the property during the post-closure period. Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this part 258. The Director of an approved State may approve any other disturbance if the owner or operator demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of waste, will not increase the potential threat to human health or the environment.

(d) The owner or operator must notify the State Director that a post-closure plan has been prepared and placed in the operating record no later than the effective date of this part, October 9, 1993, or by the initial receipt of waste, whichever is later.

(e) Following completion of the post-closure care period for each MSWLF unit, the owner or operator must notify the State Director that a certification, signed by an independent registered professional engineer or approved by the Director of an approved State, verifying that post-closure care has been completed in accordance with the post-closure plan, has been placed in the operating record.

[56 FR 51016, Oct. 9, 1991; 57 FR 28628, June 26, 1992]

§§ 258.62-258.69 [Reserved]

Browse Previous | Browse Next

Section 508 / Accessibility

Last updated: August 7, 2006

United States
Environmental Protection
Agency

Solid Waste
and Emergency Response
(5306W)

EPA530-F-97-001
July 1997

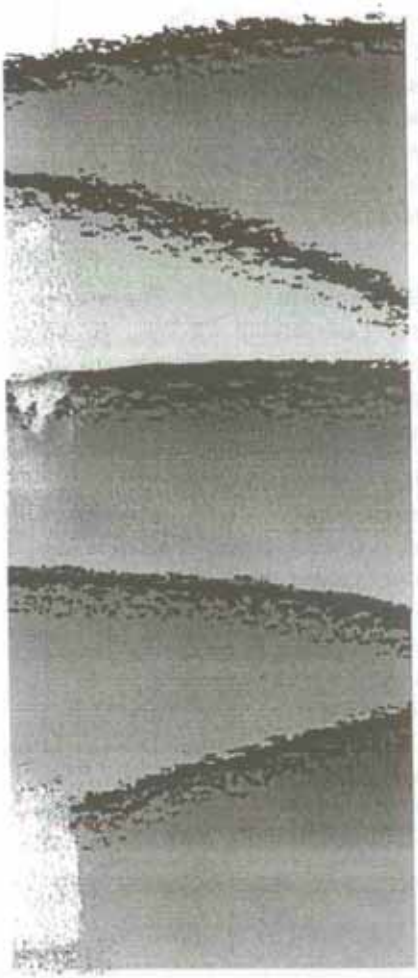
Landfill Reclamation

This fact sheet describes new and innovative technologies and products that meet the performance standards of the Criteria for Municipal Solid Waste Landfills (40 CFR Part 258).

Landfill reclamation is a relatively new approach used to expand municipal solid waste (MSW) landfill capacity and avoid the high cost of acquiring additional land. Reclamation costs are often offset by the sale or use of recovered materials, such as recyclables, soil, and waste, which can be burned as fuel. Other important benefits may include avoided liability through site remediation, reductions in closure costs, and reclamation of land for other uses.

Despite its many benefits, some potential drawbacks exist to landfill reclamation. This technology may release methane and other gases, for example, that result from decomposing wastes. It may also unearth hazardous materials, which can be costly to manage. In addition, the excavation work involved in reclamation may cause adjacent landfill areas to sink or collapse. Finally, the dense, abrasive nature of reclaimed waste may shorten the life of excavation equipment. To identify potential problems, landfill operators considering reclamation activities should conduct a site characterization study.

Landfill reclamation projects have been successfully implemented at MSW facilities across the country since the 1980s. This fact sheet provides information on this technology and presents case studies of successful reclamation projects.



The Reclamation Process

Landfill reclamation is conducted in a number of ways, with the specific approach based on project goals and objectives and site-specific characteristics. The equipment used for reclamation projects is adapted primarily from technologies already in use in the mining industry, as well as in construction and other solid waste management operations. In general, landfill reclamation follows these steps:

Excavation

An excavator removes the contents of the landfill cell. A front-end loader then organizes the excavated materials into manageable stockpiles and separates out bulky material, such as appliances and lengths of steel cable.

Soil Separation (Screening)

A trommel (i.e., a revolving cylindrical sieve) or vibrating screens separate soil (including the cover material) from solid waste in the excavated material. The size and type of screen used depends on the end use of the recovered material. For example, if the reclaimed soil typically is used as landfill cover, a 2.5-inch screen is used for separation. If, however, the reclaimed soil is sold as construction fill, or for another end use requiring fill material with a high fraction of soil content, a smaller mesh screen is used to remove small pieces of metal, plastic, glass, and paper.

Trommel screens are more effective than vibrating screens for basic landfill reclamation. Vibrating screens, however, are smaller, easier to set up, and more mobile.

Processing for Reclamation of Recyclable Material or Disposal

Depending on local conditions, either the soil or the waste may be reclaimed. The separated soil can be used as fill material or as daily cover in a sanitary landfill. The excavated waste can be processed at a materials recovery facility to remove valuable components (e.g., steel and aluminum) or burned in a municipal waste combustor (MWC) to produce energy.

Steps in Project Planning

Before initiating a landfill reclamation project, facility operators should carefully assess all aspects of such an effort.

The following is a recommended approach:

1. Conduct a site characterization study.
2. Assess potential economic benefits.
3. Investigate regulatory requirements.
4. Establish a preliminary worker health and safety plan.
5. Assess project costs.

Benefits and Drawbacks

Facility operators considering the establishment of a landfill reclamation program must weigh several benefits and drawbacks associated with this waste management approach.

Potential Benefits

Extending landfill capacity at the current site
Landfill reclamation extends the life of the current facility by removing recoverable materials and reducing waste volume through combustion and compaction.

Generating revenues from the sale of recyclable materials
Recovered materials, such as ferrous metals, aluminum, plastic, and glass, can be sold if markets exist for these materials.

Lowering operating costs or generating revenues from the sale of reclaimed soil
Reclaimed soil can be used on site as daily cover material on other landfill cells, thus avoiding the cost of importing cover soil. Also, a market might exist for reclaimed soil used in other applications, such as construction fill.

Producing energy at MWCs
Combustible reclaimed waste can be mixed with fresh waste and burned to produce energy at MWCs.

Reducing landfill closure costs and reclaiming land for other uses
By reducing the size of the landfill "footprint" through cell reclamation, the facility operator may be able to either lower the cost of closing the landfill or make land available for other uses.

Retrofitting liners and removing hazardous materials
Liners and leachate collection systems can be installed at older landfills. These systems can be inspected and repaired if they are already installed. Also, hazardous waste can be removed and managed in a more secure fashion.

Potential Drawbacks

Managing hazardous materials
Hazardous wastes that may be uncovered during reclamation operations, especially at older landfills, are subject to special handling and disposal requirements. Management costs for hazardous waste can be relatively high, but may reduce future liability.

Controlling releases of landfill gases and odors
Cell excavation raises a number of potential problems related to the release of gases. Methane and other gases, generated by decomposing wastes, can cause explosions and fires. Hydrogen sulfide gas, a highly flammable and odorous gas, can be fatal when inhaled at sufficient concentrations.

Controlling subsidence or collapse
Excavation of one landfill area can undermine the integrity of adjacent cells, which can sink or collapse into the excavated area.

Increasing wear on excavation and MWC equipment
Reclamation activities shorten the useful life of equipment, such as excavators and loaders, because of the high density of waste being handled. Also, the high particulate content and abrasive nature of reclaimed waste can increase wear on MWC equipment (e.g., grates and air pollution control systems).

This planning sequence assumes that project planners will make an interim assessment of the project's feasibility after each planning step. After completion of all five steps, planners should conclude the feasibility assessment by weighing costs against benefits. A thorough final assessment should include a review of project goals and objectives and consideration of alternative approaches for achieving those ends.

Conduct a Site Characterization Study

The first step in a landfill reclamation project calls for a thorough site assessment to establish the portion of the landfill that will undergo reclamation and estimate a material processing rate.

The site characterization should assess facility aspects, such as geological features, stability of the surrounding area, and proximity of ground water, and should determine the fractions of usable soil, recyclable material, combustible waste, and hazardous waste at the site.

Assess Potential Economic Benefits

Information collected in the site characterization provides project planners with a basis for assessing the potential economic benefits of a reclamation project. If the planners identify likely financial benefits for the undertaking, then the assessment will provide support for further investing in project planning. Although economics are likely to serve as the principal incentive for a reclamation project, other considerations may also come into play, such as a communitywide commitment to recycling and environmental management.

Most potential economic benefits associated with landfill reclamation are indirect; however, a project can generate revenues if markets exist for recovered materials. Although the economic benefits from reclamation projects are facility-specific, they may include any or all of the following:

- Increased disposal capacity.
- Avoided or reduced costs of:
  - —Landfill closure.
  - —Postclosure care and monitoring.
  - —Purchase of additional capacity or sophisticated systems.
  - —Liability for remediation of surrounding areas.
- Revenues from:
  - —Recyclable and reusable materials (e.g., ferrous metals, aluminum, plastic, and glass).
  - —Combustible waste sold as fuel.
  - —Reclaimed soil used as cover material, sold as construction fill, or sold for other uses.
- Land value of sites reclaimed for other uses.

Thus, this step in project planning calls for investigating the following areas:

- Current landfill capacity and projected demand.
- Projected costs for landfill closure or expansion of the site.
- Current and projected costs of future liabilities.
- Projected markets for recycled and recovered materials.
- Projected value of land reclaimed for other uses.

Investigate Regulatory Requirements

Landfill reclamation operations are not restricted under current federal regulations. Before undertaking a reclamation project, however, state and local authorities should be consulted regarding any special requirements. Although some states have enacted general provisions concerning the beneficial use of recovered materials, as of 1996, only New York State had established specific landfill reclamation rules. In most states, officials offer assistance in project development, and they review work plans on a case-by-case basis. A few states, such as New York and New Jersey, encourage landfill reclamation by making grant money available.

Establish a Preliminary Worker Health and Safety Plan

After project planners establish a general framework for the landfill reclamation effort, they must account for the health and safety risks the project will pose for facility workers. Once potential risks are identified from the site characterization study and historical information about facility operations, methods to mitigate or eliminate them should be developed. This information then becomes part of a comprehensive health and safety program. Before the reclamation operation begins, all workers who will be involved in the project need to be well versed in the safety plan and receive training in emergency response procedures.

Drawing up a safety and health plan can be particularly challenging given the difficulty of accurately characterizing the nature of material buried in a landfill. Project workers are likely to encounter some hazardous materials; therefore, the health and safety program should account for a variety of materials handling and response scenarios.

Although the health and safety program should be based on site-specific conditions and waste types, as well as project goals and objectives, a typical health and safety program might call for the following:

- Hazard communication (i.e., a "Right to Know" component) to inform personnel of potential risks.
- Respiratory protection measures, including hazardous material identification and assessment; engineering controls; written standard operating procedures; training in equipment use, respirator selection, and fit testing; proper storage of materials; and periodic reevaluation of safeguards.
- Confined workspace safety procedures, including air quality testing for explosive concentrations, oxygen deficiency, and hydrogen sulfide levels, before any worker enters a confined space (e.g., an excavation vault or a ditch deeper than 3 feet).
- Dust and noise control.
- Medical surveillance stipulations that are mandatory in certain circumstances and optional in others.
- Safety training that includes accident prevention and response procedures regarding hazardous materials.
- Recordkeeping.

The program should also cover the protective equipment workers will be required to wear, especially if hazardous wastes may be unearthed. The three categories of safety equipment used in landfill reclamation projects are:

- Standard safety equipment (e.g., hard hats, steel-toed shoes, safety glasses and/or face shields, protective gloves, and hearing protection).
- Specialized safety equipment (e.g., chemically protective overalls, respiratory protection, and self-contained breathing apparatus).
- Monitoring equipment (e.g., a combustible gas meter, a hydrogen sulfide chemical reagent diffusion tube indicator, and an oxygen analyzer).

Assess Project Costs

Planners can use information collected from the preceding steps to analyze the estimated capital and operational costs of a landfill reclamation operation. Along with the expenses incurred in project planning, project costs may also include the following:

- Capital costs:
  - — Site preparation.
  - — Rental or purchase of reclamation equipment.
  - — Rental or purchase of personnel safety equipment.
  - — Construction or expansion of materials handling facilities.
  - — Rental or purchase of hauling equipment.
- Operational costs:
  - — Labor (e.g., equipment operation and materials handling).
  - — Equipment fuel and maintenance.
  - — Landfilling nonreclaimed waste or noncombustible fly and bottom ash if waste material is sent off site for final disposal.
  - — Administrative and regulatory compliance expenses (e.g., recordkeeping).
  - — Worker training in safety procedures.
  - — Hauling costs.

Part of the cost analysis involves determining whether the various aspects of the reclamation effort will result in reasonable costs relative to the anticipated economic benefits. If the combustible portion of the reclaimed waste will be sent to an offsite MWC, for example, planners should assess whether transportation costs will be offset by the energy recovery benefits. Planners also need to consider whether capital costs can be minimized by renting or borrowing heavy equipment, such as excavating and trommel machinery, from other departments of municipal or county governments. Long-term reclamation projects may benefit from equipment purchases.

Case Studies

Table 1. Landfill Reclamation Project Summaries

Project	Operation Start	Mined Area	Use of Recovered Material	Main Objectives
Naples Landfill (Collier County, Florida)	April 1986 (ongoing).	10 acres	Cover material.	Decrease liability. Recover soil.
Edinburg Landfill (Edinburg, New York)	Dec. 1990 and June 1991 (both completed).	1 acre		Alternative to landfill closure.
	Aug. - Sept. 1992 (completed).	1.6 acre	Construction fill.	Reduce landfill footprint.
Frey Farm Landfill (Lancaster County, Pennsylvania)	Jan. 1991 - July 1996 (completed).	300,000 to 400,000 cubic yards	Waste-to-energy fuel. Cover material.	Recover fuel. Reuse of landfill capacity.

Source Based on: Dickinson, 1995.

Naples Landfill Collier County, Florida

In 1986, the Collier County Solid Waste Management Department at the Naples Landfill conducted one of the earliest landfill reclamation projects in the country. At that time, the Naples facility, a 33-acre unlined landfill, contained MSW buried for up to 15 years.

In an evaluation performed by the University of Florida on 38 of the state's unlined landfills, investigators discovered that the Naples Landfill (along with 27 others) posed a threat to ground water. Moreover, the high cost of complying with the state's capping regulations for unlined landfills concerned many county officials. Florida's capping regulations required the installation of a relatively impermeable cover or cap and postclosure monitoring.

Naples officials developed a reclamation plan with the following objectives: decreasing site closure costs, reducing the risk of groundwater contamination, recovering and burning combustible waste in a proposed waste-to-energy facility, recovering soil for use as landfill cover material, and recovering recyclable materials. Collier County never built the waste-to-energy plant. The project did prove successful, however, in recovering landfill cover material. The project proved less successful at recycling recovered materials (e.g., ferrous metals, plastics, and aluminum). These materials required substantial processing to upgrade their quality for sale, something the county chose not to pursue.

In 1991, the U.S. Environmental Protection Agency selected the Naples Landfill reclamation project as a demonstration project for the Municipal Solid Waste Innovative Technology Evaluation (MITE) program. The MITE program assessed the excavation and mechanical processing techniques used in the project for reclaiming cover material to be used in ongoing landfill operations. It also assessed the capacity and performance of equipment, the environmental aspects of the project, the characteristics of recovered materials, the market acceptability of recovered materials, and the probable costs and economics of the overall project. The MITE assessment found the processing techniques used in the Naples project effective and efficient for recovering soil but not for recovering recyclables of marketable quality.

During the MITE demonstration project, Collier County effectively and efficiently recovered a soil fraction deemed environmentally safe under Florida's MSW compost regulations. The 50,000 tons of reclaimed soil were suitable for use as a landfill cover material and as a soil medium for supporting plant growth.

The mention of publications, products, or organizations in this fact sheet does not constitute or imply endorsement or approval for use by the U.S. Environmental Protection Agency.

Pennsylvania

In 1990, the Lancaster County Solid Waste Management Authority constructed an MWC to use in reducing the volume of waste deposited in the

operations. During reclamation, workers took precautions to avoid damaging the site's synthetic liner, since it would be reused following the reclamation operations. An initial layer of

wear and tear on equipment.)

By 1996, MWC facility operators no longer needed supplemental feed materials from Frey Farm Landfill to

Air quality monitoring indicated that landfill gas was not an issue at the reclamation site, apparently due to the high degree of waste decomposition that had already occurred. As a result of this finding, typical personnel protective gear worn during the project consisted of standard construction apparel.

Ongoing reclamation activities at the Naples facility focus exclusively on recovering soil for use as landfill cover material. All excavated materials other than the reclaimed soil and small amounts of recyclables are redisposed of in lined landfill cells. Reclamation activities are only performed on an as-needed basis. A 3-inch trommel screen is used to reclaim the soil cover material. The weight ratio of reclaimed soil to overs (i.e., materials caught by the screen), after white goods and tires are separated, is 60 to 40. This indicates that the Collier County landfill reclamation project is efficient given that 60 percent of the reclaimed material is reused as landfill cover material.

Based on 1995 prices, landfill cover material costs Collier County $3.25 per ton. According to Collier County's director of solid waste, the reclamation of cover material on an as-needed basis costs the county $2.25 per ton, a savings of $1 per ton.

According to county officials, the reclamation project yielded the following benefits: lower operating costs through reuse of cover materials, extended landfill life, reduced potential for ground-water contamination from unlined cells, and possible avoidance of future remediation costs.

Edinburg Landfill Edinburg, New York

The New York State Energy Research and Development Authority (NYSERDA) and the New York State Department of Environmental Conservation sponsored projects to assess the feasibility and cost-effectiveness of undertaking landfill reclamation efforts to avoid closures and reduce the footprint of state landfills. NYSERDA established these projects in anticipation of the closure of numerous landfills in New York State, and based, in part, on the success of the Naples Landfill reclamation project.

NYSERDA's first demonstration project was conducted at a 5-acre MSW landfill in Edinburg, New York, which received waste from 1969 to 1991. NYSERDA chose the Edinburg Landfill because of its small size and lack of buried industrial waste. After NYSERDA chose to sponsor the reclamation of 1 acre of the 5-acre landfill, Edinburg town officials expanded the project to reclaim 1.6 additional acres.

NYSERDA divided the Edinburg demonstration project into three phases. The first phase, started in December 1990, included the excavation of 5,000 cubic yards of waste from a 12-year-old section of the landfill at an average depth of 20 feet. The second phase, initiated in June 1991, included the excavation of 10,000 cubic yards of waste from a 20-year-old section of the landfill at an average depth of 8 feet. The first two phases of the demonstration project cost an estimated $5 per cubic yard for excavation and processing. This cost included the inspection and supervision of a fully contracted operation and was based on an average excavation rate of 1,000 to 1,200 cubic yards per day.

The third phase of the Edinburg project occurred from August to September 1992. NYSERDA provided the majority of the project funding, with the remaining funding (primarily for phase three) provided by the town of Edinburg. This third and final phase reclaimed an additional 1.6 acres (31,000 cubic yards) in 28 days. Because the town supplied required equipment and labor, the contracted cost for this phase decreased from $5 per cubic yard excavated to $3 per cubic yard. Subsequently, the town looked into reclaiming the remaining 2.4 acres of the landfill and completely eliminating the footprint. The proposed fourth stage proved unviable, so the remaining portion of the landfill will be capped.

The Edinburg Landfill is located in a soil-rich area that provides ample amounts of landfill cover material. For this reason, officials tested and approved the reclaimed soil (75 percent of the reclaimed material) for offsite use as construction fill in nonsurface applications. A test burn performed on the reclaimed waste found the British thermal unit (Btu) value to be lower than desired because of the high degree of waste decomposition and stones remaining in the screened material.

The recovered nonsoil materials, representing 25 percent of the reclaimed waste, were hand-sorted for potential recyclables. Although 50 percent of the nonsoil material was considered recyclable, cleaning the materials to market standards was not feasible. Some tires, white goods, and ferrous metals, however, were separated and recycled. The remaining materials were sent to a nearby landfill.

NYSERDA officials developed a worker health and safety plan for the Edinburg project that established work zones, personnel protection requirements, and other operating procedures. The inspectors, as well as all personnel working at the site, were required to wear respirators, goggles, helmets, and protective suits. Excavation equipment was used to separate suspicious drums and other potentially hazardous material for evaluation by the safety inspector using appropriate monitoring equipment. In the event that hazardous materials were encountered, the health and safety plan provided for a project contingency plan, a segregated disposal area, and special waste handling procedures. No significant quantities of hazardous materials, however, were unearthed.

The Edinburg Landfill Reclamation Project was successful both in securing offsite uses for the reclaimed soil and in reducing the landfill footprint to decrease closure costs. The economic benefits would be enhanced further if the avoided costs for postclosure maintenance and monitoring, as well as potential remediation and the value of recovered landfill space, are also considered.

Frey Farm Landfill Lancaster County, Pennsylvania

In 1990, the Lancaster County Solid Waste Management Authority constructed an MWC to use in reducing the volume of waste deposited in the Frey Farm Landfill, a lined site (double layers of 60-mil high density polyethylene sheeting on a 6-inch clay sub-base) containing MSW deposited for up to 5 years. After building the MWC, the quantity of waste received at the facility declined, leaving a significant portion of the MWC capacity unused. In an effort to increase the energy production and efficiency of the MWC, officials initiated a landfill reclamation project to augment the facility's supply of fresh waste with reclaimed waste.

The reclaimed waste had a high Btu value (about 3,080 Btu per pound). To achieve a more efficient, higher heating value of 5,060 Btu per pound of waste, four parts of fresh waste, which included tires and woodchips, were mixed with one part reclaimed waste.

Between 1991 and 1993, approximately 287,000 cubic yards of MSW were excavated from the landfill. These reclamation activities processed 2,645 tons of screened refuse per week for the MWC. As a result, Lancaster County converted 56 percent of the reclaimed waste into fuel. The county also recovered 41 percent of the reclaimed material as soil during trommeling operations. The remaining 3 percent proved noncombustible and was reburied in the landfill. By the end of the project in 1996, landfill operators had reclaimed 300,000 to 400,000 cubic yards of material.

Before the reclamation work began, officials prepared a safety plan for work at the site and assigned a full-time compliance officer to oversee the operations. During reclamation, workers took precautions to avoid damaging the site's synthetic liner, since it would be reused following the reclamation operations. An initial layer of protective material surrounded the synthetic liner system, aiding worker precautions by acting as a buffer between the liner and the excavation tools. Continuous air monitoring for methane, both in the cabs of vehicles and in the reclamation area, enhanced the operation's safety operations.

Benefits of the project at Frey Farm Landfill include: reclaimed landfill space, supplemented energy production, and recovered soil and ferrous metals. Drawbacks include: increased generation of ash caused by the high soil content found in reclaimed waste, increased odor and air emissions, increased traffic on roads between the MWC and the landfill, and increased wear on both the landfill operation and MWC equipment (i.e., due to the abrasive properties of the reclaimed waste).

Costs for the resource recovery portion of the project were relatively low for the following reasons:

- The distance for transporting both the reclaimed waste and the ash was only 18 miles each way.
- The management authority avoided commercial hauling prices by using its own trucks and employees to transport the reclaimed waste and the ash.
- The landfill and MWC were operated by the same management authority, thus no tipping fees were required. (Generally, a higher tipping fee can be charged at an MWC for reclaimed waste because of its abrasiveness and higher density, which increases the wear and tear on equipment.)

By 1996, MWC facility operators no longer needed supplemental feed materials from Frey Farm Landfill to run at full capacity. Thus, landfill officials concluded the reclamation project in July of that year.

References

Dickinson, W. 1995. Landfill mining comes of age. Solid Waste Technologies, March/April:46.

Forster, G. 1994. Assessment of Landfill Mining and the Effects of Age on Combustion of Recovered Municipal Solid Waste. Landfill Reclamation Conference, Lancaster, PA.

Morelli, J. 1992. Town of Edinburg Landfill Reclamation Demonstration Project. Doc. 92-4. New York State Energy Research and Development Authority, Albany, NY.

Morelli, J. 1993. Town of Edinburg Landfill Reclamation Demonstration Project: Report Supplement. Doc. 93-7. New York State Energy Research and Development Authority, Albany, NY.

Russel, D. 1995. Director of the Solid Waste Department at Collier County, FL, Landfill. Personal communication by telephone on January 7.

Salerni, E. 1995. SSB Environmental, Primary Contractor for Edinburg Landfill. Personal communication by telephone on December 8.

Visalli, J., and J. Reis. 1993. Town of Edinburg Reclamation Demonstration Project: Report Supplement. New York State Energy Research and Development Authority, New York, NY. May. p. 5-11.

Sources of Additional Information

Aquino, J.T. 1994. Landfill reclamation attracts attention and questions. Waste Age, December:63-65 & 68.

Bader, C.D. 1994. Beauty in landfill mining: More than skin deep. MSW Management, March/April:54-63.

Childe, D.E. 1994. Landfill Reclamation Health and Safety Issues. Landfill Reclamation Conference, Lancaster, PA.

Donegan, T.A. 1992. Landfill mining: An award-winning solution to an environmental problem. The Westchester Engineer, April:56(8).

Forster, G. 1995. Assessment of Landfill Reclamation and the Effects of Age on Combustion of Recovered Municipal Solid Waste. Golden, CO, National Renewable Energy Laboratory. January.

Gagliardo, P.F., and T.L. Steele. 1991. Taking steps to extend the life of San Diego's landfill. Solid Waste and Power, June:34-40.

Guerriero, J.R. 1994. Landfill Reclamation and Its Applicability to Solid Waste Management. Landfill Reclamation Conference, Lancaster, PA.

Guerriero, J.R., and D.E. Vollero. 1992. Landfill Mining Feasibility Study. Presented at the Second U.S. Conference on Municipal Solid Waste Management. June.

Kelly, W.R. 1990. Buried treasure. Civil Engineering, April:52-54.

LCSWMA. 1992. Landfill Reclamation. Lancaster County Solid Waste Management Authority, Lancaster, PA. April.

Lueck, G.W. 1990. Landfill mining yields buried treasure. Waste Age, March: 118-120.

Magnuson, A. 1990. Cap repair leads to landfill reclamation. Waste Age, September:121-124.

Magnuson, A. 1991. Landfill reclamation at Edinburg. Waste Age, November: 75-78.

Michaels, A. 1993. Solid waste forum: Landfill recycling. Public Works, May:66-68.

Morelli, J. 1990. Landfill reuse strategies. BioCycle, March:40-43.

Morelli, J. 1990. Landfill reuse strategies. BioCycle, April:60-61.

Morelli, J. 1991. Landfill reclamation: An alternative to closure and siting. MSW Management, September/October:33-37.

Morelli, J. No date. Municipal Solid Waste Landfills: Optimization, Integration and Reclamation. New York State Energy Research and Development Authority, New York, NY.

Nutting, L.M. 1994. The Financial Aspects of Landfill Reclamation. Landfill Reclamation Conference, Lancaster, PA.

NYSERDA. 1990. Town of Edinburg Landfill Reclamation Fact Sheet. New York State Energy Research and Development Authority, New York, NY. December.

Rettenberger, G., S. Urban-Kiss, R. Schneider, and R. Goschl. 1995. German project reconverts a sanitary landfill. BioCycle, June:44-47.

RRR. 1992. NY landfill mining successful. Resource Recovery Report, September:3.

RRR. 1993. Three mining projects begun. Resource Recovery Report, December:6.

Spencer, R. 1990. Landfill space reuse. BioCycle, February:30-32.

Spencer, R. 1991. Mining landfills for recyclables. BioCycle, February:34.

SWR. 1992. New York to research landfill reclamation. Solid Waste Report, September 10, p. 321.

SWR. 1995. Excavating waste saves landfills, yet strains infrastructure: Study. Solid Waste Report, August 3, p. 248.

U.S. EPA. 1993. Evaluation of Collier County, Florida, Landfill Mining Demonstration. EPA600-R-93-163. Prepared by von Stein, E.L., and G.M. Savage for EPA Office of Research and Development, Washington, DC. September. pp. 3 and 38.

U.S. EPA. 1996. Report of 1995 Workshop on Geosynthetic Clay Liners. EPA600-R-96-149. Washington, DC. June.

EPA

United States
Environmental Protection Agency
(5306W)
Washington, DC 20460

Official Business
Penalty for Private Use
$300

at dc

f landf

a wid

Grad

Par

Indi

Shc

Offi

Nat

Spc

n Grad

Redevelopment of Landfill Sites

October 19, 2006

Shiann-Jang Chern, Ph.D., P.E.
Superfund Project Manager, USEPA Region 9

What do we mean the landfill sties redevelopment?

- Reuse of landfill sites means redevelopment.
- It can be a wide range of redevelopment.

Low Graded of site re use -

Parking Area,

Industrial Area,

Shopping Malls,

Office Buildings,

Nature Open Land, and

Sport and Recreation.

High Graded of Site Reuse – Residential Area.

Barriers to the Site Redevelopment

- Ambiguous legal liability;
- Lack of concentrated expertise;
- Potentially substantial capital costs;
- Insufficient financing;
- Clouded federal, state, and local environmental and legal policies;
- Entrenched attitudes among regulators;
- Absence of a consistent redevelopment framework;
- Public opposition;
- Limited demand for redeveloped sites; and
- Competition from greenfields.

Critical Elements for Redevelopment

- Past Waste Disposal Records
- Landfill Characterization
- Landfill Gas Control
- Leachate Control
- Impact to the Groundwater
- Exposure Pathway and Abatement
- Potential Waste Removal/Waste Consolidation during Redevelopment
- Geotechnical Considerations
- Proposed of Redevelopment Plan

Risk Associated with Site Redevelopment

- Type of Reuse is Depending on Redevelopment Planning
- Type of Reuse also Related to the Potential Vulnerability, Expressed in the Average Hours of Exposure at the Location
- Risk Assessments (including Potential Air Pathway, Surface Soils, Potential Leachate Migration, Potential Groundwater Pathway) shall be conducted Thoroughly.

Remedy Strategies for Site Redevelopment

- Cleanup Criteria are Dependent On Intended Property Use.
- Commercial Factors Prohibit Inordinately Long Site Investigations.
- Redevelopment Financing Must Have "Hard Dollar" Cost for Partial Site Cleanup.
- Cleanup of Soil and Groundwater Must be Synergistic with Property Build-out Activities.
- Involvement of Community is Paramount

Site Remedy and Redevelopment Process

1. Site Assessment and Characterization
2. Site Investigation and Feasibility Study
3. Site Investigation and Feasibility Study Report
4. Site Cleanup
5. Site Redevelopment Plan
6. Site Redevelopment Design
7. Construction
8. Long Term Operation, Monitoring, Maintenance, and Controls

Issues Related to the Landfill Site Redevelopment ("Ready for Reuse")

1. Regulatory Policy and Regulatory Issues
2. Environmental Issues
3. Stakeholder Negotiations
4. Financial Issues
5. Site Remedy & Redevelopment Issues
6. Design/Construction Integration
7. Post Site Redevelopment Controls Including Long Term Operation, Maintenance, and Land Use Convenants

Examples of OII Landfill Site Redevelopment

OII Industrial Landfill Superfund Site

Location: 10 Miles East of City of Los Angeles next to Highway 60 in the City of Monterey Park

Two Parcels:

1. South Parcel - 145 Acres (approximately 300 feet above the ground surface). Big landfill south of Hwy 60
2. North Parcel - 45 Acres (flat surface) has 10 acres of landfill. North of Highway 60

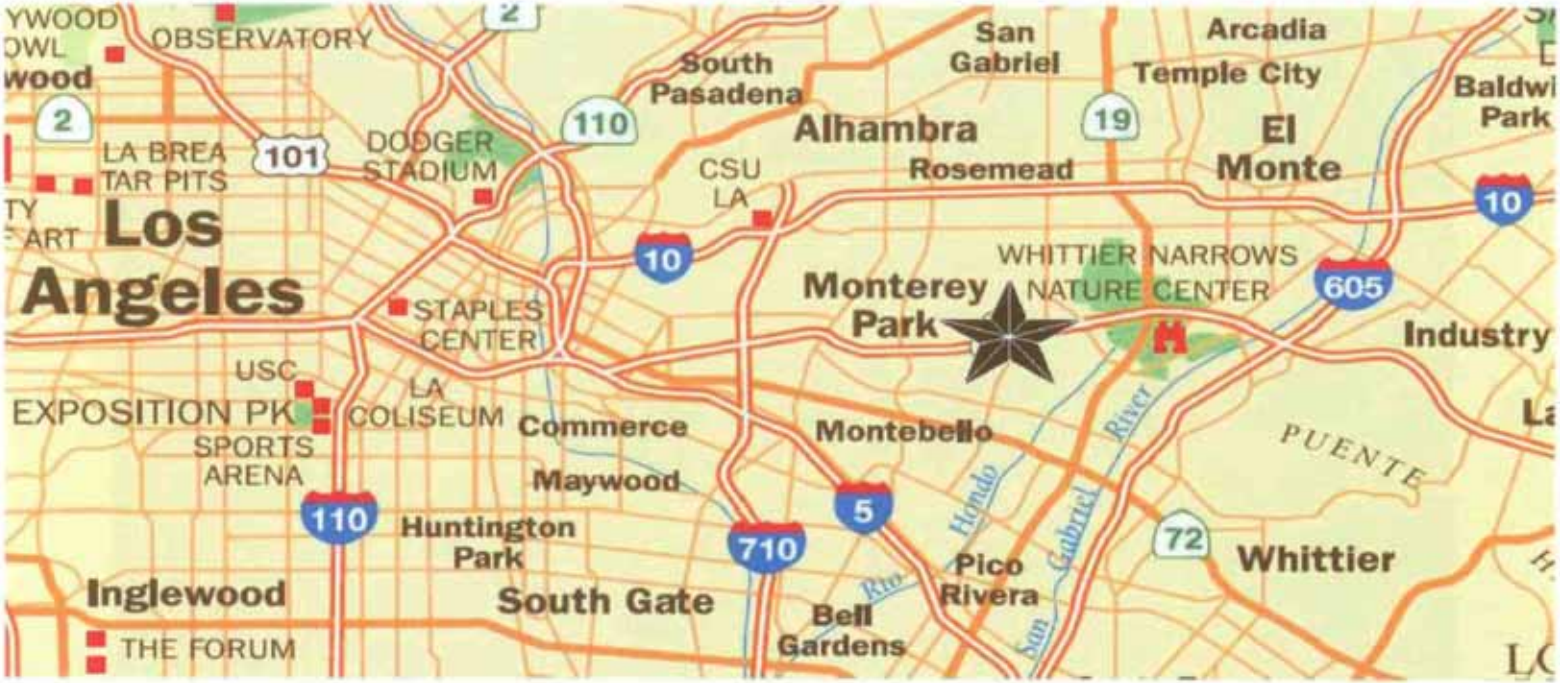
Site Remedy: Landfill Cover, Landfill Gas Extraction System, Landfill Gas Treatment System, Leachate Treatment Plant, Perimeter Liquids Control System, Groundwater Monitoring

Site Remediation Costs: Approximately $600 Million

Site Redevelopment: North Parcel including Home Depot and Target Retail Stores. No Redevelopment on South Parcel.

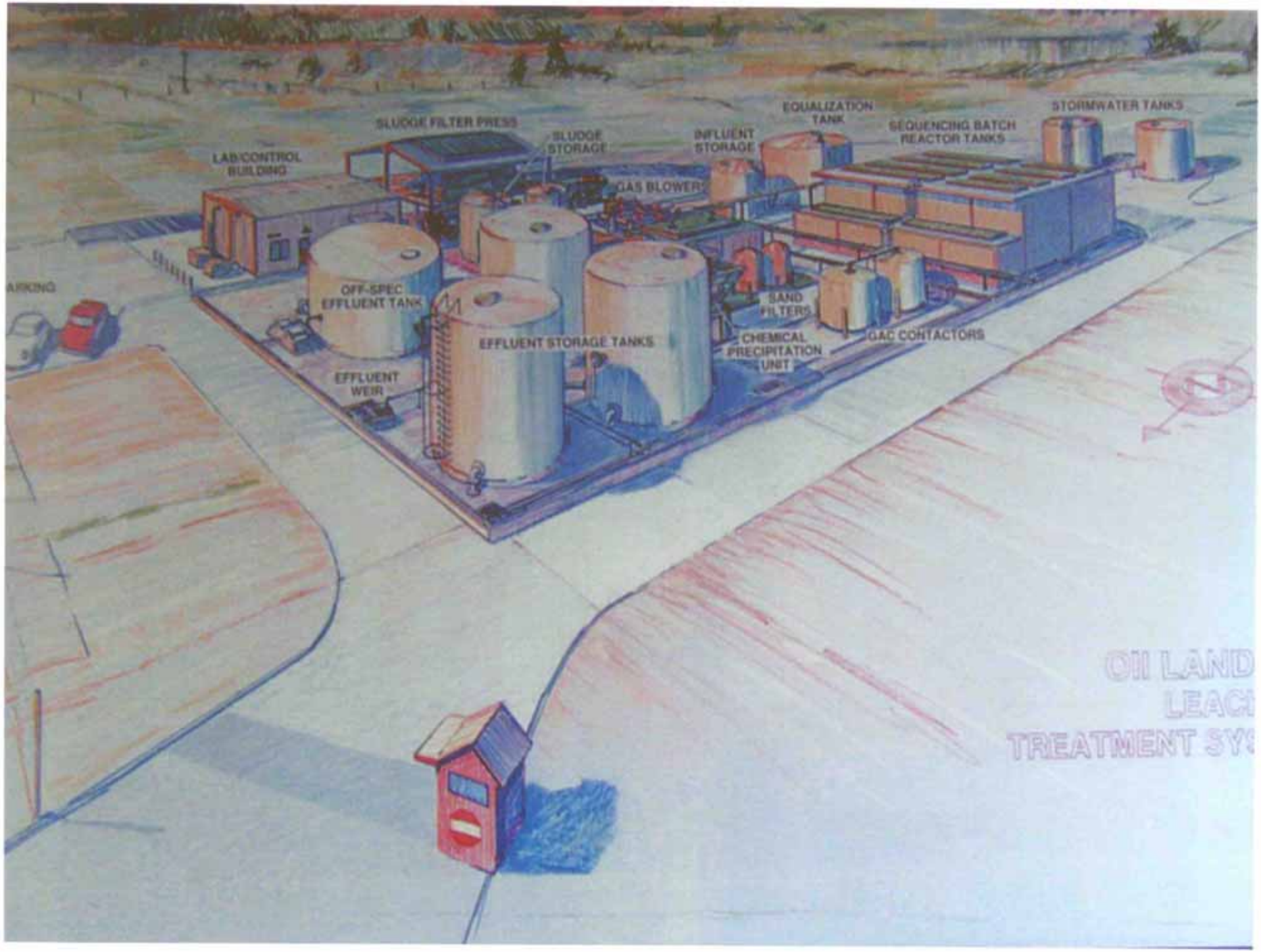
Operating Industries, Inc

A SUPERFUND SITE



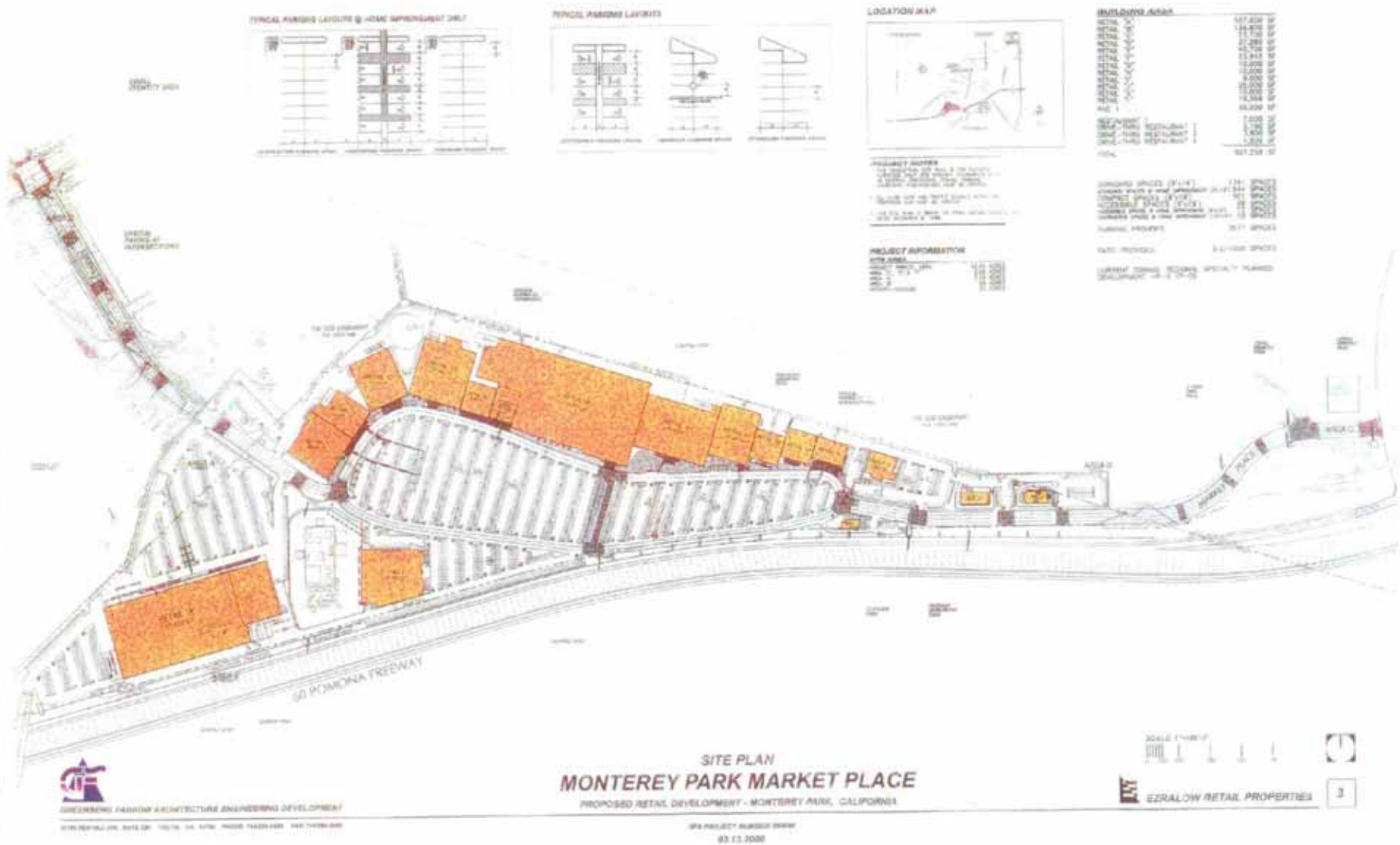

PE
30
D
PE
30
S


13


SLUDGE FILTER PRESS
SLUDGE STORAGE
EQUALIZATION TANK
INFLUENT STORAGE
STORMWATER TANKS
SEQUENCING BATCH REACTOR TANKS
LAB/CONTROL BUILDING
GAS BLOWERS
OFF-SPEC EFFLUENT TANK
EFFLUENT STORAGE TANKS
SAND FILTERS
CHEMICAL PRECIPITATION UNIT
GAC CONTACTORS
EFFLUENT WEIR
OIL LAND
LEACH
TREATMENT SYS


LANDFILL GAS
LANDFILL GAS


CONTACTOR
0
CONTACTOR
0



SITE PLAN

MONTEREY PARK MARKET PLACE

PROPOSED RETAIL DEVELOPMENT - MONTEREY PARK, CALIFORNIA

GREENBERG FARROW ARCHITECTURE ENGINEERING DEVELOPMENT

EZRALOW RETAIL PROPERTIES

3

03.11.2000

AERIAL PERSPECTIVE

MONTEREY PARK MARKET PLACE

PROPOSED RETAIL DEVELOPMENT - MONTEREY PARK, CALIFORNIA

GREENBERG FARROW ARCHITECTURE ENGINEERING DEVELOPMENT

EZRALOW RETAIL PROPERTIES

2

03.13.2000

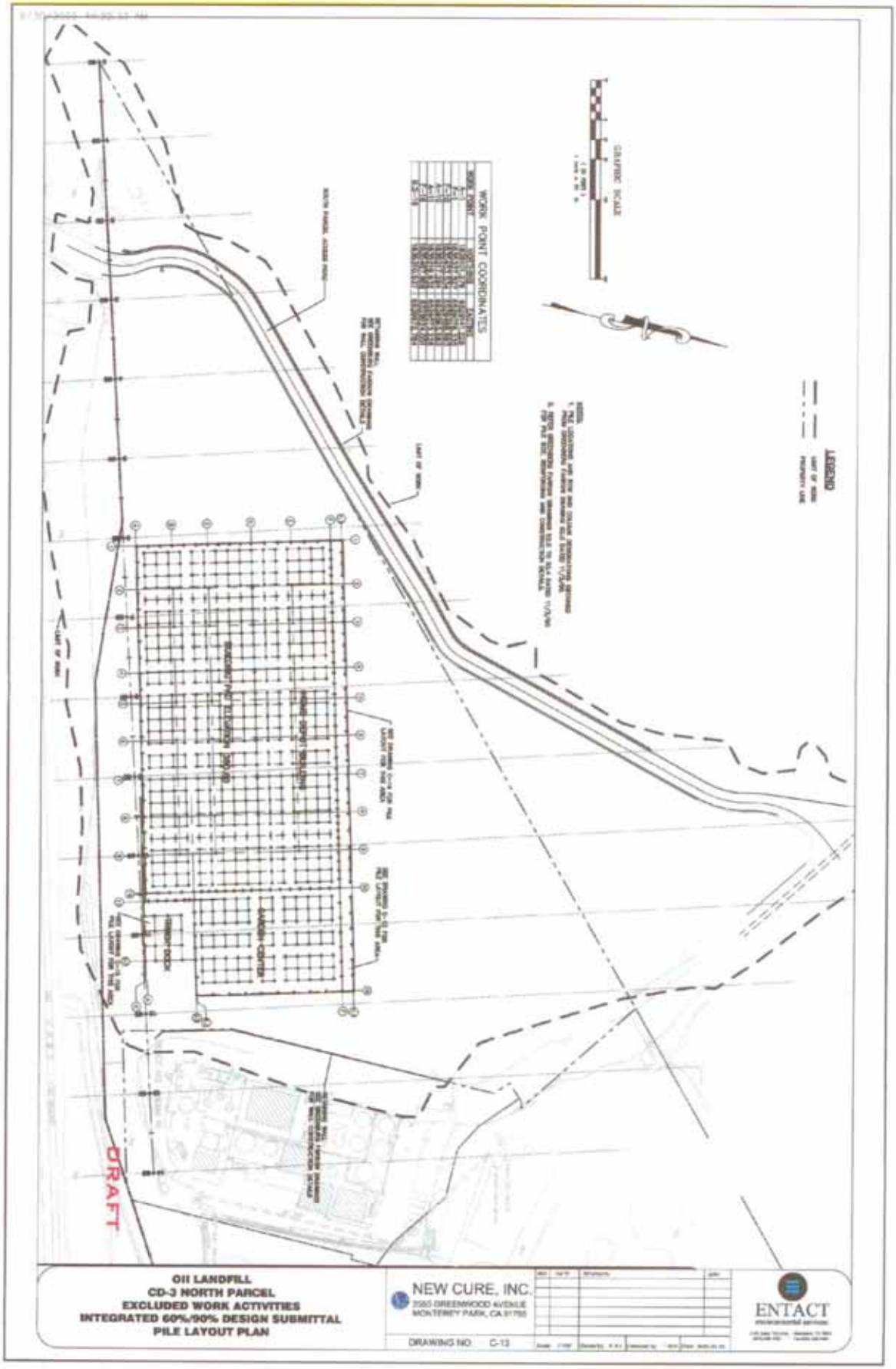
CIRCULATION PLAN

MONTEREY PARK MARKET PLACE

PROPOSED RETAIL DEVELOPMENT - MONTEREY PARK, CALIFORNIA

EZRALOW RETAIL PROPERTIES

4

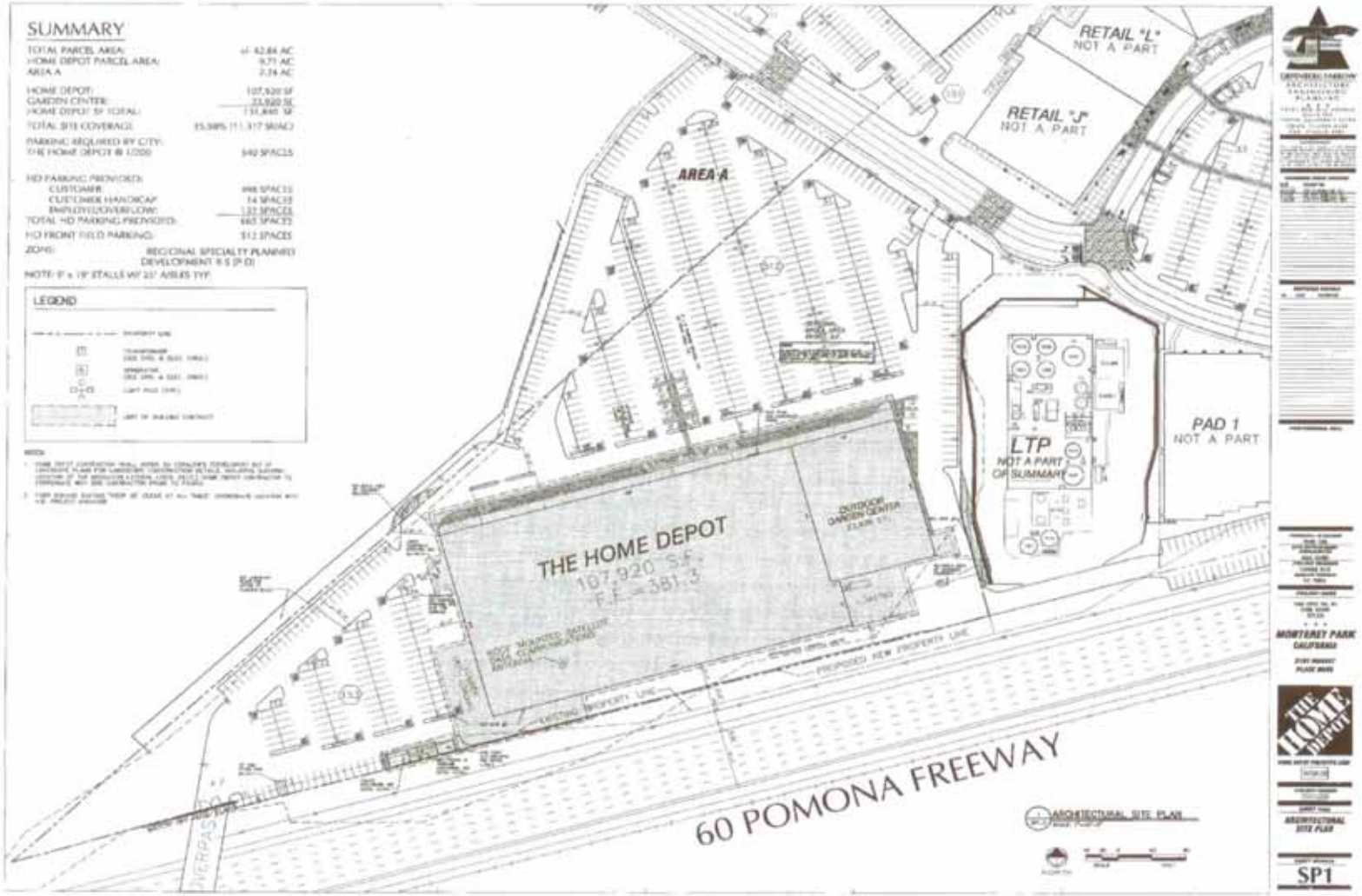


GII LANDFILL
CD-3 NORTH PARCEL
EXCLUDED WORK ACTIVITIES
INTEGRATED 60%/90% DESIGN SUBMITTAL
PILE LAYOUT PLAN

NEW CURE, INC.
2585 GREENWOOD AVENUE
MONTEREY PARK, CA 91755

DRAWING NO. C-13

ENTACT
environmental services


SUMMARY
TOTAL PARCEL AREA: +/- 42.84 AC
HOME DEPOT PARCEL AREA: 9.71 AC
AREA A 2.24 AC
HOME DEPOT: 107,920 SF
GARDEN CENTER: 23,920 SF
HOME DEPOT SF TOTAL: 131,840 SF
TOTAL SITE COVERAGE: 35.98% (111,317 SF/AC)
PARKING REQUIRED BY CITY:
THE HOME DEPOT @ 1/200 540 SPACES
HD PARKING PROVIDED:
CUSTOMER 618 SPACES
CUSTOMER HANDICAP 14 SPACES
EMPLOYEE/OVERFLOW 33 SPACES
TOTAL HD PARKING PROVIDED: 665 SPACES
HD FRONT FIELD PARKING: 512 SPACES
ZONE: REGIONAL SPECIALTY PLANNED DEVELOPMENT 6.5 (P-D)
NOTE: 9' x 19' STALLS W/ 25' AISLES TYP.
LEGEND
RETAIL "L"
NOT A PART
RETAIL "J"
NOT A PART
AREA A
PAD 1
NOT A PART
LTP
NOT A PART OF SUMMARY
THE HOME DEPOT
107,920 S.F.
F.F. = 381.5
OUTDOOR GARDEN CENTER
23,920 SF
PROPOSED NEW PROPERTY LINE
EXISTING PROPERTY LINE
60 POMONA FREEWAY
PERRAO CO
ARCHITECTURAL SITE PLAN
MONTEREY PARK
CALIFORNIA
SP1

Examples of McColl Landfill Site Redevelopment

McColl Superfund Site

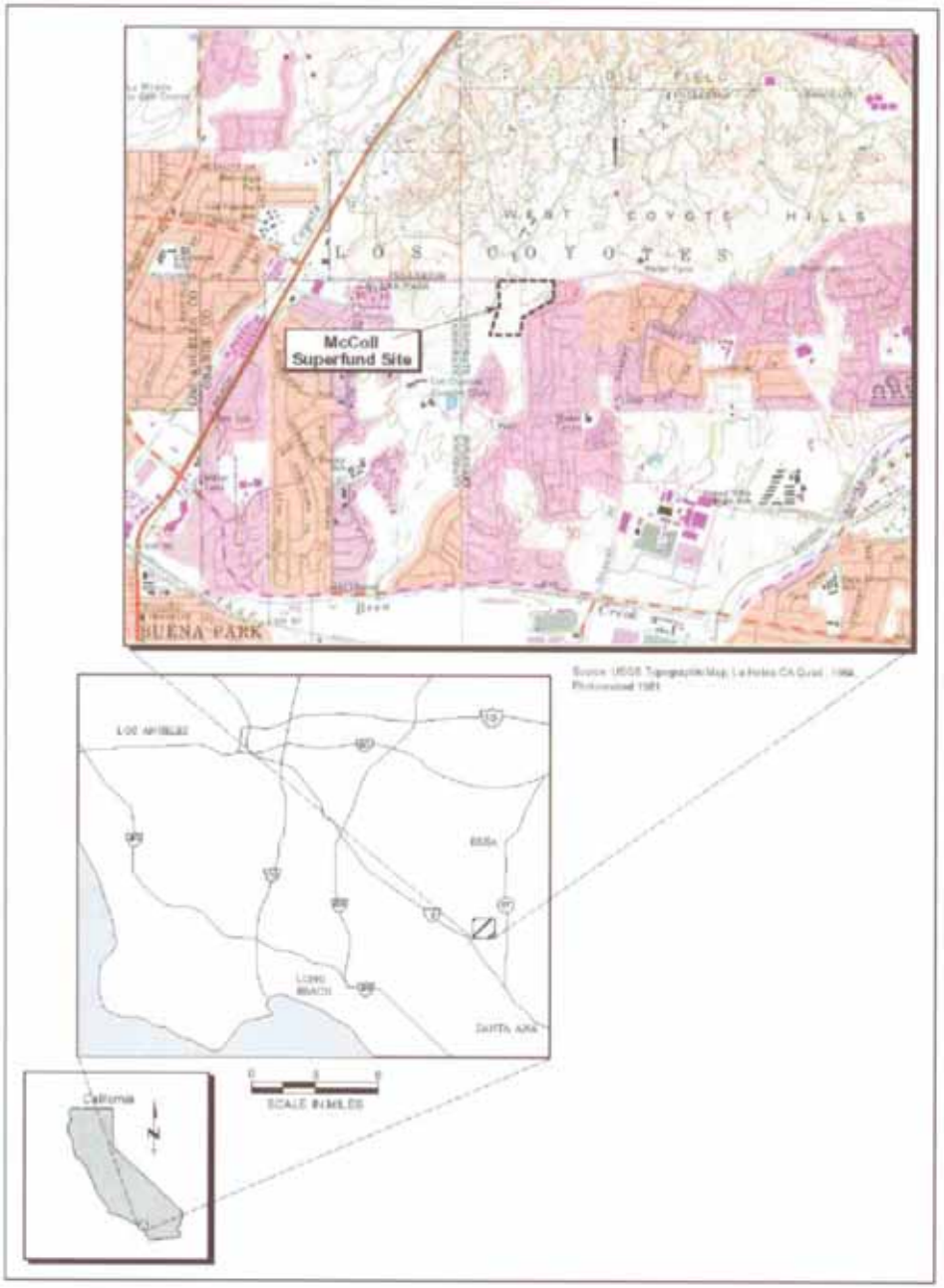
Location: Fullerton, CA

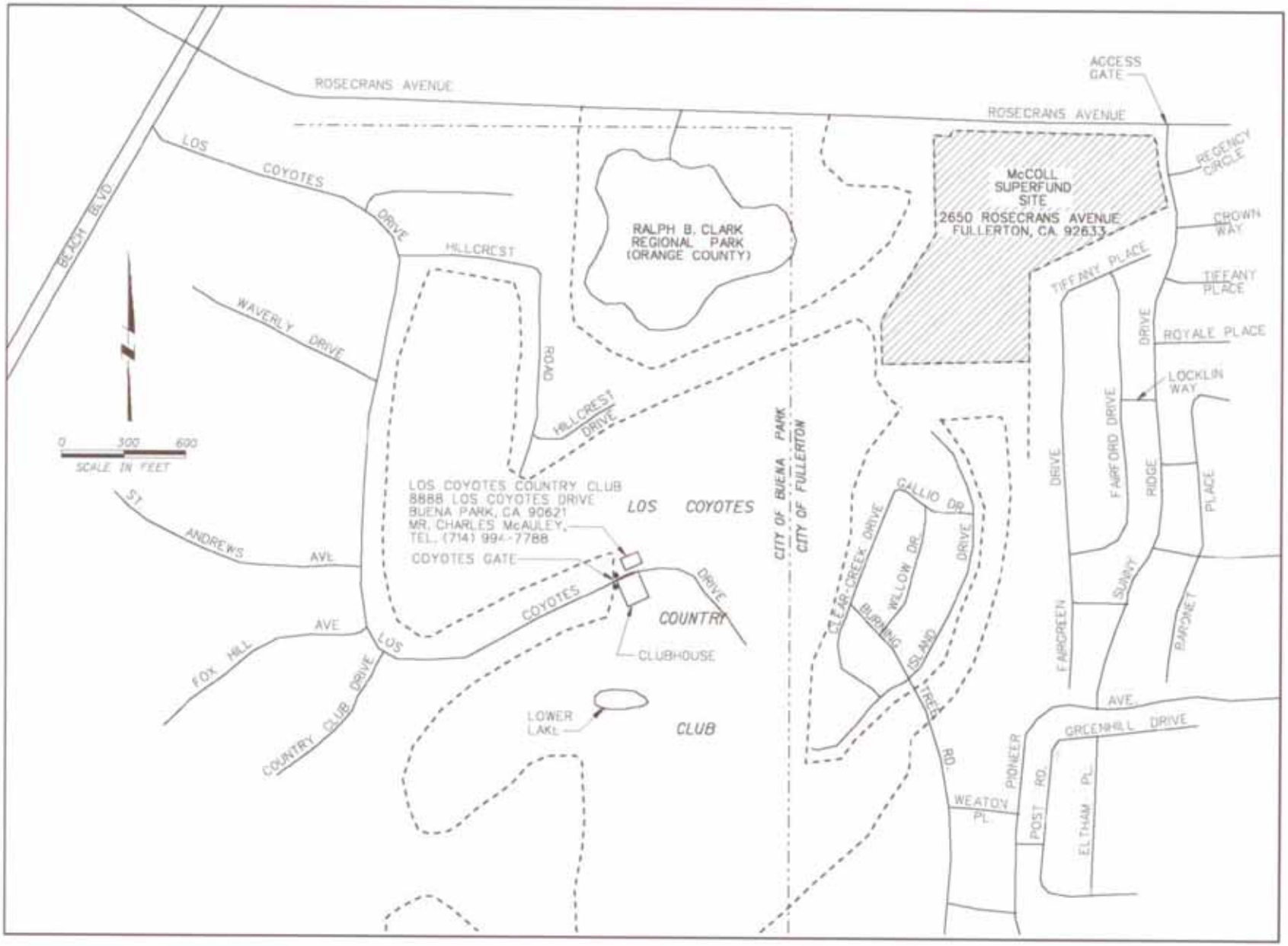
Size: 22 Acres Landfill Site with Oil Refinery and Military Wastes

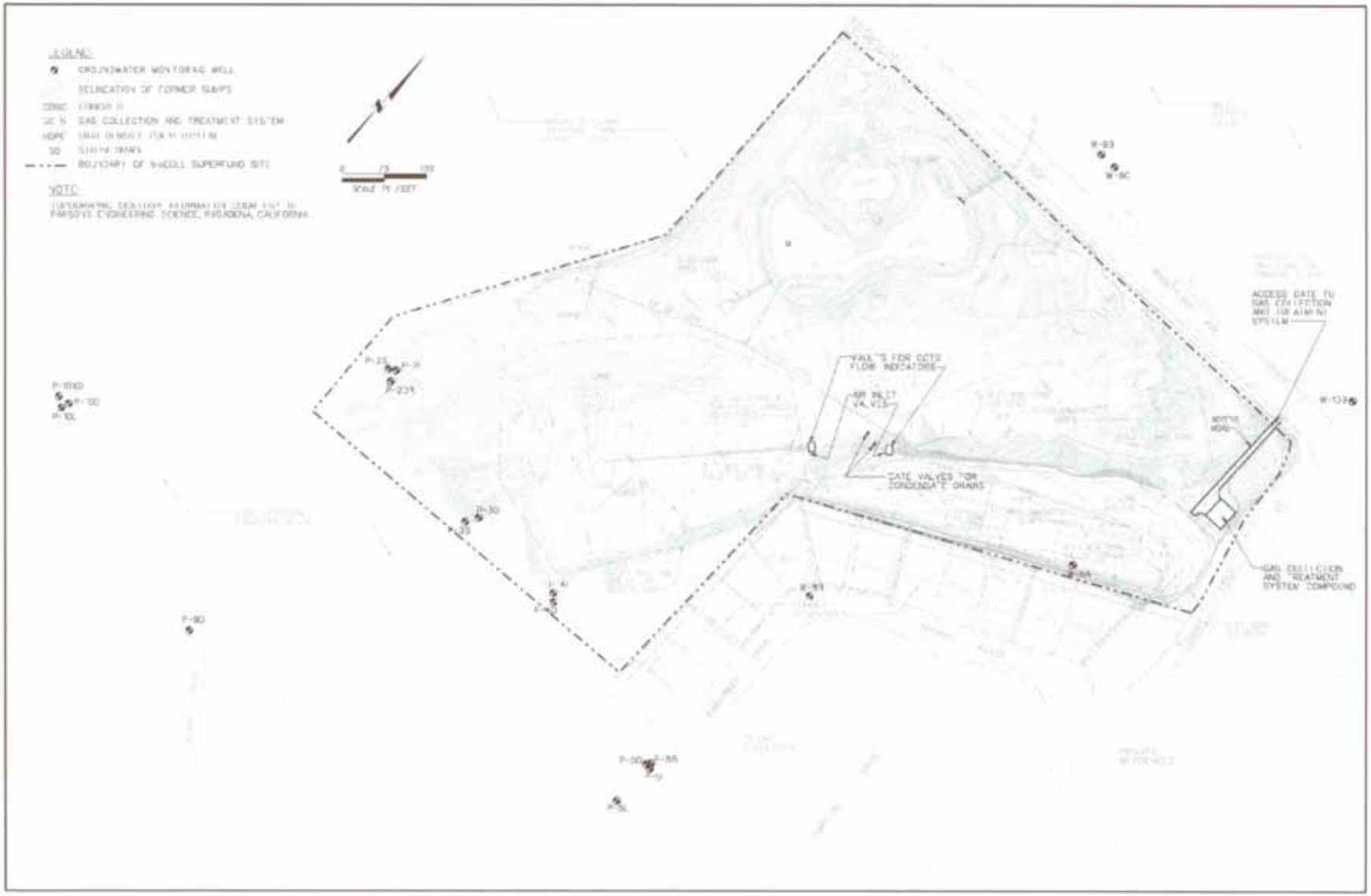
Site Remedy: Landfill Cover, Slurry Walls, Landfill Gas Extraction System

Site Remediation Costs: Approximately $25 Million

Site Redevelopment: Recreational Use as Part of a 27-Hole Golf Course.


McColl
Superfund Site
LOS COYOTES
WEST COYOTE HILLS
BUENA PARK
LOS ANGELES
SANTA ANA
LONG BEACH
California
SCALE IN MILES


ROSECRANS AVENUE
ACCESS GATE
ROSECRANS AVENUE
BEACH BLVD.
LOS COYOTES DRIVE
HILLCREST
RALPH B. CLARK REGIONAL PARK (ORANGE COUNTY)
McCOLL SUPERFUND SITE
2650 ROSECRANS AVENUE
FULLERTON, CA 92633
REGENCY CIRCLE
CROWN WAY
TIFFANY PLACE
TIFFANY PLACE DRIVE
ROYALE PLACE
LOCKLIN WAY
WAVERLY DRIVE
ROAD
HILLCREST DRIVE
0 300 600
SCALE IN FEET
LOS COYOTES COUNTRY CLUB
8888 LOS COYOTES DRIVE
BUENA PARK, CA 90621
MR. CHARLES McAULEY,
TEL. (714) 994-7788
LOS COYOTES
COYOTES GATE
CLUBHOUSE
COUNTRY CLUB
LOWER LAKE
CITY OF BUENA PARK
CITY OF FULLERTON
ST ANDREWS AVE
FOX HILL AVE
COUNTRY CLUB DRIVE
LOS COYOTES DRIVE
GALLIO DR.
CLEAR CREEK DRIVE
WILLOW DR.
BURNING TREE RD.
ISLAND
FAIRFORD DRIVE
RIDGE
PLACE
SUNNY
FAIRGREEN
BARONET
AVE.
GREENHILL DRIVE
PIONEER RD.
POST RD.
ELTHAM PL.
WEATON PL.


KEY:
GROUNDWATER MONITORING WELL
DELINEATION OF FORMER SUMPS
GAS COLLECTION AND TREATMENT SYSTEM
BOUNDARY OF McCOLL SUPERFUND SITE
NOTE:
SCALE IN FEET
VALVES FOR GCTS FLOW INDICATORS
AIR INLET VALVES
GATE VALVES FOR CONDENSATE DRAINS
ACCESS GATE TO GAS COLLECTION AND TREATMENT SYSTEM
GAS COLLECTION AND TREATMENT SYSTEM COMPOUND
W-93
W-9C
W-133
P-229
P-90
P-55
W-91


LOS COYOTES


TSU-4200F
CAUTION
KEEP OUT
TSU-4200F

Conclusions

1. Landfill Site Redevelopment is of Public Interest
2. Reuse of Previous Developed Land Protects Green Land Elsewhere
3. Good Redevelopment Planning is Essential
4. Good Design and Construction Integration is a Must
5. Enforceable Post Redevelopment Controls are Necessary
6. Successful Landfill Sites Redevelopment after Clean Up are Achievable