Prepared for

County of Sonoma
Department of Transportation and Public Works
117A Administrative Building
575 Administration Drive
Santa Rosa, California 95403

REVISED
JOINT TECHNICAL DOCUMENT
CENTRAL DISPOSAL SITE
Sonoma County, California

Volume I
Amendment 2A
May 31, 2005

Prepared by:

GeoSyntec Consultants, Inc.
1500 Newel1 Avenue, Suite 800
Walnut Creek, California 94596
(925) 943-3034

Project Number: WL0062
31 May 2005

COUNTY OF SONOMA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC WORKS
2300 COUNTY CENTER DRIVE, SUITE B-100
SANTA ROSA, CALIFORNIA 95403
David D. Knight, Director

AREA CODE (707)
ROADS 565-2231
TRANSIT 585-7516
REFUSE 565-7940
AIRPORT 565-7243
AIR POLLUTION 433-5911
FAX 565-2620
www.sonomacountypublicworks.com

May 31, 2005

File: 50-01-17.600

Mr. Bob Swift
Senior Environmental Health Specialist
Sonoma County Department of Health Services
Environmental Health Division
475 Aviation Blvd., Suite 220
Santa Rosa, CA 95403

Re: Transmittal of Amendment No. 2A to Joint Technical Document Central Disposal Site, Sonoma County, California

Dear Mr. Swift:

We are submitting for your review the enclosed Amendment No. 2A, dated May, 2005 to the Joint Technical Document (JTD) for the Central Disposal Site. This Amendment No. 2A is in response to your letter dated May 9, 2005 and provides additional information and descriptions of site facilities and operations. In addition to the information provided in Amendment 2, this Amendment 2A provides the following information:

a) Section 2.8.2.1 - Need for Proposed Improvement:
This section has been revised to address the possibility that solid waste may also be hauled to a permitted out-of-County facility and that due to potential hauling constraints, it may not be possible to remove all solid waste accepted at the facility at the end of each operating day.

b) Section 2.8.2.3 - Facility Operation:
This section has been revised to include discussion of commercial collection vehicles and self-hauler vehicles separation as they pertain to traffic patterns at the site.

c) Section 2.8.2.3 - Facility Operation:
This section has been revised to include a discussion of estimated peak daily tonnage by commercial haulers, in addition to self-haulers.

d) Section 2.10.2.1 - Daily Operations:
Table 2-3 has been updated to reflect the current estimated landfill capacity.

e) <u>Section 2.10.5 - Emergency Contact List:</u>
This section has been updated to reflect minor changes in County personnel and emergency phone numbers.

f) <u>Section 2.12.10 - Traffic Control and Appendix A-5:</u>
This section has been updated to include a current internal traffic route map, and a discussion of distinct routes at the TF/TS for commercial haulers and self-haulers.

g) <u>Section 2.18 - Permits and Approvals:</u>
This section has been updated to reflect the current Waste Discharge Requirements and Monitoring and Reporting Program Orders.

h) <u>Section 3.3 - Waste Quantities:</u>
Tables 3-1 and 3.2 of this section have been updated and to reflect current site tonnages and vehicle traffic.

i) <u>Section 10 - Preliminary Closure Plan:</u>
The February 11, 2005 Preliminary Closure Plan has been referenced as a replacement for this section.

j) <u>Section II - Preliminary Post Closure Maintenance Plan:</u>
The February 11, 2005 Preliminary Post Closure Maintenance Plan has been referenced as a replacement for this section.

k) <u>Appendix B-15 - Public Tipping Facility:</u>

- Section 17407.2 (Cleaning): This section of Appendix B-15 has been modified to reflect the intent of Title 14 CCR, section 17407.2 such that all operations and facilities shall be cleaned each operating day of all <u>loose materials and litter.</u>
- Section 17407.3 (Drainage Control): This section of Appendix B-15 has been modified to reflect current operational hours constraints due to out-hauling.
- Section 17410.1 (Solid Waste Removal): This section of Appendix B-15 has been amended to reflect the intent of Title 14 CCR, section 17410.1 such that all solid wastes shall be removed at a frequency approved by the EA, in order to prevent the propagation or attraction of flies, rodents or other vectors.

l) <u>Appendix D-7 - Corrective Action Financial Assurance:</u> This appendix has been updated to include the most current letter, dated May 5, 2005 from the Financial Assurances Section of the CIWMB stating adequacy of the closure fund for the Central Landfill.

There is one change to the JTD Indices in this Amendment No. 2A reflecting the inclusion of the Preliminary Closure and Postclosure Maintenance Plans, dated 11 February 2005, in Appendix G.

If you have any questions, please contact me at (707) 565-7958.

Very truly yours,

DAVID D. KNIGHT, DIRECTOR
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

Don R. Poindexter, Division Manager
Operations and Engineering
Integrated Waste Division

Enclosure three (3) sets: Amendment No. 2A, Revisions to JTD, Central Disposal Site, June 1, 2005, with instructions

c: David D. Knight, Susan Klassen, Ken Wells

COUNTY OF SONOMA
DEPARTMENT OF TRANSPORTATION
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April 28, 2005

File: 50-01-17.600

Mr. Bob Swift
Senior Environmental Health Specialist
Sonoma County Department of Health Services
Environmental Health Division
1030 Center Drive, Suite A
Santa Rosa, CA 95403

Re: Transmittal of Amendment No. 2 to Joint Technical Document Central Disposal Site, Sonoma County, California

Dear Mr. Swift:

We are submitting for your review the enclosed Amendment No. 2, dated April 2005 to the Joint Technical Document (JTD) for the Central Disposal Site. This Amendment No. 2 provides updated descriptions of site facilities and operations. Significant changes include the following:

- The expansion of the tipping facility: The tipping facility is to be expanded by one full bay that will measure approximately 56 feet wide by 120 feet deep. The expansion will add an additional 11,300 square feet to the existing facility for a total of 44,012 square feet. The additional floor space will be used to hold debris boxes for materials diversion purposes and to improve operating efficiency. No new loading bay is included in the expansion project. The expansion to the tipping facility is scheduled to begin sometime in the summer of 2005.

- A change of operation: Convert operations at the Central Landfill from an exclusively landfill operation to a landfill/transfer station operation. The County will use the public tipping facility/transfer station (TF/TS) to load and transfer solid waste directly to the Landfill operation at the Central Disposal Site OR to load and out-haul solid waste to an alternative permitted facility outside the County of Sonoma for an interim period of approximately three (3) years. Operations by contractors and employees may start as early as 6:00 a.m. and end as late as 6:30 p.m. for the purpose of moving, loading, out-hauling solid waste and the application of soil cover or alternative daily cover (ADC) and maintenance operations. As before, the hours of operation by contractors and employees may be extended on an urgent or emergency basis with the approval of the LEA. There is no change to the hours the Central Disposal Site receives waste, which is from 7:00 a.m. to 4:00 p.m., 7 days per week.

In addition, the JTD has been amended to reflect the following changes:

- Appendix A-10 (CEQA and Conformance Findings Information, dated 4/13/05);
- Appendix H [Ancillary Facilities-Central Improvements; Tipping Facility Expansion (Phase I, Building I)];
- Appendix G (Preliminary Closure and Post Closure Maintenance Plans, dated 2/11/05); and
- Appendix L (Household Toxic Waste Facility Operations Plan, dated 11/05).

There were no changes to the Joint Technical Document Indices in this Amendment No. 2.

With LEA and RWQCB concurrences, we anticipate starting 100% out-hauling operations beginning August 1, 2005. There may be a transition period of reduced waste landfilling until the out-hauling operations are fully phased in.

We will keep you advised of progress and any changes in the project schedule.

If you have any questions, please contact me at (707) 565-7958.

Very truly yours,

DAVID D. KNIGHT, DIRECTOR
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

Don R. Poindexter, Division Manager
Operations and Engineering
Integrated Waste Division

Enclosure (two sets): Amendment No. 2, Revisions to JTD, April 2005, with instructions

c: David D. Knight, Ken Wells
Catherine E. Kuhlman, Executive Director, RWQCB, w/encl. (2 sets)

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December 10, 2002

File: 50-01-17.6

Mr. Bob Swift
Senior Environmental Health Specialist
Sonoma County Department of Health Services
Environmental Health Division
3273 Airway Drive, Suite D
Santa Rosa, CA 95403

Re: Transmittal of Application for Solid Waste Facility Permit/Waste Discharge Requirements and Amendment No. 1 to Joint Technical Document Central Disposal Site, Sonoma County, California

Dear Mr. Swift:

We are submitting for your review the enclosed Application for Solid Waste Facility Permit/Waste Discharge Requirements, dated December 10, 2002, and Amendment No. 1, dated December 1, 2002 to the Joint Technical Document (JTD) for the Central Disposal Site.

This Amendment No. 1 provides updated descriptions of site operations and facilities and adds a fifth volume that includes various added appendices and Record Drawings of completed projects. Significant changes include the following:

- A change of hours of operation: There is no change to the hours the Central Disposal Site receives waste, which is from 7:00 a.m. to 4:00 p.m., 7 days per week. However, operations by contractors and employees may start by 6:00 a.m. and end by 7:00 p.m. (formerly 5:00 p.m.), including daily soil cover or ADC placement and related operations and maintenance. The hours of operation by contractors and employees may be extended on an urgent or emergency basis with the approval of the LEA.

- The addition and operation of a scrap metal baler on the landfill to facilitate scrap metal recycling;

- The addition and operation of a facility for a Construction and Demolition Debris Diversion Program on the landfill;

- The proposed construction of a Clean Fuel Facility for compressed landfill gas, including a pilot program modular landfill gas filter/compressor and fueling station for County transit vehicles;

- The construction of a waste oil recycling building in the Operations Improvement Project area;

- The installation of a cardboard baler in the recycle area of the Operations Improvement Project area;

- The conditional use of Posi-Shell as an ADC.

With LEA and RWQCB concurrences, we anticipate starting operations at the Operations Improvement Project, including the public tipping building and recycle/reuse facility, but excluding the household hazardous waste facility (HHW), approximately January 2, 2003. The HHW facility construction was suspended at the end of November, pending a review of building code, safety, and operational requirements and subsequent redesign, as needed.

We will keep you advised of progress and any changes in the project schedule.

If you have any questions, please contact me at (707) 565-7958.

Very truly yours,

DAVID D. KNIGHT, DIRECTOR
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

Don R. Poindexter, Division Manager
Operations and Engineering
Integrated Waste Division

Enclosures (two sets):
1. Application for Solid Waste Facility Permit/Waste Discharge Requirements (12/10/02)
2. Amendment No. 1, Revisions to JTD, 12/01/02, with instructions

c: David D. Knight, Ken Wells
Terri Kinney, RWQCB, w/encl. (2 sets)

CERTIFICATION

I hereby certify that I am the Engineer-of-Record for this Amendment No. 2A, dated May 2005, to the Joint Technical Document (JTD) prepared by GeoSyntec Consultants, Inc. (GeoSyntec), dated 22 October 1999, Revised 25 January 2000, and modified by Amendment No. 1, prepared by the County of Sonoma and dated 1 December 2002, and Amendment No. 2., dated April 2005, for the Central Disposal Site (CDS) in Sonoma County, California. This Amendment No. 2A, which supplements Amendment No. 2, was prepared under my direct supervision, and meets the applicable requirements of Title 27 of the California Code of Regulations, Title 40 of the Federal Code of Regulations (Subtitle D) and the California Regional Water Quality Control Board - North Coast Region (CRWQCB) Order No. RI-2004-0040, dated 23 June 2004. This document has been prepared for submittal to the CRWQCB, the California Integrated Waste Management Board (CIWMB), and the Enforcement Agency (EA), which is the Sonoma County Department of Health Services.

KRZYSZTOF S. JESIONEK
Associate

Civil Engineer No. C048344
Expiration Date: 30 June 2006

CERTIFICATION

I hereby certify that I am the Engineer-of-Record for this Amendment No. 2, dated April 2005, to the Revised Joint Technical Document (RJTD) prepared by GeoSyntec Consultants, Inc. (GeoSyntec), dated 25 March 2000, as modified by Amendment No. 1, prepared by the County of Sonoma and dated 1 December 2002, for the Central Disposal Site (CDS) in Sonoma County, California. This Amendment No. 2, prepared under my direct supervision, was prepared to meet the applicable requirements of Title 27 of the California Code of Regulations, Title 40 of the Federal Code of Regulations (Subtitle D) and the California Regional Water Quality Control Board - North Coast Region (CRWQCB) Order No. RI-2004-0040, dated 23 June 2004. This document has been prepared for submittal to the CRWQCB, the California Integrated Waste Management Board (CIWMB), and the Enforcement Agency (EA), which is the Sonoma County Department of Health Services.

REGISTERED PROFESSIONAL ENGINEER
KRZYSZTOF S. JESIONEK
No. 048344
Expires: 30 June 2006
CIVIL
STATE OF CALIFORNIA

KRZYSZTOF S. JESIONEK
Associate

Civil Engineer No. C048344
Expiration Date: 30 June 2006

CERTIFICATION

I hereby certify that I am the Engineer-of-Record for this Amendment No. 1, dated December 1, 2002, to the Revised Joint Technical Document (RJTD) prepared by GeoSyntec Consultants, Inc. (GeoSyntec) and dated March 25, 2000, for the Sonoma Central Disposal Site in Petaluma, California, and that this document has been prepared under my direct supervision. The Revised JTD and Amendment No. 1 were prepared to meet the applicable requirements of Title 27 of the California Code of Regulations, Title 40 of the Federal Code of Regulations (Subtitle D) and the California Regional Water Quality Control Board - North Coast Region (CRWQCB) Order No. RI-2000-62. This document has been prepared for submittal to the California Regional Water Quality Control Board - North Coast Region, (CRWQCB), the California Integrated Waste Management Board (CIWMB), and the Enforcement Agency (EA), which is the Sonoma County Environmental Health Department.

DON R. POINDEXTER, CE, GE
Civil Engineer No. 24420
Expiration Date: 12/31/05

Division Manager, Engineering and Operations
Department of Transportation and Public Works
Integrated Waste Division

TE OF CALIFORNIA

CALIFORNIA INTEGRATED WASTE MANAGEMENT BOARD
REGIONAL WATER QUALITY CONTROL BOARD

PLICATION FOR SOLID WASTE FACILITY PERMIT/WASTE DISCHARGE REQUIREMENTS

B E-1-77 (Rev. 6/96)

RCEMENT AGENCY: Environmental Health Division	FOR OFFICIAL USE ONLY
NTY: Sonoma	SWIS NUMBER
E OF APPLICATION:	DATE RECEIVED: / DATE ACCEPTED: / DATE REJECTED: / FILING FEE: / RECEIPT NUMBER: / DATE ACCEPTANCE OF INCOMPLETE APPLICATION:

. NEW SWFP AND/OR WDRS ☐ 4. REVIEW
REVISION OF SWFP AND/OR WDRS ☐ 5. AMENDMENT OF APPLICATION
EXEMPTION AND/OR WAIVER ☐ 6. RFI/ROWD/JTD AMENDMENTS ☐ 7. CHANGE OF OWNER/OPERATOR OR ADDRESS

E: This form has been developed for multiple uses. It is the transmittal sheet for documents required to be submitted to the appropriate cy. See instructions for completing this application.

NERAL RIPTION LITY

A. NAME OF FACILITY: Central Disposal Site

B. LOCATION OF FACILITY: (Give address or location, also include legal description by section, township, range, base, and meridian if surveye or projected.)
500 Mecham Road, Petaluma, CA 94952
(Refer to JTD Appendix A-1 for legal description)

C. TYPE OF OPERATION: (Check applicable boxes.)

- [X] DISPOSAL TYPE: Mixed Municipal
- [ ] COMPOSTING TYPE: ____
- [ ] TRANSFORMATION
- [ ] TRANSFER OR PROCESSING STATION TYPE: ____
- [ ] SEWAGE TREATMENT
- [ ] INDUSTRY (discharge to sewer)
- [ ] INDUSTRY (on-site disposal)
- [ ] OTHER (describe): ____

D. COSWMP/CIWMP REFERENCES:
DATE OF DOCUMENT: April 1, 1996 PAGES: 4 - 20

E. TYPE OF WASTES TO BE RECEIVED: (Check applicable boxes.)

- [ ] AGRICULTURAL
- [ ] ASBESTOS
- [ ] ASH
- [ ] AUTO SHREDDER
- [x] CONSTRUCTION/DEMOLITION
- [x] DEAD ANIMALS
- [ ] FRIABLE - ASBESTOS
- [x] INDUSTRIAL
- [ ] LIQUIDS
- [x] MIXED MUNICIPAL
- [x] SLUDGE
- [ ] TIRES
- [ ] WOOD MILL
- [ ] OTHER: (describe) ____

CILITY RMATION

A. PROPOSED CHANGE (Check applicable boxes)

- [X] DESIGN (describe) Refer to IWD letter dated December 10, 2002 for description of proposed changes.
- [ ] OPERATION (describe) ____
- [ ] OTHER (describe) ____

B. FACILITY INFORMATION:

PEAK DAILY LOADING (TPD): 2,500	AVERAGE ANNUAL LOADING (TPY): 450,000	SITE CAPACITY(yds): 32,650,000	FACILITY SIZE (acres): 398.5
DISPOSAL AREA: 172	TOTAL WASTE IN PLACE (yds): 21,244,000	AREA IN WHICH SOIL WILL BE WILL BE DISTURBED (acres) 70	DESIGN AIR SPACE CAPACITY: 11,406,000
EXPECTED CLOSURE DATE: 2014			

C. PRESENT OR PROPOSED:

DAILY FLOW (in MGD): na	MAXIMUM:	AVERAGE:	DESIGN FLOW (in MGD):

SOURCE OF WATER SUPPLY (check all appropriate)

. MUNICIPAL OR UTILITY SERVICE:	[X] B. INDIVIDUAL (wells)	
AME OF WATER SURVEYOR	[ ] C. SURFACE SUPPLY:	
	NAME OF STREAM, LAKE, ETC ______	
	TYPE OF WATER RIGHTS: [ ] RIPARIAN	[ ] APPROPRIATION

(OVER)

ENVIRONMENTAL IMPACT REPORT (EIR)

AS AN EIR BEEN PREPARED FOR THIS PROJECT?	[x] YES	[ ] NO
IF "YES", PLEASE ENCLOSE A COPY	[ ] YES	[ ] NO
IF "NO", WILL AN EIR BE PREPARED?	[ ] YES	[ ] NO
ILL A NEGATIVE DECLARATION (ND) BE PREPARED?	[ ] YES	[ ] NO
IF "YES", PLEASE ANSWER THE FOLLOWING:	WHO WILL PREPARE THE ND?	
	APPROXIMATE DATE OF COMPLETION:	

TYPE OF BUSINESS OPERATING FACILITY:

LE PROPRIETORSHIP [ ] PARTNERSHIP [ ] CORPORATION [X] GOVERNMENT AGENCY

ERATOR RMATION nd disposal, rator is ent from wner, attach or franchise ment.				
	OWNER OF LAND (Name): Sonoma County	ADDRESS: Room 117 A 2300 County Center Drive, Suite B-100 Santa Rosa, CA 95403	TELEPHONE # 707-565-2231	SSN OR TAX ID # 94-60000539
	FACILITY OPERATOR (Name): Same	ADDRESS: 500 Mecham Road Petaluma, CA 94952	TELEPHONE # 707-565-2231	SSN OR TAX ID #: same
	ADDRESS WHERE LEGAL NOTICE MAY BE SERVED:			

by acknowledge that I have read this application and the Report of Facility Information, if applicable, JTD or ROWD and certify that the nation given is true and accurate to the best of my knowledge and belief. In operating the solid waste facility, I agree to comply with the tions of the permit and with federal, state, and local enactment's.

ATURE (LAND OWNER OR AGENT): Don R. Poindexter	SIGNATURE (FACILITY OPERATOR OR AGENT): Don R. Poindexter
D NAME: on R. Poindexter	TYPED NAME: Don R. Poindexter
DATE: ngineering and Operations Division Manager 12/10/02	TITLE: DATE: Engineering and Operations Division Manager 12/1

T OF ATTACHMENTS (CHECK IF APPLICABLE):

- [ ] REPORT OF FACILITY INFORMATION
- [ ] REPORT OF WASTE DISCHARGE
- [X] JTD (RDSI/ROWD)
- [ ] CONTRACT AGREEMENTS
- [ ] DEPARTMENT OF HEALTH SERVICES PERMIT
- [ ] LOCAL USE/PLANNING PERMITS
- [ ] CERTIFIED ENVIRONMENTAL REVIEW REPORTS (CEQA)
- [ ] INFORMATION ON THE STATUS OF THE APPLICANT'S COMPLIANCE WITH CEQA REQUIREMENTS REGARDING THE PROPOSED PROJECT.
- [ ] EVIDENCE THAT THERE HAS BEEN COMPLIANCE WITH CEQA PRC, DIVISION 13, 2100 et.sec
- [ ] OPERATING LIABILITY FINANCIAL MECHANISM
- [ ] PRELIMINARY CLOSURE/POSTCLOSURE MAINTENANCE PLAN
- [ ] FINAL CLOSURE/POSTCLOSURE MAINTENANCE PLAN
- [ ] FINANCIAL RESPONSIBILITY DOCUMENTATION
- [ ] OTHER REGULATORY AGENCY PERMITS
- [ ] OTHER ______

LIST OF ACRONYMS

AB	(California) Assembly Bill
ADC	Alternative Daily Cover
ASTM	American Society for Testing and Materials
BAAQMD	Bay Area Air Quality Management District
CAM	California Administrative Manual
CCL	Compacted Clay Liner
CCR	California Code of Regulation
CDS	Central Disposal Site
CEQA	California Environmental Quality Act
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CIWMB	California Integrated Waste Management Board
COCA	Continued Operation and Corrective Action
CoSWMP	County Solid Waste Management Plan
County	County of Sonoma
CQA	Construction Quality Assurance
CPP	Corrugated Plastic Pipe
CRWQCB	California Regional Water Quality Control Board
CSP	Corrugated Steel Pipe
CUP	Conditional Use Permit
C&D	Construction and Demolition
DHS	California Department of Environmental Quality
DU	Disposal Unit
EA	Enforcement Agency
EAD	Engineered Alternative Design
ECA	East Canyon Area
EHS	Environmental Health and Safety
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
FCP	Final Closure Plan
FPCP	Final Partial Closure Plan
FPMP	Final Postclosure Maintenance Plan
ft^3	Cubic Foot
ft^2	Square Foot
GCL	Geosynthetic Clay Liner
GeoSyntec	GeoSyntec Consultants, Inc.
GTE	Gas to Energy

LIST OF ACRONYMS (cont'd)

ha	hectare
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HELP	Hydrologic Evaluation of Landfill Performance
HHW	Household Hazardous Waste
HHWE	Household Hazardous Waste Element
JTD	Joint Technical Document
Landfill 1	1971-Permitted Landfill at Central Disposal Site
Landfill 2	East Canyon Expansion at Central Disposal Site
LCRS	Leachate Collection and Removal System
LDS	Leak Detection System
LEL	Lower Explosive Limit
LFG	Landfill Gas
LP	Leachate Pond
LMP	Leachate Management Plan
LMS	Leachate Management System
LP	Leachate Pond
m^2	Square Meter
m^3	Cubic Meter
MARP	Monitoring and Reporting Program
MCE	Maximum Credible Earthquake
MPE	Maximum Probable Earthquake
MPH	Miles per Hour
msl	Mean Sea Level
MSW	Municipal Solid Waste
MSWLF	Municipal Solid Waste Landfills
MW	Monitoring Well
ND	Negative Declaration
Neg Dec	Negative Declaration
NMOC	Non-Methane Organic Compound
NOE	Notice of Exemption
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
PCP	Preliminary Closure Plan
PPCP	Preliminary Partial Closure Plan
PE	Professional Engineer
PET	Polyethylene
PHGA	Peak Horizontal Ground Acceleration
PPCP	Preliminary Partial Closure Plan

LIST OF ACRONYMS (cont'd)

POWT	Publicly Owned Water Treatment
PPMP	Preliminary Postclosure Maintenance Plan
PPP	Personal Protective Equipment
PTF	Public Tipping Facility
PTO	Permit to Operate
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RDSI	Report of Disposal Site Information
REA	Rock Extraction Area
RG	Registered Geologist
ROWD	Report of Waste Discharge
SPCC	Spill Prevention Control and Countermeasure Plan
SWFP	Solid Waste Facility Permit
SWPPP	Storm-Water Pollution Prevention Plan
SWMS	Surface-Water Management System
TF	Transfer Facility
TS	Transfer Station
US	United States
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WDRs	Waste Discharge Requirements
WMU	Waste Management Unit
yd^3	Cubic Yard

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1. INTRODUCTION

1.1 General

The Central Disposal Site (CDS) has been owned and operated by the County of Sonoma since 1971. The landfill is located in Sonoma County at 500 Mecham Road, in Petaluma, California, and is a permitted Class III solid waste disposal site, which accepts mixed municipal wastes, construction and demolition wastes, agricultural wastes, landscaping wastes and non-hazardous industrial wastes.

The CDS property consists of 398.5 acres (161.6 ha), of which the original landfill, the 1971 Permitted Area (also known as Landfill 1) occupies approximately 130 acres. The site owner constructed approximately 20 acres (8 ha) of Phases I and II of the East Canyon Area (ECA) expansion (i.e. Parts 1 and 2) in the spring of 2002 and 2003, respectively. The total ECA is approximately 42.4 acres (17.2 ha) in plan, and is also a Class III facility. Wetland mitigations have been constructed during 2000 to 2002 on a 38-acre (15.4 ha) parcel south of Hammel Road. Figure 2-2 shows property boundaries.

1.2 Purpose and Scope

The Joint Techical Document (JTD), dated 25 January 2000, and the Revised JTD (RJTD), dated 25 March 2000, were prepared by GeoSyntec Consultants, Inc. (GeoSyntec) to satisfy the requirements of Section 21585 of Division 2 (Solid Waste) of Title 27 of the California Code of Regulations (CCR). The JTD and RJDT were prepared for submission to the California Regional Water Quality Control Board – North Coast Region (CRWQCB), the California Integrated Waste Management Board (CIWMB), and the Enforcement Agency (EA), which is the Sonoma County Department of Health Services.

The JTD, as revised 25 March 2000, consists of four volumes, the first containing a written report with figures and tables, the second, third, and fourth including appendices and two sets of drawings entitled *"Development Drawings, East Canyon Expansion, Central Landfill, Sonoma County, California"*, prepared by GeoSyntec, dated January 1999; and "*Landfill Gas Master Plan, Central Landfill, Sonoma County*", prepared by Landfill Systems Engineering, dated October 1997.

The JTD presents information describing the siting, design, construction, operation, closure and postclosure maintenance of the CDS. The information is intended to demonstrate compliance of the plan for landfill development with all applicable requirements of Title 27, CRWQCB Orders No. 93-83 and RI-2004-0040, as well as federal regulations contained in Part 257, *"Criteria for Classification of Solid Waste Disposal Facilities and Practices"*, and Part 258, *"Criteria for Municipal Solid Waste Landfills,"* of Title 40 of the Code of Federal Regulations (CFR) (hereafter referred to as Subtitle D). The JTD addresses all applicable requirements of these regulations. JTD Indices for the State Water Resources Control Board (SWRCB) and the CIWMB are presented in Section 1.5 of this JTD, as required, to aid the regulatory reviewer in establishing that all applicable requirements have been addressed.

Amendment No. 1, dated 1 December 2002, provided updated descriptions of site operations and facilities and added a fifth volume that includes various added appendices and Record Drawings of completed projects. Significant changes include the following:

- A change of hours of operation: There is no change to the hours the Central Disposal Site receives waste, which is from 7:00 a.m. to 4:00 p.m., 7 days per week. However, operations by contractors and employees may begin as early as 6:00 a.m. and end as late as 6:30 p.m. for the purpose of moving, loading, out-hauling, applying ADC and other related operations and maintenance tasks. The hours of operation by contractors and employees may be extended on an urgent or emergency basis with the approval of the LEA.

- The addition and operation of a scrap metal baler on the landfill to facilitate scrap metal recycling;

- The addition and operation of a facility for a Construction and Demolition Debris Diversion Program on the landfill;

- The proposed construction of a Clean Fuel Facility for compressed landfill gas, including a pilot program modular landfill gas filter/compressor and fueling station for County transit vehicles;

- The construction of a waste oil recycling building in the Operations Improvement Project area;

- The installation of a cardboard baler in the recycle area of the Operations Improvement Project area; and

- The conditional use of Posi-Shell as an ADC.

Amendment No. 2, dated April 2005, provides updated descriptions of site operations and facilities, in particular, related to converting the public Tipping Facility (TF) from exclusively landfill operation to Tipping Facility/Transfer Station (/TF/TS) operation.

1.3 East Canyon Area Expansion Design

This JTD and ECA expansion design were based upon the following principles:

- the need to reasonably maximize waste disposal volume in the East Canyon and thus, provide sufficient additional capacity at the CDS, and
- that the design of ECA was developed as an engineered alternative to the prescriptive requirements of Section 20260 (a) and (b) of Title 27 related to separation from and protection of groundwater.

The key features of the ECA design, which provide protection of groundwater include:

- a groundwater underdrain underlying entire ECA expansion (base and side slopes);
- a composite liner system over the entire ECA that exceeds the requirements of Subtitle D and SWRCB Resolution 93-62, and on side-slopes includes a high density polyethylene (HDPE) backed geosynthetic clay liner (GCL) overlain by a 60-mil thick HDPE geomembrane; thus the side-slopes will have two HDPE geomembranes with a clay liner in between;
- a composite liner with leachate collection and recovery system (LCRS) over a portion of the 1971 Permitted Area (i.e., Landfill 1), which will enhance collection and control of leachate in the existing landfill;
- additional systems to reduce potential for leachate and landfill gas impacts on ground water which include:
    - a leachate collection layer below the liner over waste in the 1971 Permitted Area;
    - a french drain with leachate and landfill gas collection pipes;

- leachate collection from existing landfill gas (LFG) wells in the area where 1971 Permitted Area meets the ECA; and
- additional LFG collection lines at the transition area.

Additional details of these systems are provided in Section 8.3.2 and on the Landfill Development Plan and Landfill Gas Master Plan drawings in Appendices E-1 and E-2, respectively.

These features exceed the minimum level needed to provide suitable protection of groundwater below the ECA and will also enhance protection of groundwater below a portion of the existing 1971 Permitted Area adjacent to the ECA.

1.4 Organization of Report

The JTD is organized as indicated below.

- A facility overview including hours of operation, site plan, site life projection, site capacity, land use, airport safety, health and safety, equipment, personnel requirements and training, nuisance and related controls, site security and access, record keeping and reporting, ancillary facilities, emergency response, end use of site, and permits and approvals are described in Section 2.
- Waste characteristics and handling, including waste types, quantities, treatment, storage, disposal, decomposition, salvaging and resource recovery are presented in Section 3.
- Geologic, hydrogeologic, and hydrologic conditions at the CDS, including geology, faulting and seismic hazards, and ground-water and surface-water hydrology, are described in Section 4.
- The physical characteristics of the site, including topography, climate, evaporation and wind are described in Section 5.
- The design of the original landfill (1971 Permitted Area, also designated Landfill 1) is presented in Section 6. The design includes the site plan, construction sequencing plan, leachate management, surface water management, landfill gas management, groundwater monitoring, seismic stability, settlement, and soil erosion analysis results.

- The existing and proposed monitoring and control systems for the CDS are described in Section 7. Surface water, groundwater, vadose zone, leachate and landfill gas monitoring and control systems are described along with the financial assurance plan.

- The design of the ECA landfill is described in Section 8. The section includes information about the proposed grading, ground-water collection system, composite liner system, leachate collection and removal system, leachate management system, active gas extraction system, cover system, surface-water management system, landfill gas management system, water-quality monitoring system, and ancillary facilities.

- The engineering analyses and results performed for the ECA landfill are presented in Section 9. The analyses and results presented include static and seismic slope stability, settlement, liquefaction, HELP modeling and surface water.

- A preliminary closure plan is presented for the CDS in Section 10. The preliminary closure plan describes previously closed areas, final grading, final cover, stability and construction considerations, waste settlement and subsidence, and environmental monitoring and control systems at closure. Other items presented related to closure include the schedule for closure, final treatment procedures, post-closure, change of ownership protocols, and the closure maintenance fund.

- A preliminary post-closure maintenance plan for the CDS is presented in Section 11. The preliminary post-closure maintenance plan describes post-closure landfill inspection and maintenance, the protocols for the leachate, gas, surface water and water monitoring systems during post-closure, and post-closure land use. Other described post-closure maintenance activities included post-closure maintenance, emergency response plan, change of ownership protocols, and the postclosure maintenance fund.

- The construction quality assurance (CQA) plan for construction of the landfill is presented in Section 12. The CQA plan describes the CQA consultants' qualifications and duties, project meetings, field monitoring and testing activities, laboratory testing activities, and surveying activities.

- The limitations of this document are described in Section 13.

- A list of references is included in Section 14.

Figures and tables are provided within each section. Supporting documentation including drawings of the present details of the proposed design of the East Canyon Area are provided in Appendices A through H in Volumes II through IV. Additional appendices and supporting documents as referenced in Amendment No. 1 to the JTD are provided in Volume V. The public TF/TS "as-built" drawings are included in Appendix J.

1.5 JTD Indices

The CIWMB and SWRCB indices are presented on the following pages.

Joint Technical Document Index
CIWMB Requirements

CIWMB JTD Requirements	CIWMB Section No.	SWRCB Section No.	JTD Page(s) or Section
General			
Name of Facility, Site Operator and Owner	21600(b)(1)(A)		2-1
Description of the Operation Cycle	21600(b)(1)(A)		2-1
Site Plan Including Boundaries, Acreage, and Buffer Zones	21600(b)(1)(B)		2-2
Hours of Operation	21600(b)(1)(C)		2-8
Waste Classification and Management			
Types and Quantities of Waste	21600(b)(2)(A)	21740(a)(1)	3-1 to 3-7
Waste Management Unit Classification and Siting			
Airport Safety	21600(b)(3)(A)		2-44
Volumetric Capacity	21600(b)(3)(B)		2-41
Site Life Estimate	21600(b)(3)(C)		2-43
Site Location (vicinity map)	21600(b)(3)(D)		2-1
rounding Land Use and Zoning (plot plan)	21600(b)(3)(E)	21750(h)4	2-3 to 2-5
Ancillary Facilities (include on plot plan)	21600(b)(3)(F)		2-9 8-69 to 8-70
Design and Construction Standards for All Waste Management Units			
Design Responsibility *{Describe how the site design provides for the surrounding physical setting}*	21600(b)(4)(A)	21750(a-h)	2-3 to 2-7 4-1 to 4-15 5-1 to 5-6, 7-1 to 7-13 8-41 to 8-48
Design Responsibility *{New disposal sites shall be designed under a civil engineer}*	21600(b)(4)(B)		1-1
Construction Sequencing Plans	21600(b)(4)(C)		8-7 to 8-10 Appendices E
Grading Plan *{Include existing and proposed final contours for disposal area and borrow area}*	21600(b)(4)(D)	21090(b)-(b)(3)	Appendices E

Joint Technical Document Index
CIWMB Requirements

CIWMB JTD Requirements (cont'd)	CIWMB Section No.	SWRCB Section No.	JTD Page(s) or Section
Gas Management Plan *{Demonstrate the ability to comply with T27 20919, 20919.5 and gas control for closure plans}*	21600(b)(4)(E)		6-4, 7-9 to 7-13 8-65 to 8-67 Appendices D, E,

Operating Criteria {Demonstrate the ability to comply with the following:}

Disposal Site Records	21600(b)(5)(A)		2-40
Site Security	21600(b)(5)(B)		2-8
Sanitary Facilities	21600(b)(5)(C)		2-24
Communications Systems	21600(b)(5)(D)		2-25
Lighting {for facilities which operate during darkness}	21600(b)(5)(E)		2-25
Safety Equipment	21600(b)(5)(F)		2-25
Personnel Requirements	21600(b)(5)(G)		2-26
Personnel Training	21600(b)(5)(H)		2-28
Supervisory Structure	21600(b)(5)(I)		2-29
Spreading and Compacting	21600(b)(5)(J)		3-7 to 3-8

Cover

Cover Materials	21600(b)(6)(A)		3-8 to 3-10 6-5
Cover Frequency	21600(b)(6)(B)		3-9 to 3-10
Intermediate Cover	21600(b)(6)(C)		3-9 6-5

Handling

Public Health Design Parameters	21600(b)(7)(A)		2-23
Salvaging Activities	21600(b)(7)(B)		3-22
Volume Reduction Activities	21600(b)(7)(C)		3-24
Equipment	21600(b)(7)(D)		2-25
Special Waste Handling	21600(b)(7)(E)	21740(a)(1)	3-11

Joint Technical Document Index
CIWMB Requirements

CIWMB JTD Requirements (cont'd)	CIWMB Section No.	SWRCB Section No.	JTD Page(s) or Section
Environmental Controls			
Nuisance	21600(b)(8)(A)		2-34
Fire Control	21600(b)(8)(B)		2-34
Leachate Control (for purposes of public health)	21600(b)(8)(C)		3-14 to 3-19
Dust Control	21600(b)(8)(D)	21090(a)(5)(B)	2-35
Vector Control	21600(b)(8)(E)	20425(d)(3)	2-35
Drainage & Erosion Control	21600(b)(8)(F)	21090(c)(4)	2-36
Litter Control	21600(b)(8)(G)		2-37
Noise Control	21600(b)(8)(H)		2-37
Traffic Control (within the facility)	21600(b)(8)(I)		2-38
Hazardous Waste/Load checking	21600(b)(8)(J)		2-39

APPROVALS

Compilation of Approvals	21600(b)(9)		2-41
CIWMB - Requirements for JTD/RDSI amendments and/or complete application package [21600(a)]	**CIWMB Section No.**	**SWRCB Section No.**	**JTD Page(s) or Section**
CEQA Information	21570(f)(3)(4)		2-46, A-10
Conformance Finding Information	21570(f)(5)		2-46, A-10
Complete Closure/Postclosure Maintenance Plan	21570(f)(6)		Appendix G
Financial Assurances Operating Liability Information	21570(f)(7 and 8)		Appendix G
Land Use and/or Conditional Use Permits	21570(f)(9)		Appendix A-8
CIWMB - Closure/Postclosure Maintenance Plan Requirements if part of JTD - PRELIMINARY Closure Plans	**CIWMB Section No.**	**SWRCB Section No.**	**JTD Page(s) or Section**
Closure Cost Estimate	21790(b)(1)	20950(f)	Appendix G
Location Maps	21790(b)(2 & 4)		Appendix G
Post-Closure Land Uses	21790(b)(5)		2-44 , Appendix G
Estimate of Required Closure	21790(b)(6)		Appendix G
Estimated Closure Date	21790(b)(7)		Appendix G

Joint Technical Document Index
CIWMB Requirements

CIWMB JTD Requirements (cont'd)	CIWMB Section No.	SWRCB Section No.	JTD Page(s) or Section
Closure Activities	21790(b)(8)	21090(d)	Appendix G
Site Security and Structure Removal	21790(b)(8)(A)		Appendix G
Final Cover and Grading	21790(b)(8)(B)	21090(a)-(a)(2), (a)(6), (b)-(b)(3), 21750 (f)(5)	Appendix G
Construction Quality Assurance	21790(b)(8)(C)		Section 12, Appendix G
Drainage and Erosion Control	21790(b)(8)(D)	21090(a)(3)-(a)(3)(B)	Appendix G
Gas Monitoring	21790(b)(8)(E)	20425(d)(3)	Appendix G
Leachate Monitoring	21790(b)(8)(F)	21090(c)(2)	Appendix G
CIWMB – Closure/Postclosure Maintenance Plan Requirements if part of JTD – FINAL Closure Plans	**CIWMB Section No.**	**SWRCB Section No.**	**JTD Page(s) or Section**
Items Under 21790 (Preliminary Plans)	21800(c)	20425(d)(3), 20950(f), 20909(a)-(a)(3) (A)(3), 21090	NA
Sequence of Closure Stages With Dates	21800(c)	21090(a)-(a)(2), (d)	NA
Schedule for Disbursement	21800(d)		NA
CIWMB - Closure/Postclosure Maintenance Plan Requirements if part of JTD - PRELIMINARY Postclosure Maintenance Plans	**CIWMB Section No.**	**SWRCB Section No.**	**JTD Page(s) or Section**
Description of Planned Uses per 21190	21825(b)(1)	21769(b)	2-44, Appendix G
Description of Maintenance per 21180	21825(b)(2)	21769(b)	Appendix G
CIWMB - Closure/Postclosure Maintenance Plan Requirements if part of JTD - FINAL Postclosure Maintenance Plans	**CIWMB Section No.**	**SWRCB Section No.**	**JTD Page(s) or Section**
Emergency Response Plans per 21130	21830(b)(1)	21769(c)	NA
List of Responsible Parties	21830(b)(2)	21769(c)	NA
Post-Closure Planned Uses per 21190	21830(b)(3)	21769(c)	NA
As-builts for Monitoring and Control Systems, etc.	21830(b)(4)	21769(c)	NA
Description of Maintenance per 21180	21830(b)(5)	21769(c)	NA
Operations and Maintenance plan for Gas Control System	21830(b)(6)	21769(c)	NA

Joint Technical Document Index
CIWMB Requirements

CIWMB JTD Requirements (cont'd)	CIWMB Section No.	SWRCB Section No.	JTD Page(s) or Section
Plan to Report Results of Monit./Control per 21180	21830(b)(7)	21769(c)	NA
Postclosure Mtce. Cost Estimates per 21840	21830(b)(8)	21769(c)	NA

NOTE: For submitting amendments of Closure and Postclosure Maintenance Plans as part of a JTD, use Section 21780 and include the requirements of Section 21865 (b)(1)-(4).

SWRCB Requirements	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Chapter 1. General Article 1. Purpose, Scope and Applicability of this Subdivision			
§20080. General Requirements. [engineered alternatives to prescriptive standards]	20080(b-c)		If proposed: Section 8,
Chapter 3. Criteria for All Waste Management Units, Facilities, and Disposal Sites Subchapter 2. Siting and Design Article 2. SWRCB - Waste Classification and Management §20200. SWRCB - Applicability and Classification Criteria.			
Concept (& describes possible exemption)	20200(a)		if proposed:
Demonstration proposing to allow discharge of a particular waste to a particular landfill of lower classification	20200(a)(1)		if proposed:
Dedicated units/cells for certain wastes	20200(b)-(b)(2)(C)		If proposed: 3-3
Waste characterization	20200(c)		3-1 to 3-3
Management of liquids	20200(d)-(d)(3)		3-2 to 3-3
§20220. Nonhazardous Solid Waste.			
Demonstration by discharger	20220(b)-(b)(2)		2-37; 3-4; 3-12 to 3-13; Appendix B
Dewatered sludge (describes conditions for discharge)	20220(c)-(c)(3)		If sludge: 3-2
Ash (allows discharge of non-hazardous ash to Class III landfills w/o determining of ash is designated waste)	20220(d)		If ash:
Article 3. Waste Management Unit, Facility, or Disposal Site Classification and Siting **			
§20240. Classification and Siting Criteria.	20240		2-1 to 2-2, 2-6,
§20250. Class II: Waste Management Units for Designated Waste.	20250		If Class II: n/a
§20260. Class III: Landfills for Nonhazardous Solid Waste.	20260		If Class III: 2-1 to 2-2

SWRCB Requirements	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Article 4. SWRCB - Waste Management Unit Construction Standards **			
§20310. General Construction Criteria.	20310		Section 8,
§20320. General Criteria for Containment Structures.	20320		8-10 to 8-29,
§20323 & ͽ20324. CQA Plan & Requirements	20323 & 20324		12-1 to 12-2,
§20330. Liners.	20330		8-20 to 8-29,
§20340. Leachate Collection and Removal Systems (LCRS).	20340		8-29 to 8-40,
§20360. Subsurface Barriers.	20360		If proposed: NA
§20365. Precipitation and Drainage Controls.	20365		8-40 to 8-55,
§20370. Seismic Design.	20370		9-1 to 9-19,
§20375. Special Requirements for Surface Impoundments.	20375		If LF facility has SI: NA
Subchapter 3. Water Monitoring Article 1. SWRCB - Water Quality Monitoring and Response Programs for Solid Waste Management Units §20380. SWRCB - Applicability.			
Corrective action financial assurance	20380(b)		7-14
Duration of applicability	20380(c)-(c)(2)	21900	NA
Limitations on engineered alternatives	20380(e)-(e)(3)		7
§20385. Required Programs.	20385		7-2
§20390. Water Quality Protection Standard (Water Standard).	20390		7-1
§20395. Constituents of Concern (COCs).			
COCs	20395(a)		7-2
MSW COCs	20395(b)		7-7
§20400. Concentration Limits.			
Proposing COCs	20400(a)-(a)(3)		7-1
Adoption of concentration limits	20400(b)-(b)(3)		7-1

SWRCB Requirements	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Establishing a CLGB (for corrective action only)	20400(c-h)		NA
Decreasing a CLGB (in DMP following a CAP)	20400(i)		NA
§20405. Monitoring Points and the Point of Compliance.	20405(a-b)		7-1 to 7-7
§20410. Compliance Period.	20410(a-c)		7-1
§20415. General Water Quality Monitoring and System Requirements.			
Section applies to all monitoring programs	20415(a)		7-1
G.W. Mon. System (general)	20415(b)-(b)(4)(D)		7-1 to 7-2
Sfc. Water Mon. (general)	20415(c)-(c)(2)(D)		If any: 7-1
U.Z. Mon. (general)	20415(d)-(d)(4)		If any: 7-2
Mon. systems designed by RG or RCE	20415(e)(1)		7-1 to 7-7
Logging of borings	20415(e)(2)-(e)(2)(C)		Appendix D
Shared monitoring system demonstration for contiguous Units	20415(e)(3)		If contig. Units:
Monitoring sample QA/QC	20415(e)(4)-(e)(4)(D)		7-2
Sampling & analytical methods (perf. std. for)	20415(e)(5)		7-2
Monitoring data procurement, analysis, and submittal	20415(e)(6)-(c)(15)		7-2
§20420. Detection Monitoring Program.	20420		7-1
§20425. SWRCB - Evaluation Monitoring Program.	20425	Re.&(d)(3): 20919 et seq., 21600(b)(8)(E), 21790(b)(8)(E), 21800(c)	If newly-found release:
§20430. Corrective Action Program.	20430		If treating a release:

SWRCB Requirements	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Subchapter 4. Criteria for Landfills and Disposal Sites Article 2. CIWMB - Daily and Intermediate Cover			
§20705. Standards for Daily and Intermediate (Interim) Cover.	20705		3-8, 3-9
Subchapter 5. Closure and Post-Closure Maintenance ** Article 1. General Standards For All Waste Management Units **			
§20950. General Closure and Post-Closure Maintenance Standards Applicable to Waste Management Units (Units) for Solid Waste.	20950	re &(f): 21780(a)(3), 21790(b)(1), 21800(c), 21820, 21840	Appendix G
Article 2. Closure and Post-Closure Maintenance Standards for Disposal Sites and Landfills §21090. Closure and Post-Closure Maintenance Requirements for Solid Waste Landfills.			
Final cover requirements (general)	21090(a)-(a)(2)	21140, 21790(b)(8)(B), 21800(c)	Appendix G
Erosion control layer	21090(a)(3)-(a)(3)(A)3.	21140, 21150, 21790(b)(8)(D), 21800(c)	Appendix G
Maintenance (& plan for)	21090(a)(4)-(a)(4)(D)		Appendix G
Discharges of liquids to covers (leachate & condensate)	21090(a)(5)(A)		Appendix G
Discharges of liquids to covers (other liquids)	21090(a)(5)(B)	20800, 21600(b)(8)(D)	Appendix G
Stability analysis	21090(a)(6)	21145, 21790(b)(8)(B)	Appendix G
Grading requirements (performance standards)	21090(b)-(b)(3)	20650, 21142(a), 21150, 21600(b)(4)(D), 21790(b)(8)(B)	Appendix G

SWRCB Requirements	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
General post-closure duties	21090(c)-(c)(5)	**re (c)(2):** 21150, 21160, 21180, 21790(b)(8)(F) // **re (c)(4):** 21600(b)(8)(F)	Appendix G
Landfill closure deadline & extension	21090(d)	21110, 21790(b)(8), 21800(c)	Appendix G
Final cover survey(s)	21090(e)-(e)(4)	21142(b)	Appendix G
Optional clean closure	21090(f)-(f)(2)	21810	NA
§21132. Landfill Emergency Response Plan Review.	э21132		Appendix G
§21400. Closure Requirements for Surface Impoundments.	э21400		If LF facility has SI: NA
§21410. SWRCB - Closure Requirements for Waste Piles.	э21410		If LF facility has WP: NA
Chapter 4. Documentation and Reporting For Regulatory Tiers, Permits, WDRs, and Plans Subchapter 3. Development of Waste Discharge Requirements (WDRs) and Solid Waste Facility Permits Article 2. CIWMB - Applicant Requirements.			
§21585. SWRCB - Joint Technical Document (JTD). [format for submittal of э21710, э21750, э21760 information]	21585		1-3
Article 4. SWRCB - Development of Waste Discharge Requirements (WDRs) **			
§21710. SWRCB - Report Of Waste Discharge (ROWD) and Other Reporting Requirements. [see also э21585]	21710	re &(c)(1-2): 21145(b), 21200, 21630	1-2
§21720. SWRCB - Waste Discharge Requirements (WDRs).	21720(d-f)	re &(f): 20510, 20515	2-45
§21730. SWRCB - Public Participation. [proposed listing of potentially interested parties]	21730(a)		2-1
§21740. SWRCB - Waste Characteristics.	21740	re & (a)(1): 21600(b)(2)(A) & (b)(7)(E)	3-1

SWRCB Requirements	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
§21750. SWRCB - Waste Management Unit (Unit) Characteristics and Attributes to be Described in the ROWD.			
Analysis of potential for impairment	21750(a)	21600(b)(4)(A)	3-5
Support for proposed Unit classification	21750(b)	21600(b)(4)(A)	6, 7, 8, 9
Listing & incorporation of supporting documents	21750(c)	21600(b)(4)(A)	Table of Contents
Topographic map	21750(d)(1)	21600(b)(4)(A)	5-1 to 5-2; Figure 5-1
Floodplain analysis	21750(d)(2)-(d)(2)(C)2.	21600(b)(4)(A)	Figure 5-2,
Climate	21750(e)-(e)(6)	21600(b)(4)(A)	5-2 to 5-6
Geology	21750(f)-(f)(7)	21600(b)(4)(A) // re (f)(5): 21145, 21790(b)(8)(B)	4-1 to 4-7,
Hydrogeology	21750(g)-(g)(7)(D)	21600(b)(4)(A)	4-7 to 4-14
Land/Water Use	21750(h)-(h)(5)	21600(b)(4)(A) re ¶(h)(4): 21600(b)(3)(E)	2-4 to 2-5
Preliminary closure plan	21750(i)		Appendix G
§21760. SWRCB - Design Report and Operations Plan.			
Design Report , preliminary and as-built plans	21760(a)(1)		Appendices E
Design Report	21760(a)(3)-(a)(4)		7-1 to 7-13; 9
Operation Plan	21760(b)-(b)(3)		10-1
Subchapter 4. Development of Closure/Post-Closure Maintenance Plans §21769. SWRCB - Closure and Post-Closure Maintenance Plan Requirements.			
Prelim. Cl/P-Cl Plan X purpose	21769(b)(1)		Appendix G
Prelim. Cl/P-Cl Plan Contents X cost analysis	21769(b)(2)-(b)(2)(B)5.		Appendix G
Final Cl/P-Cl Plan	21769(c)-(c)(2)(H)3.		NA

SWRCB Requirements	SWRCB Citation	Related CIWMB Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Chapter 5. Enforcement Article 4. Enforcement by Regional Water Quality Control Board (RWQCB) **			
§22190. SWRCB - Mandatory Closure (Cease and Desist Orders).	22190(b)		If early closure mandated: NA
Chapter 6. Financial Assurances at Solid Waste Facilities and at Waste Management Units for Solid Waste Subchapter 2. Financial Assurance Requirements Article 1. Financial Assurance for Closure			
§22207. SWRCB - Closure Funding Requirements.	22207(a)		Appendix G
Article 2. Financial Assurance for Postclosure Maintenance			
§22212. SWRCB - Post-Closure Funding Requirements.	22212(a)		Appendix G
Article 4. Financial Assurance Requirements for Corrective Action			
§22222. SWRCB - Corrective Action Funding Requirements.	22222		7-14

2. FACILITY OVERVIEW

2.1 Introduction

This section of the JTD presents background information about the Sonoma County Central Disposal Site (CDS) including the 1971 Permitted area (Landfill 1) and the East Canyon Area (ECA or Landfill 2). Pursuant to Sections 21600 and 21750 of Title 27, and other requirements as noted, this section contains information about the site; personnel and training; equipment used at the site; surrounding land and groundwater uses; site health and safety; site controls; record keeping and reporting, and permits and approvals.

2.2 General Facility Information

Section 21600 (b)(1)(A) requires that each operator of a disposal site must file with the enforcement agency "... *a statement including the name of the site, the name of the person who will operate the site, the name of the person who owns the land, and a description of the operations cycle.*" and Section 21600 (b)(3)(d) requires that each operator "... *describe the site location referencing a location map, highlighting the legal boundaries, points of access, and major access routes for waste deliveries to the site.*"

The CDS has been owned by the County of Sonoma, Department of Transportation and Public Works since it opened in 1971. The landfill is located in Sonoma County at 500 Mecham Road, 4 miles southwest of the City of Cotati, California, in the Rancho Roblar De La Miseria. The site is bounded by Mecham Road to the east, Hammel Road to the south, and is located at latitude 38 degrees, 18 minutes north and longitude 122 degrees, 45 minutes west. The site location and facility boundaries are shown in Figure 2-1 and Figure 2-2, respectively. Figure 2-9 shows the acquired Camozzi property and ancillary facilities. A legal description of the permitted boundaries is included in Appendix A-1.

The CDS is a Class III facility as defined by Sections 20240 and 20260 of Title 27 which state that *"waste management units shall be classified according to their ability to contain wastes"*, and *"Class III landfills shall be located where site characteristics provide adequate separation between nonhazardous solid waste and waters of the state"*, respectively. The site accepts mixed municipal wastes, construction and demolition wastes, agricultural wastes, and landscaping wastes and non-hazardous industrial wastes.

The East Canyon Area (Landfill 2) serves as a lateral expansion of the existing Sonoma CDS 1971 Permitted Area (Landfill 1) and is designated Class III by Title 27 standards. The expanded area also receives mixed municipal wastes, construction and demolition wastes, agricultural wastes, and landscaping wastes and non-hazardous industrial wastes.

The site is managed by the Integrated Waste Division (IWD) of Sonoma County's Department of Transportation and Public Works, located at 2300 County Center Drive, Suite B-100 in Santa Rosa, California. Day to day landfill operations are performed by the IWD's Operations Headquarters located at CDS at 500 Mecham Road, Petaluma, California. Current Operations Plans are included in Appendix L.

2.3 Site Plan

Section 21600(b)(1)(B) of Title 27 states that landfill operators shall "*... provide facility plan(s) including the predisposal topography..., the facility boundary (clearly illustrating parcels..), the total permitted acreage of the site, the acreage of the disposal area, fill sequencing and excavation plans, the extent of any buffer zones between the disposal area and the permitted property boundaries.*"

The CDS is located on county owned parcel (APN 24-080-19) in an unincorporated portion of Sonoma County [Environmental Impact Report (EIR), WCC, 1997]. The project site is designated for "Public/Quasi-Public" (PQP) land uses in the Sonoma County General Plan, and is zoned Public Facilities (PF) to reflect this. The site owner has expanded the Central Landfill into the canyon immediately to the east of the original permitted landfill area.

The CDS property covers about 398.5 acres (161.6 ha). Figure 2-2 shows property boundaries. Within the site boundaries are the current 130-acre landfill (1971 Permitted area); the 42-acre (17 ha) East Canyon area, and the ancillary facilities described in Section 2.6. The planned final top elevation of the permitted site will be about 565 ft (172 m). The elevation of the surrounding topography varies from 520 to 675 ft (159 to 206 m) at the north end of the site, and 250 ft (62.5 m) at the south end of the site. All elevations are based on a local datum. The Site Plan for the CDS, including the 1971 Permitted Area and the East Canyon Area, is shown in Appendix A-2.

The County property includes approximately 6.5 acres of land previously acquired from the adjacent parcel (APN 24-080-18) northeast of the disposal site. Figure 2-9 shows the property boundary in this area. Five acres of the acquired land have been used for the development of the Operational Improvements Project, including roads, buildings, and recycling facilities. The remaining 1.5 acres are used as a permanent 220 to 1,500 ft (67 to 457 m) wide buffer zone on the northern and eastern sides of the household hazardous waste and recycling areas. Trees have been planted in some of the buffer areas to provide visual screening of the northern part of the CDS; however, most of the buffer zone will remain as native open grassland.

2.4 Land Use and East Canyon Siting Criteria

2.4.1 Introduction

Section 21600(b)(3)(E) of Title 27 states that landfill operators shall "... *describe and provide a plot plan showing land uses and land use zoning for all properties within 1,000 feet of the facility boundary shown on a site plan.*" Similarly, Sections 21750(h)(4)(A-D) and 21750(h)(5) of Title 27 state that dischargers shall provide information about "... *current land use within one mile of the perimeter of the Unit including: types of land use, crops, livestock, and number and location of dwellings.*", and "... *current and future estimated use of groundwater within one mile of the facility perimeter.*", respectively. This information is included in the following sections.

2.4.2 Existing Land Uses

The site is surrounded by lands which have been designated as "Land Extensive Agriculture", and is accordingly zoned Exclusive Agriculture, consistent with the General Plan and the County Solid Waste Management Plan [Report of Disposal Site Information (RDSI), 1997]. The lands surrounding the landfill parcel on three sides are used for grazing. Appendix A-3 includes zoning and general plan maps.

2.4.3 Proposed Land Uses

The CDS is currently estimated to remain in operation until 2019 and no specific proposal has been developed at this time for its use after closure. Consideration is being given to the idea of converting the closed landfill into a regional park. This is in accordance with the County's General Plan, which has proposed the future use of the CDS as a park [RDSI, Sonoma County, 1997].

2.4.4 Surrounding Land Use

Within a 1-mile (1.6-km) radius of the site, adjacent land uses include rural residential and agricultural operations such as dairy and cattle ranches, and grazing lands. Happy Acres, the nearest established subdivision, is located about 0.5 mile (0.8 km) northeast of the proposed project site. The subdivision currently has about 70 residences. After Happy Acres, the nearest established subdivision areas are located in the City of Cotati, approximately 3 miles northeast, and the City of Petaluma, approximately 8 miles (12.6 km) south [WCC, 1997].

To the north, the nearest residence (associated with Gray View Ranch) is approximately 600 ft (183 m) from the site's northern boundary. Approximately 1,000 ft (305 m) to the northeast are dairy operations and an associated residence. Also to the north is the agricultural Bloom Ranch property. The Sonoma County Open Space District has been negotiating to purchase the development rights of this area for preservation purposes. The Stony Point Quarry which is located approximately 2 miles (3.2 km) north of the site serves as a disposal site for rock excavated from the landfill; and an occasional borrow site for landfill cover soil material [WCC, 1997].

The 1,121-acre (454 ha) Button Ranch is located approximately 0.5 mile (0.8 km) west of the site. The ranch was operated as a dairy under the University of California from 1974 until 1996 when it was purchased by a private owner. Future use for the land is unknown. The nearest residence east of the landfill is on the hilltop, across from the site access road [WCC, 1997], at 403 Mecham Road. The County owns this property and currently leases the grazing rights of the surrounding property to another private party.

To the south, the nearest residences are on Mecham Road approximately 800 ft (244 m) from the site's southern boundary. The Diamond M Dairy, which includes several residences, is located about 500 ft (152 m) southwest from the site's boundary. Additional residences are located along Mecham Road east of the site, and along Stony Point Road, north of the site [WCC, 1997].

2.4.5 Groundwater Uses

Privately owned low-yield water supply wells are used for domestic and agricultural activities south of Hammel Road. Well depths range from approximately 11 to 220 ft (4 to 67 m) below the ground surface) and, based on their locations and depths, appear to draw water from the alluvium, or the shallow/low yield areas of the Wilson Grove formation, one of the principal water-producing formations in Sonoma County [WCC, 1997].

In the vicinity of Stony Point Road, north of the site, wells with higher yields are seated in the Wilson Grove Formation. Approximately 1 mile (1.6 km) from the site, a well from a privately owned water utility serves some of the homes in the Happy Acres subdivision, northeast of the landfill. Other homes obtain water from individual wells on their properties [WCC, 1997].

Also located north of the landfill near Stony Point Road is a 242 ft (74 m) deep well owned by Sonoma County. The well supplies about 65,000 gallons (246,050 L) of water per day during the dry season (June through October) to the landfill. Most of this water is used at the compost facility and some is used for dust control [WCC, 1997]. Taber and Herzog located groundwater wells located within a 1-mile radius of the site [Taber, 1987 and Herzog, 1993]. Figure 2-8 shows the domestic wells located in close proximity or adjacent to the project site (after Tabler 1987, Herzog 1993, and WCC 1997). Based on the domestic well survey review, five domestic wells were identified down gradient of the east canyon [Herzog, 1993].

Spring discharge of groundwater in the region occurs primarily at locations where open bedrock fractures intercept the ground surface. Within a 1-mile radius of the site, a single spring was located at the end of Hammel Road at a contact of the base of the Wilson Grove Formation with the underlying Franciscan formation. The water from the spring is used for livestock purposes [Taber, 1987]. Of the remaining 413 major springs within Sonoma County, none is located within a 1-mile (1.6-km) radius of the site [WCC, 1997].

2.4.6 East Canyon Siting and Location Criteria

Various requirements and restrictions for siting of existing and proposed landfills are spelled out in Sections 20240 and 20260 of Title 27. Additional requirements are included in the Subtitle D. These criteria have been considered in the development of the East Canyon area, and are summarized in this section.

2.4.6.1 General

Based on the criteria described in this section, as well as site topography and climatology, the ECA is classified to accept Class III wastes by Title 27 standards.

Section 20240 of Title 27 requires that all new landfills be designed such that waste will be a minimum of five feet above the level of highest anticipated underlying groundwater. However, the East Canyon area does not meet this requirement and has been designed with an engineered alternative meeting performance criteria. The proposed capillary break/underdrain system, which effectively separates the groundwater from the waste, is described in more detail in Section 8.2.

The foundation for the ECA has been designed to meet all foundation requirements, including design against hydraulic pressure gradients, settlement, compression, uplift, and effects of ground motions, as required by Section 20240. Design for foundation requirements is discussed in more detail in Section 9.

2.4.6.2 Geologic Setting

The ECA has been designed to meet all requirements for geologic setting as they are spelled out in Section 20260 of Title 27 and Subtitle D. The geologic characteristics and a geologic assessment of the site are provided in Section 4.1. Other related issues, including the design of the containment system to protect the beneficial uses of surface water and groundwater water, are discussed later in this section.

2.4.6.3 Seismic Issues

Section 20260 of Title 27 and Subtitle D both include requirements for site seismic conditions and seismic design. Site seismic conditions are described in Section 4.1.4. Seismic design of the East Canyon area is discussed in Appendix F-4.

2.4.6.4 Flooding

As required by Section 20260 of Title 27 and Subtitle D, and discussed in Section 5.2, the East Canyon area is not located within a 100-year flood plain zone. A Federal Emergency Management Agency (FEMA) Map for the region in which the site is located is included as Figure 5-2.

2.4.6.5 Wetlands

Within the proposed East Canyon expansion area, there are lands defined as jurisdictional wetlands, riparian areas and aquatic habitats, as shown on Figure 2-8. Approximately 1.6-acres of seasonal wetland and 0.1 acre of stream channel were filled during construction of Phases I and II, Parts 1 and 2 of the facility. In response to the wetland mitigation requirements specified by the CRWQCB and comments on previous plans, the County developed and implemented an Alternatives Analysis and a Wetland Mitigation and Monitoring Plan dated March 2000. These documents are included in Appendix D-8. The mitigation area is currently being maintained and monitored and repairs are made as needed.

2.4.6.6 Airport Safety

Subtitle D requires that landfills within a specific distance from an airport be designed not to pose a bird hazard to aircraft. The CDS and East Canyon Area expansion are not in the vicinity of an airport, as shown on Figure 2-1.

2.5 Hours of Operation

Section 21600 (b)(C) requires that facility operators shall "... *state the hours and days of operation for the site*." The CDS, including the public Tipping Facility/Transfer Station (TF/TS) is open to the public to receive waste between the hours of 7:00 a.m. and 4:00 p.m., 7 days per week. County and contractor employees have access to the site to perform all ancillary and operations related work, for the purpose of moving, loading, out-hauling, applying ADC and other related operations and maintenance tasks, between the hours of 6:00 a.m. and 6:30 p.m., 7 days a week. The hours of operations by contractors and County employees may be extended on an urgent or emergency basis with the approval of the Enforcement Agency (EA). Rock blasting operations are between the hours of 4:30 p.m. and 5:30 p.m. on weekdays, excluding holidays.

The facility is closed for the holidays of New Year's Day, Easter, 4th of July, Labor Day, Thanksgiving, and Christmas [Sonoma County, 1997a].

2.6 Site Security and Access

Section 21600 (b)(5)(B) states that landfill operators shall "... *describe how the operator will discourage unauthorized access by persons or vehicles.*" The CDS has public and nonpublic access points at Mecham and Hammel Roads, respectively. From the Mecham Road entrance, a 1-mile asphalt paved, or chip sealed road leads to within 100 to 1,000 ft (30 to 300 m) of the tipping apron. A gravel surface road provides site access from Hammel Road. Signs placed at the site entrances identify the owner and operator of the site; which materials are and are not accepted; hours of operation; and general health and safety information. The roads leading to the wood chipping and composting areas have gravel surfacing. All of the other roads on the site are dirt, including haul roads. A third entrance with a gate, which is located on Hammel Road west of the leachate ponds, was constructed in 1998 to provide access to the REA. A fourth entrance has been added on Hammel Road near Mecham Road as access to Landfill 2. The site is surrounded by a fence with locking gates at all entrances. All three external access gates are equipped with Knox-Boxes™ that contain keys to all the gates and buildings at the CDS.

The site signs, security, and roads are in accordance with the CIWMB requirements in Sections 20520, 20530, and 20540 of Title 27, which state, respectively, that *"...each point of access from a public road shall be posted with an easily visible sign indicating the facility name, and other pertinent information as required by the enforcement agency..."* Further, "... *the site shall be designed to discourage unauthorized access by persons and vehicles by using a perimeter barrier or topographic constraints...;* and *"...roads within the permitted facility boundary shall be designed to minimize the generation of dust and the tracking of material onto adjacent public roads."*

2.7 Ancillary Facilities

Section 21600(3)(F) of Title 27 states that operators shall "... *describe and provide a plot plan showing all ancillary facilities at the site...*" Ancillary facilities at the site include administrative buildings; an equipment yard; a recycle/reuse facility; wood chipping and composting operations, a metals recycling facility, a gypsum recycling area, a public tipping building, six vehicle weight scales; three fee gatehouses; a fleet maintenance building, a power plant which converts methane gas into electricity; and a flare that burns excess landfill gas [Sonoma County, 1997a]. An expansion to the power plant, consisting of two, 0.8 Mw modular generators located behind the main power plant, was completed and source tested in March 2003 and put into operation in July 2004.

Portable buildings on site include five storage containers and several miscellaneous storage sheds for maintenance supplies, a trailer where breaks are taken by equipment operators, four household hazardous waste storage lockers, three trailers used by the private contractor operating the wood and yard waste chipping and composting, two office/lab temporary trailers for construction contractors, one trailer for the gas system maintenance crew, and eight portable toilets. The ancillary facilities are shown on the site plan maps in Appendix A-2.

2.8 Other Site Facilities

In addition to the East Canyon Area (ECA) expansion, the CDS has proposed other site facilities and projects associated with the handling of municipal solid waste. Each of these additional facilities is discussed below. The information about each facility, with the exception of the TF/TS, was referenced from the Environmental Impact Report (EIR) by Woodward-Clyde Consultants [WCC, 1997]. The County provided information related to the TF/TS in 2005.

2.8.1 Household Hazardous Waste Facility

2.8.1.1 Need for and Objectives of the Proposed Improvement

In general, a material or waste is classified as "hazardous" if it is one of nearly 800 chemicals specifically listed as hazardous in Title 22 of the CCR; if it is a mixture containing one or more listed wastes or materials; or if it is reactive, flammable, explosive, or toxic. Hazardous waste is a hazardous material that is a byproduct of a process, is no longer of use, or is a hazardous material that has spilled or leaked.

The CDS is not permitted to accept hazardous materials for disposal (except used motor oil, oil filters, automobile batteries, and latex paint, which are accepted at the recycling/reuse facility). This is a problem for the public because people cannot dispose of hazardous materials as easily as other household waste. This is also an environmental problem because people may be disposing of these materials improperly. Historically, this issue had been addressed by providing periodic hazardous waste collection events held at various locations throughout the County. In 1995, about 434,014 pounds of household hazardous waste were collected through the periodic waste collection events (Table 2-1). However, this is not an adequate or convenient long-term solution, because the collection events are infrequent and at different locations. The County estimates that the existing program only served about 7,030 of the 160,000 households in Sonoma County in 1995.

A Waste Characterization Study was done for the County in 1996 by Cascadia Consulting Group. During this study, random vehicles were selected at the entry gates to the CDS and the transfer stations. Samples of the wastes were extracted and sorted into categories. Based on this sampling, the consultants concluded that the household hazardous wastes represented approximately 0.4% of the total waste stream going into the landfill. Based on this data, it was estimated that approximately 1,784 tons of hazardous wastes were disposed of in the landfill in 1995.

Of the hazardous materials disposed of in the landfill, approximately 39% came from self-haul customers. These customers are typically people who haul their own refuse to the landfill because they do not have curbside garbage service, or because they have materials that will not fit in the curbside containers. The residential waste stream accounted for 28% of the hazardous wastes. This includes the waste from residents who have curbside garbage service. The remaining 33% came from the commercial sources (businesses).

The Countywide Integrated Waste Management Plan (CoIWMP), dated October 2003, includes a Household Hazardous Waste Element (HHWE), which aims at reducing the amount of hazardous materials used and ensuring that the wastes are recycled, reused, or disposed of safely. A key part of this HHWE was a proposal to construct a household hazardous waste collection center at the CDS that would act as a drop-off point where the general public and qualified small quantity commercial generators could bring their hazardous wastes. The wastes would be stored temporarily at the facility and then transported to other facilities for recycling, treatment, or disposal. Hazardous waste would not be disposed of at the landfill.

Table 2-1
HOUSEHOLD HAZARDOUS WASTE COLLECTED IN SONOMA COUNTY IN 1995

Waste Type	Actual Weight (lbs)	Percent of Waste Stream	Management Method
1 - Flammable and Poisonous (oil-base paint, poison, reactive and explosive)	228,717	52.7	Incineration
2 - Acids (organic and inorganic)	9,678	2.2	Treatment
3 - Bases (organic and inorganic)	5,093	1.2	Treatment
4 - Oxidizers (neutral, organic, oxidizing acid, oxidizing base)	2,390	0.5	Treatment and Incineration
5 – PCB-containing HW (paint, other base)	1,462	0.3	Incineration
6 - Aerosol (corrosive, flammable poison)	11,010	2.5	Incineration and Recycling
7 - Reclaimables (antifreeze, car batteries, fluorescent bulbs, latex paint, motor oil/oil products, oil filters, mercury)	160,412	37.0	Recycling
8 - Other (medical waste, MM batteries, Class 9 Env. Haz. Substance, non-RCRA waste)	9,009	2.1	Landfill and Incineration
9 - Asbestos (cubic yards)	6,333	1.6	Landfill
Total (excluding asbestos)	**427,771**	**98.5**	
Total (including asbestos)	**434,104**	**100**	

Source: Phillips Environmental [1995]

The objectives of the HHW facility include the following:

- provide a safe, convenient, and economical means to collect and dispose of household hazardous waste, consistent with the adopted CoIWMP;
- discourage improper disposal of hazardous waste at the landfill by providing a safe and convenient means for customers of the CDS to dispose of household hazardous waste; and
- reduce the amount of illegal dumping or other improper disposal anywhere in the county by providing a convenient alternative.

2.8.1.2 Facility Design

The household hazardous waste (HHW) collection facility, along with the new gas fuel facility, a recycling facility, and the public tipping facility (described in subsequent sections) would be located north of the East Canyon waste disposal area (Figure 2-4). The public tipping facility was opened to the public in January 2003 and the HHW facility opened on 6 January 2005. The main access to this complex of facilities provides joint access to traffic for both the HHW collection facility and the recycling area. As-built drawings are included in Appendix H.

The location was chosen because it allows for an efficient traffic pattern for both the transfer station (TS) and landfill customers while minimizing traffic conflicts. More importantly, with this location, the public must pass by the HHW facility before reaching the public tipping facility (TF). The results is that the public is encouraged to stop at the HHW facility prior to disposing of refuse at the transfer station, thereby reducing the chance that people will dispose of hazardous materials improperly on the tipping floor.

A complete edition of the Sonoma County Household Toxic Waste Facility Operations Plan, dated November 2004, is included in Appendix L of this JTD.

2.8.2 Public Tipping Facility/Transfer Station

Due to operational changes at the CDS, the refuse tipping building will be referred to as public Tipping Facility/Transfer Station (TF/TS) to better reflect the actual function of the building.

2.8.2.1 Need for Proposed Improvement

Prior to the new public tipping building operation commencement in December 2002, the public used a tipping apron that was located immediately adjacent to and about 10 ft (3 m) above the active refuse disposal area. Private self-haulers backed their vehicles to the edge of the tipping area and threw or pushed refuse over the edge. The tipped waste was then moved from this area into the disposal cell by landfill workers.

Several problems have been associated with this practice of public dumping at the apron. First, as disposal cells were developed in different parts of the landfill, the tipping apron had to be moved resulting in additional costs in constructing the apron at each new location. Second, a customer could be injured while tipping refuse off the apron's edge. Third, this method of dumping also increased problems associated with wind-blown litter at the site. To address these problems, the Operations Improvement Project included an enclosed public TF/TS. The TF/TS meets Title 14 of the CCR General Design Requirements, Operating Standards, and Recordkeeping Requirements, as per Sections 17406-17419 of Title 14 of the CCR.

2.8.2.2 Facility Design

The TF/TS is located on the north side of the access road to the north of the existing CDS operations office. This location is shown on Figure 2-4. Design drawings are included in Appendix H.

The facility consists of a steel frame structure about 282.5 ft long and about 120 ft wide, with a level tipping floor and a lower trailer loading area built for two trailers. The structure is up to about 35 feet high and is enclosed on three sides, with one side open for public vehicle access to the tipping floor that can accommodate 18 stalls along the north side of the building.

As part of the operational improvements on this part of the CDS, approximately 1,550 ft of the electric transmission line serving the site has been realigned from the point at which it enters the landfill parcel to the power plant. This required moving several power poles on the northern part of the parcel. An additional pole was installed on the property acquired from the adjacent dairy to facilitate the power needs of the HHW and Recycle/Reuse facilities. This realignment did not affect any other parcels or make a change that would be visible from off-site locations.

The TF/TS was designed to accommodate the current and projected number of self-haul vehicles. In the original design, enough space had been reserved to expand the facility to the west if it became necessary. In 2003, the County failed to secure its permits from the CRWQCB to expand the site and permit Phases 3 and 4 of the Landfill 2 expansion plan. Without the expansion, the County was forced to begin out-hauling approximately 30% of its Class III waste to an alternative permitted facility located outside the County. By September of 2005, the County plans to begin temporarily out-hauling 100% of its solid waste to an alternative permitted facility, outside the County of Sonoma, for an interim period of approximately 3 years. To this end, the County will use the existing tipping facility (TF) to either load and transfer solid waste directly to the landfill operation at the CDS or to load and out-haul solid waste to an alternative permitted facility outside the County. As a result, more waste will be processed through the TF/TS, creating the need for additional transfer station floor space (see Section 2.8.2.6 - Proposed Design Modifications). In order to facilitate this alternate operating scenario, the County is planning an expansion to the existing TF/TS.

Due to operational hours constraints, it is unlikely that all solid waste at the TF/TS will be able to be removed at the end of each operating day, as specified in EA condition "n" of the original SWFP. It is expected that as much as 150 tons of Class III solid waste may have to remain on the tipping floor for a time frequency approved by the EA.

In order to accommodate the CIWMB requirement, the County will submit an application for a SWFP revision to address the converted use of this building from a "tipping facility" to a "transfer station." Because the structure is located within the permitted boundaries of the CDS, a revision to the SWFP, to accommodate the change to a dual use Disposal Site/Transfer Station, will be considered by the CIWMB as an acceptable permitting option.

2.8.2.3 Facility Operations

The TF/TS is currently open to the public the same hours as the landfill, from 7:00 am to 4:00 pm, 7 days a week. Adequate staff is available to help operate the facility and to keep traffic flowing in accordance with the design traffic patterns (see Appendix A-5 - Internal Traffic Routes). At the TF/TS building, public self-haul vehicles and commercial collection vehicles are separated by concrete barriers and delinators and use different unloading bays. Under the direction of County disposal workers, self-haul vehicles back into one of 18 stalls located in the unloading bay and unload their refuse onto the tipping floor. When necessary, a track-mounted dozer is used to break up and compact the refuse on the tipping floor. Large rubber-tired front-end loaders are then used to "push" refuse from the tipping floor into large tractor/trailer transfer vehicles. From there, refuse is transferred to the active face of the landfill or out-hauled to an alternate permitted facility located outside the County of Sonoma.

In the 12-month period from 1 April 2003 through March 2004, and immediately preceeding the commencement of out-hauling of solid waste to an out-of-County receptor, a total of 572,990 tons of Class III solid waste was received at the CDS. Of this, 99,959 tons was diverted through various recycling programs and 473,031 tons were placed in the active cell of the landfill. The peak daily tonnage hauled to the site by self-haulers and commercial haulers was 2,394 tons of Class III solid waste. Of that, approximately 1,349 tons was contributed by self-haul vehicles and 1,045 tons by commercial haulers.

Beginning 1 September 2005, the County will enter a transition period and begin out-hauling all Class III solid waste generated within the County to an alternative permitted facility outside the County of Sonoma. Only enough solid waste will be placed at the active face of the landfill to allow operations staff to build-out the shape of Landfill 2 unit and prepare for possible closure sequencing. During that time, the average amount of waste brought to the site will drop significantly until eventually all solid waste coming into the TF/TS will be out-hauled to an out-of-County site. Commercial haulers, consisting of compactor trucks and debris boxes, will be routed to either Healdsburg Transfer Station, Sonoma Transfer Station or Redwood Landfill, in Marin County, whichever is the most convenient for the haulers. Conversly, self-haul vehicles will continue to deposit waste at the TF/TS. All transfer trailer loads from the outer transfer stations will be routed directly to an out-of-County permitted solid waste disposal site.

Additional information on the TF/TS is included in Appendix B-15.

2.8.2.4 Construction Schedule and Methods

The TF/TS building has been constructed and operations began in January 2003. A County Construction Report and details of the facility are presented in the Record Drawings in Appendices J-1 and J-2, respectively.

2.8.2.5 Proposed Operation Modifications

The County propses to convert the public TF from exclusively landfill operation to landfill transfer station (TS) operation. The County will use the TS to either load and transfer solid waste directly to the landfilling operation at the CDS <u>or</u> to load and out-haul solid waste to an alternative permitted facility outside the County of Sonoma for an interim period of approximately 3 years. The change in operation will allow the County to move, load, and out-haul solid waste as necessary during normal ancillary operations/facility operating hours of between 6:00 a.m. and 6:30 p.m., 7 days a week.

2.8.2.6 Proposed Design Modifications

The design modifications to the transfer station building will consist of the addition of one unloading bay that will add another 11,300 ft^2 to the existing building for a total of 44,012 ft^2. The expansion will take place at the west end of the existing building and consist of one bay 56 ft wide and 120 ft deep and conform to the existing roof line. The expansion design will include a "Z" wall to facilitate a minimum of three 30-yard debris boxes. The boxes will be used to handle the expected influx of recyclable materials from the tipping floor.

In addition to the expansion of the TF/TS facility, a roof structure will be fitted over the existing "white goods" (refrigerators and other freon containing appliances and goods as well as discarded engine parts) area and the existing public scale house and commercial scale house will be redesigned to improve cashier to customer interface and allow for improved traffic flow throughout the site. Exterior to the TF/TS building 3 storage bunkers will be installed to handle porcelain, concrete debris, rock/soil that are presently being deposited into modified metal debris boxes. Construction of the expansion to the facility is expected to begin sometime in 2006. Design drawings for the expansion project are included in Appendix H.

2.8.3 Recycle/Reuse Area Improvements

2.8.3.1 Need for Proposed Improvement

The previous recycling/reuse facility was removed and replaced with a new facility located east of the new public tipping building and north of the ECA and entrance drive. A new drop-off area for recyclables has been constructed adjacent to the new household hazardous waste facility site. This location was chosen because it would require the public to pass the recycle facility before reaching the public tipping area, encouraging customers to stop at the facility prior to disposing of refuse at the tipping area. This would tend to increase recycling by the landfill customers and help the County achieve its recycling goal.

2.8.3.2 Facility Design and Operations

This saw-toothed recycling area, or "Z" wall, is shown on Figure 2-4. The drop-off area has two levels - upper and lower. The upper level would be accessible to the public and would consist of a paved unloading area. The public would park, unload, and drop off materials into appropriate bins on the lower level. The site operator has access to the lower level and replaces the full bins with empty ones as needed. The reuse area is located immediately south of the recycle drop-off area. Several sheds and buildings of a total of approximately 7,410 ft^2 floor area have been constructed for the recycling, reuse area, including an office and an attendance booth. A cardboard baler is planned, but noit yet scheduled for installation, at the west end of the recycle area Z-wall to add to the efficiency of the recycling efforts.

In addition, the recycling/reuse facility includes a 12 feet wide by 16 feet long waste oil recycling building at the southeast corner of the improvements area. This waste oil recycling building consists of a pre-cast concrete structure with a ramp and a roll-up door. The interior includes a grate floor over a secondary containment sump area. The building contains two, 480-gallon double containment storage tanks for the waste oil and two, 55-gallon barrels for waste oil filter disposal. The recycle/reuse contractor is responsible for monitoring the waste oil building and having the tanks emptied as needed by a licensed hauler. The waste oil recycling building is planned for relocation within the recycle area for aoperational efficiency. The relocation is scheduled to take place sometimes in 2006.

The expanded recycling/reuse facility is operated in a manner similar to the previous one. The types of materials accepted and the hours of operations (7:00 am to 4:00 pm) remain the same. Preliminary design drawings are included in Appendix H. The County Construction Report and Record Drawings are presented in Appendices J-1 and J-2.

2.8.3.3 Construction Schedule and Methods

The recycling area improvements have been constructed and opened to the public in December 2002. Landscaping has been planted in areas where space is available, as shown on Figure 2-4.

2.8.4 Rock Extraction Project

One other project that was proposed and implemented at the CDS is the Rock Extraction Project. There was a 14.3-acre rocky outcrop at the CDS, of which 10.6 acres lie within the existing permitted disposal area. This area has so far not been used for waste disposal. Figure 2-6 shows the location of the rock extraction project. This work was completed in December 2001, except for minor erosion protection and drainage improvements made during 2002.

Refuse could have been placed over the rock, but this would not have been the most efficient use of the space. The County entered into an agreement with the Stony Point Quarry, whereby the quarry operator excavated and removed about 700,000 cubic yards of rock from this area. This rock, primarily fractured shale and sandstone, was hauled to the Stony Point Quarry, about 2 miles from the landfill, where it was processed and sold. The project benefited the County because it would allow a more efficient use of space on the landfill and extend its useful life by about 8 months, avoid the waste of a resource, and generate revenues for the landfill. Also as part of the agreement, the quarry operator supplied clean soil to the landfill to use as cover for the existing landfill. This soil was hauled to the site in trucks that hauled rock from the landfill.

The rock extraction project was considered an independent, stand-alone project. It was not dependent upon any component of the improvement program for implementation, and was not proposed for the same reasons as the improvement program. The objectives of the rock extraction project were to use the area already permitted for waste disposal more efficiently and to avoid wasting a resource (the rock). The County will prepared a separate environmental document for this project; however, impacts of the Rock Extraction Project that will be cumulative with this project are discussed in this EIR [WCC, 1997].

2.8.5 Scrap Metal Baler

Another project that was implemented at the CDS is the installation of a scrap metal baler on the landfill (placed on intermediate cover) adjacent to the appliance (white goods) and CRT recycling staging areas are located. The scrap metal baler uses diesel power to compress scrap metal into bales that will then be hauled off-site to metal recycling facilities. The scrap metal baler operation is performed by a contractor. Details of the baler and supporting documents such as the Notice of Categorical Exemption and a site plan are provided in Appendix K-1.

2.8.6 Construction and Demolition Debris Diversion Program

Another project at the CDS is the operation of a facility for construction and demolition debris (C&DD) diversion services. The facility is located on intermediate cover in a nearly level area previously used as a public tipping apron. This facility is operated by County operations staff under agreement with Sonoma Compost and recycles materials that would otherwise be disposed of in the landfill. C&DD materials are sorted at the Landfill 2 tipping apron and transported to the site. Sorted material is then processed through a large tub grinder. Processed material is stored and used as alternative daily cover (ADC) at the active cell of the landfill. No buildings or permanent structures have been erected for this project. County staff inspects incoming loads at the fee booths, using relocatable inspection platforms, as necessary, to determine which loads are to be directed to the C&DD facility. Details of the proposed facility and supporting documents, such as the Notice of Categorical Exemption and a site plan, are provided in Appendix K-2.

2.8.7 Clean Fuel Facility

This project consists of the installation of a facility that will clean and compress landfill gas, which will be used to refuel the County fleet of natural gas powered buses, school buses and refuse vehicles. First, a modular unit will be installed south of the public tipping building and connected to the existing landfill gas collection system. Landfill gas will be processed to develop a clean fuel on a trial basis for vehicles brought to the site for refueling. If the trial is successful, additional modules will be installed to provide more fuel. In the future, a proposed pipeline would be constructed to deliver the fuel gas to a tie-in at Todd Road and Bane Road near the County transportation center site. Details of the proposed landfill gas processing modules will be provided when they are available.

2.8.8 Gypsum Diversion Program

The gypsum diversion operation is located on the top of Landfill l, just east of the metal recycling area. The operation occupies approximately 0.6 acres that has been prepared with a CTB surface to prevent storm water intrusion. The operation consists of recycling clean, unpainted gypsum stored in approved containers at the site. Full containers of recyclable material are removed from the site within 24 hours. No buildings or permanent structures have been built for this operation. Additional information on the Gypsum Diversion Program is included in Appendix K-3.

2.9 Health and Safety

2.9.1 Introduction

Sections 21600(b)(5)(C-F) of Title 27 state that landfill operators shall describe, respectively, *"...sanitary facilities available to site personnel and the public"*; *"...communications systems utilized and emergency communications procedures followed at the site; "...the locations, numbers, and types of all permanent and portable lighting to assure safety of employees during nighttime operations"*; and *"...personal safety equipment used by operating and maintenance personnel."* These requirements are pursuant Sections 20550, 20560, 20570, 20580, and 20590 of Title 27 which state, respectively, that *"sanitary facilities...shall be available to personnel at or in the immediate vicinity of the site...; "safe and adequate drinking water for the site personnel shall be available;" "... each site shall have communication facilities available to site personnel to allow quick response to emergencies"; "where operations are conducted during hours of darkness, the site and/or equipment shall be equipped with adequate lighting;"* and *"... operating and maintenance personnel shall wear* *and use appropriate safety equipment."* The reference for the following information is the RDSI [Sonoma County, 1997].

2.9.2 Sanitary Facilities

The site has a permanent building that houses the Integrated Waste Division's Operations Headquarters (headquarters). The building has two flush toilet restrooms, and two showers. Wastewater from headquarters is treated in a septic system adjacent to the building. It is planned to abandon the current septic system when East Canyon Phase III is constructed. The County has also constructed a new septic system as part of the Operations Improvements Project located north of the public tipping building. This new system services rest rooms in the Household Hazardous Waste building, the recycle area office, the public tipping building, and the restroom in the power plant office. The new system was designed to provide sufficient capacity for the new facilities, the power plant office restroom, and the existing office.

There are eight portable toilets located on-site: at the fee gate buildings; recycle area; the wood chipping and compost area; the tipping area; the fleet maintenance building, at Leachate Pond No. 1, and two at the storage and maintenance area at the north end of the site.

There is a mobile break room for operations staff that has a built-in restroom with hot and cold water. There are also restrooms in the recycle area office, the public tipping building, and household hazardous waste building.

2.9.3 Potable Water Supply

Water for the headquarters building and the site comes from an off-site water well. Well water is pumped into three storage tanks, consisting of a 50,000 gallon wooden tank and two 100,000 gallon steel tanks. The water is treated at the pump station with chlorine and tested quarterly to ensure potability. This water is used for the headquarters toilets and showers. Bottled drinking water from water coolers is available at the gatehouses and the headquarters building.

2.9.4 Communications and Early Warning Systems

Telephones are the primary system used for normal communication at the site. Hand-held radios are used for communications between equipment operators. All enclosed structures have gas detection systems, which will emit an alarm noise if the methane level in the building reaches 25% of the Lower Explosive Limit (LEL). When water tank levels drop below the one-third level in the tanks, an alarm sounds in the headquarters building.

2.9.5 Lighting

Lighting will be provided for all on-site structures during operating hours. For outdoor operations, during the winter months, portable lighting will be provided during periods of darkness during operating hours and for emergencies. The front gate has an overhead light on a post.

2.9.6 Safety Equipment

Landfill safety equipment includes fire extinguishers, showers, and five eyewash/showers. All landfill operations vehicles and other mobile equipment is equipped with a fire extinguisher. Two showers are located in the Operation Headquarters building. The portable eyewash/showers are used primarily in conjunction with the load checking and household hazardous waste collection program, and at the leachate filter plant; however, they are accordingly placed as needed.

2.9.7 Spill Prevention, Control and Countermeasure Plan and Contingency Plan

In order to expedite emergency measures in the event of an accidental release of oil or oil products to the environment, the County has developed a Spill Prevention, Control and Countermeasure Plan and a Contingency Plan. These plans depict oil spill containment kits at the site, and describe the contingency plan to be implemented in case of an emergency. These plans, along with other Operations Plans, are included in Appendix L.

2.10 <u>Personnel Requirements and Training</u>

2.10.1 Introduction

Section 21600 (b)(5)(G-I) state that the landfill operators shall describe, respectively, "*... the minimum numbers and qualifications of personnel required for site operations, maintenance, environmental controls, records, emergency and health and safety;*" "*...the training required by the various personnel... and how it is to be provided; and the supervisory structure, including the management organization which will operate the site and the name of the supervisor(s)*". These requirements are pursuant to Sections 20610 and 20615 of Title 27 which state that "*... personnel assigned to operate the site shall be adequately trained in subjects pertinent to the site operation and maintenance...*"; and "*... the site operator shall provide adequate supervision of a sufficient number of qualified personnel to ensure proper* *operation of the site.*" The reference for the following information is the RDSI [Sonoma County, 1997].

2.10.2 Personnel

Personnel at the CDS work in the areas of daily operations, site maintenance, monitoring of environmental controls, maintenance of required records, and safety and emergency response operations. The employees required for these areas are listed below along with job descriptions and titles.

2.10.2.1 Daily Operations

Table 2-2 lists personnel involved in the daily operations of the CDS (not all on same days due to 7-day schedule), excluding contractors.

Table 2-2
DISPOSAL SITE PERSONNEL
Central Disposal Site

Job Description	Job Title	Number of Employees
Cashier	Disposal Worker I	14
Tipping Person/HHW/ Water Truck Operator	Disposal Worker I	14
Equipment Operator	Disposal Worker II	12
Supervisor	Disposal Supervisor	4
Maintenance	Building Mechanic I and II, Groundskeeper	3
Site Improvements, Design, Construction, and Environmental Monitoring	2 Sr. Civil Engineers, 1 Civil Engineers, 1 Assistant Civil Engineer 1 Resident Engineer 1 Geologist, 4 Engineering Technicians	10
Landfill Engineering and Operations Manager	Division Manager	1

2.10.2.2 Maintenance

Maintenance work is performed for buildings and the landfill grounds. As listed above, the County staff includes 2 building mechanics and one groundskeeper. Also, some maintenance and litter pick-up is performed by one to two County prison inmate or probation crews. Equipment maintenance is contracted out to Sonoma County Fleet Operations, which operates at a building at the south end of the East Canyon.

2.10.2.3 Monitoring of Environmental Controls

Environmental control systems monitoring work is performed by a team consisting of a geologist and a minimum of two Engineering Technician IIIs under the direct supervision of a registered civil engineer.

2.10.2.4 Records Maintenance

Maintenance of required records is done by each supervisor and is coordinated by the Landfill Operations Manager.

2.10.2.5 Safety and Emergency Response

Employees working in the areas of health and safety, and emergency response for site personnel and the public include the:

- Landfill Operations Manager;
- Household Hazardous Waste Supervisor (Disposal Supervisor I);
- Engineering Technician III; and
- Integrated Waste Division Manager.

2.10.3 Training

All operations employees receive a minimum of 24 hours of training in identifying and handling household hazardous wastes with an annual 8-hour refresher. Equipment operators also receive a minimum of three months on the job training in operating the different equipment types.

Equipment operators have a safety meeting at least once every two weeks and supervisors have a safety meeting as part of weekly management and coordination meetings, or at least once every two weeks.

All employees receive training in Blood Borne Pathogen Exposure, Prevention, Illness and Injury Prevention and various other safety practices.

2.10.4 Supervision

The Landfill Engineering and Operations Manager, a registered civil engineer, is responsible for all site operations. There are two senior civil engineers: one senior civil engineer is responsible for engineering and monitoring and the other senior engineer is responsible for construction projects, including landfill sequencing and grade controls. Both report to the Landfill Engineering and Operations Manager. Four (4) Disposal Supervisors assist the Operations Coordinator with supervision of equipment operations and the placement of waste and cover, supervision of cashiers, and supervision of the hazardous waste exclusion program. All supervisors report to the Operations Manager.

2.10.5 Emergency Contact List

The CDS is owned by the County of Sonoma and operated by the County's Department of Transportation and Public Works, Integrated Waste Division. The management organization is shown below.

County of Sonoma
Department of Transportation and Public Works
2300 County Center Drive, Suite B-100
Santa Rosa, CA 95403
Phone: (707) 565-2231

David D. Knight - Director, Department of Transportation and Public Works
Ken Wells - Integrated Waste Division Manager
Don R. Poindexter - Division Manager, Operations and Engineering

The emergency contact list for the CDS is as follows:

Don R. Poindexter - Landfill Engineering and Operations Manager
Office Phone: (707) 565-7940 or (707) 565-7958
Home Phone: (707) 773-1336
Cell Phone: (707) 696-9190
Pager: (707) 329-7265:
Address: 500 Mecham Road, Petaluma, CA 94952

Tamara Danzart - Disposal Supervisor (HHW)
Office Phone: (707) 565-7940 or (707) 565-7945
Home Phone: (707) 570-2048
Cell Phone (707) 696-9192
Pager: (707) 323-9657
Address: 500 Mecham Road, Petaluma, CA 94952

John DeStefano - Disposal Supervisor (Cashiers)
Office Phone: (707) 565-7940 or (707) 565-7960;
Home Phone: (707) 571-1379
Cell Phone (707) 479-2974
Pager: (707) 323-4679
Address: 500 Mecham Road, Petaluma, CA 94952

Bob Simi - Disposal Supervisor (Cashiers)
Office Phone: (707) 565-7940 or (707) 565-7946;
Home Phone: (707) 545-5390
Cell Phone (707) 696-9193
Pager: (707) 329-4157
Address: 500 Mecham Road, Petaluma, CA 94952

Fred Esposti - Disposal Supervisor (Heavy Equipment)
Office Phone: (707) 565-7940 or (707) 565-7944;
Home Phone: (707) 570-1450
Cell Phone (707) 953-3608
Pager: (707) 325-8677
Address: 500 Mecham Road, Petaluma, CA 94952

Ken Wells - Integrated Waste Division Manager
Office Phone: (707) 565-3788;
Home Phone: (707) 538-9385
Address: 2300 County Center Drive, Suite B-100, Santa Rosa, CA 95403

Bob Swift, Walter Kruse and Jeff Lewin - Enforcement Agency (EA)
Sonoma County Environmental Health Services
Office Phone: (707) 565-6565
Address: 475 Aviation Blvd, Santa Rosa, CA 95403

Mary Maddux-Gonzalez, M.D.
Public Health Officer
Health Services Department
Office Phone: (707) 565-4400
Address: 625 5th St., Santa Rosa, CA 95404

Rancho Adobe Fire District
Emergency: 911
Business: (707) 795-6011
Address: 11000 Main Street, P. O. Box 1029, Penngrove, CA 94951

The following numbers are for companies that monitor alarms at the CDS:

ADT
Phone: (800) 669-5454
Monitors: Landfill Gas Cogeneration Power Plant

Dean Security/Monitored by Americom Central Stations
Phone: (800) 387-8802
Monitors: All Other Alarms

The EA will be notified if any of the emergency contact people or phone numbers change. This emergency contact information is posted at the operations headquarters building, all fee gate buildings, and the equipment operators building.

2.11 Equipment

2.11.1 Introduction

Section 21600 (b)(7)(D) Title 27 requires that landfill operators describe "... *the minimum equipment requirements necessary to assure ongoing compliance with the state minimum standards*" pursuant to the requirement in Section 20740 of Title 27 which states that "*...equipment shall be adequate in type, capacity and number, and sufficiently maintained.*" The following information was excerpted from the RDSI [Sonoma County, 1997].

2.11.2 Minimum Equipment Requirements

The landfill equipment permanently assigned to this site consists of the following:

For excavation and cover:
two - Cat 637 scrapers
one - Cat 740 articulated haul truck

For compaction:
one - Cat 836C compactor with Caron wheels
one – Cat 836G compactor with Cat wheels

For pushing refuse:
five - D9R Caterpillar tractors

For dust control:
two- 3000 gallon water trucks

For application of ADC (Alternative Daily Cover):
one – Posi-Shell mixing and application machine

For public tipping building operations, the following equipment will be used:

two – Caterpillar 950 loaders
one – Caterpillar 924 loader
one – Caterpillar 963 trackloader

The following equipment is available on-site for loading recycleables and miscellaneous maintenance projects:

one – Caterpillar 426C backhoe
one – Caterpillar 330 excavator
one -- Posi-track ASV
one – 5 cy dump truck
one – 10 cy dump truck

Additional rental equipment is readily available for day-to-day operations or special projects as needed.

2.11.3 Standby Equipment

The on-site standby equipment consists of:

one – John Deer 760 motor grader
one – Caterpillar D6M LGP dozer

2.11.4 Equipment Preventive Maintenance

The preventive maintenance program is a three part program. The first part is daily operator maintenance inspection. The second part is scheduled lubrication, oil and filter changes, and safety inspection performed by Sonoma County Fleet Operations staff. The third part is equipment repair by the equipment manufacturer when a problem is found and not continuing to operate the equipment until the failure becomes a costly problem. Fleet maintenance is performed at a maintenance building at the south end of the East Canyon.

2.12 Nuisance Control and Related Controls

2.12.1 Introduction

Sections 21600(b)(8)(A-J) of Title 27 require that owners describe the methods and procedures used at the site to prevent or control: public nuisances, fire, leachate, dust, vectors, drainage and erosion, litter, noise, traffic and hazardous waste, pursuant to the applicable Title 27 requirements listed below for each section. The following information was excerpted from the RDSI [Sonoma County, 1997], or can be referenced to the same.

2.12.2 Nuisance

In accordance with the requirements in Section 20760 of Title 27, the disposal site is run so as not to be a public nuisance. Complaints at the CDS are handled on an individual basis. An incident report is made by the staff member receiving the complaint, and the complaint is investigated and appropriate response taken. Claims are handled through the County Risk Management Department.

2.12.3 Fire Control

A complete description of the fire control procedures for the CDS is included in Appendix A-9, which is updated in the Fire Prevention Plan, dated June 2002 and included in Appendix L. A summary of those procedures include the following:

- a 50,000-gallon wood storage tank and two 100,000 gallon steel storage tanks with 8 in. water supply;

- six wharf hydrants at various locations around the site, eleven standard hydrants at various locations through out the site, including the composting and recycling areas;
- two 3,000-gallon water trucks with pumping capability are available to help combat fires;
- keeping the active area of the fill clear of combustible materials; and
- good compactive effort and adequate cover to prevent fires within the fill.

Compliance with State and Local Fire Standards: The design and operation of the CDS remains in compliance with the perimeter clearance requirements. The agency having jurisdiction over the site is the Rancho Adobe Fire District.

2.12.4 Dust Control

In accordance with the requirements of Title 27 in Section 20800 which states that "... *the operator shall take adequate measures to minimize the creation of dust and prevent safety hazards due to obscured visibility*", the County has implemented Best Management Practices (BMPs) to reduce dust generation due to industrial activities at the site. These activities include excavation of soil from borrow areas, operations at the rock quarry (blasting, grading and hauling), on-site traffic, and construction on-site. The BMPs are described in the Dust Control Plan, which is included in Appendix L.

2.12.5 Vector and Bird Control

In accordance with the requirements of Section 20810 in Title 27 which states that "... *the operator shall take adequate steps to control or prevent the propagation, harborage or attraction of flies, rodents, or other vectors, and to minimize bird problems*", vectors are effectively controlled by applying soil cover material over exposed wastes at the end of the work day. In the past, Sonoma County controlled birds by using starter pistols to make noise, but the program was discontinued after a worker was injured. The County has implemented a bird control program. The program is an integrated approach that includes the following: installation of gull wires over the active areas of waste placement, the larger leachate pond; and the sedimentation ponds as needed; use of bird scare devices; preparation of a maintenance program for ongoing control of birds; and training of County personnel in implementation of all bird control measures, repellent tactics and scare devices. The scare devices may include a combination of bird bombs, bird whistlers, blank 2 caps, scare eye balloons, laser-based repellent devices, and others as needed [Sonoma County, 1997a]. The use of loud noise devices was found to be effective; however, this part of the program was discontinued in 1998 due to complaints from neighbors.

2.12.6 Drainage and Erosion Control

Surface drainage is directed to ditches and culverts on the perimeter of the site. Surface water goes through at least one of seven sedimentation basins prior to leaving the site. All structures are designed to handle a 24-hr 100-year storm event. The hydrology map for the CDS is located in Appendix F-8. The hydrologic calculations are included in Appendix F-8. These maps indicate the permanent run-on controls for the site, which have been installed.

The Stormwater Pollution Prevention Plan (SWPPP), dated July 2002 and Revised November 2002, was submitted under separate cover. The SWPPP, which is updated each year, includes a map of the site entitled, "Site Drainage and Erosion Control Plan." The map, updated each year, describes the temporary run-on controls for the fill area and excavation areas as well as other erosion control methods implemented at the site. These include removing accumulated silt from the sedimentation ponds; cleaning ditches and drainage inlets on the site; stabilization of new ditches as necessary with either grass, erosion control netting or rock; installing litter fences around drainage inlets to protect against stoppage; placing seed and straw on all bare slopes prior to the rainy season and construction of straw bale dikes and other measures as necessary to prevent erosion.

Run-off control is accomplished by the design of the active tipping areas and the method of daily operation. As a part of daily operations during times of surface water runoff, a berm is placed at the down gradient edge of the daily cell to collect any surface water that might run off of the exposed garbage. At the end of the day after the cell is covered, the berm is either used for daily cover or moved to allow free drainage of the site.

Drainage and Erosion control at the CDS are performed in accordance with the requirements in Section 20820 of Title 27, which states that "*... the drainage system shall be designed and maintained to..1) ensure the integrity of roads, structures and gas monitoring and control systems, 2) prevent safety hazards, and 3) prevent exposure of waste.*"

Detailed information about the surface water control and sedimentation plan for the East Canyon Area (ECA) expansion are included in Section 8 of this JTD.

2.12.7 Litter Control

Litter is controlled in accordance with the requirement in Section 20830 of Title 27, which states that "*Litter shall be controlled, routinely collected and disposed of properly. Windblown materials shall be controlled to prevent injury to the public and personnel.*

Controls shall prevent the accumulation or off-site migration of litter in quantities that create a nuisance or cause other problems."

Litter is controlled at the site by a combination of good compaction of waste, application of daily cover, erection of litter fences around the active area, and clean-up crews. Litter along the litter fences is collected once a day. A vacuum is used for litter pickup on a regular basis. Approach roads to the site are patrolled by a litter clean-up crew frequently, and the crew is dispatched to specific locations when complaints are received.

The County of Sonoma will continue the existing litter control program, and expand it to include landfill operations in the East and West Canyons. Litter fences will be constructed at the periphery of the landfill areas as needed to catch litter blowing from the landfill. The existing litter clean-up program will be continued while the landfill is in operation. The IWD will increase the frequency of litter pick up along Mecham Road and Stony Point Road from West Railroad Avenue to Highway 116 so that these roadsides will be cleaned each day that the landfill is open. The IWD will also post signs on Mecham Road that will give a phone number at the CDS that people may call to report vehicles that are seen littering on the way to or from the CDS. At least one sign for the northbound direction near Pepper Road and one for the southbound direction near Stony Point Road will be posted [WCC, 1997].

The California Highway Patrol (CHP) is under contract with the County to add extra patrols to the area and enforce litter and covered load laws.

2.12.8 Noise Control

The primary noise control mechanisms at the CDS are the topography and separation from neighbors. All off-road equipment is muffled as required by the State Department of Resources, and controlled so as to prevent health and safety hazards to persons using the site and to nearby residents in accordance with the requirements in Section 20840 of Title 27 which states that "*... noise shall be controlled to prevent health and safety hazards to persons using the site and to nearby residents.*" Noise has not historically been a problem at this site, and no complaints have been received from adjacent property owners or from site users (except for the previously discussed bird control measures, which were discontinued in 1998). The negative declaration for the proposed power plant, certified by the Board of Supervisors on 12 December 1991, and the negative declaration for the wood and yard waste, and construction debris diversion project, certified by the Board of Supervisors on 24 March 1992, both found that there will be no significant increase in the noise level at the property boundary. Annual noise measurements will be taken to ensure compliance with general plan standards. Noise measurements shall be taken at the start of chipping and crushing operations as well as when the chipping location is moved.

2.12.9 Odor Control

Inherent with any facility where waste is being unloaded is the possibility that patrons may deliver materials of an odoriferous quality. In accordance with the requirements of Section 20695(b)(1), which states that *"... the operator shall not cause, let, permit, suffer or allow the emission of any odorous substance which causes the ambient air at or beyond the facility's property boundary to be odorous and to remain odorous,"* all waste received at the site is covered with soil, or approved alternative daily cover each day as required by law and as a result only exposed daily waste contributes to the odor. Additionally, a methane gas collection system significantly reduces the potential for associated methane gas odors to leave the site. To help control odors in the winter, adequate wet weather stockpiles of daily cover have been planned and implemented

2.12.10 Traffic Control

In accordance with the requirements in Section 21600(b)(8)(I) of Title 27, which states that a traffic control plan is to be described which shows that "*... traffic flow into, on and out of the site is controlled to minimize interference and safety problems for traffic on-site and adjacent public streets or roads*," and which also minimizes on-site hazards, and interference with on-site operations. A report was prepared by Crane Transportation Group, dated 5 May 1994 to study the impact on surrounding traffic of the removal of gravel from the CDS and the location a permanent household hazardous waste collection area adjacent to the site. The conclusions of the study were that:

- *"... all intersections and roadways providing immediate access to the landfill are now operating at good levels of service...";*
- *"... the addition of both household hazardous waste and quarry traffic to existing volume would produce no significant impacts to intersection or roadway level of service operation ...";* and
- *"... with year 2000 volumes, all intersections and roadways providing access to the CDS should be operating at good to acceptable levels."*

This traffic report is included in Appendix A-5.

More recently, the EIR identified impacts on Mecham and Stony Point Roads. To mitigate these impacts the County has installed traffic signals at this intersection [WCC, 1997].

The traffic control maps included in Appendix A-5 show the flow patterns of traffic through the site, both prior to and following the East Canyon Expansion, for the individual facilities within the landfill.

2.12.11 Unloading Control

In accordance with Section 20870 of Title 27 (previously Sections 17742 and 17258.20 of Title 14 and Section 2523(b)(2) of Chapter 15), and the Revised Waste Discharge Requirements No. 89-8, a load checking program was implemented in January 1991 to ensure that hazardous wastes are not discharged at the Class III CDS. The load checking program was approved by the Department of Health Services and the Regional Water Quality Control Board. The program has since been updated and expanded. Detailed information about the program is in the Load Checking Program, August 4, 1999, in Appendix B-11 [Sonoma County, 1999].

Conformant with 27 CCR 20870 notification requirements, if a regulated hazardous waste is discovered at the facility, the Sonoma County Office of Emergency Services, as the DTSC designated agent, and the RWQCB, in addition to the LEA, shall be notified. The phone numbers for the respective agencies are included on the Emergency Contact List. Appendix B-2 contains information on the Household Hazardous Waste Exclusion Program.

2.13 Disposal Site Records and Reporting Procedures

Section 21600(b)(5)(A) of Title 27 states that landfill operators shall "... *describe the procedures for maintaining accurate records*" pursuant to satisfying the Title 27 requirements in Sections 20510 and 20515 which state, respectively, that "... *each site operator shall maintain records of weights of volumes accepted..., records of excavations..., a daily log book..., record of personnel training..., copy of written notifications..., and disposal site records.*" and "... *the owner or operator must record as it becomes available..., any location restriction..., inspection record and training procedures..., gas monitoring results..., closure and postclosure maintenance plans.*" The information in this section was taken from the RDSI [Sonoma County, 1997].

2.13.1 Weight/Volume Records

All commercial vehicles are weighed when they enter and leave the site. The tonnage brought in from autos, vans, and pickup trucks have been estimated with periodic weight surveys of those vehicles; however, the new public tipping facility provides for the weighing of autos, vans, and pickup trucks that enter and leave the site. A computer system, which records fees received, also records the tonnage of waste received at the site. A report of daily tonnage is prepared monthly and kept at the CDS. The filling rate of the site is verified through annually prepared topographical maps.

2.13.2 Subsurface Records

There are no accurate records of the excavation cuts made in natural terrain for the 1971 Permitted Area of the CDS. However, records for the East Canyon Area already constructed are available and will be used to monitor volumes of waste received. Similar data will be obtained at the time of construction of future phases of the East Canyon expansion.

2.13.3 Special Occurrences

A log of special occurrences is kept by the cashiers at the fee gatehouse. Cashiers are responsible for maintaining the log. If any other employee on the site observes a special occurrence, they are required to report it to the operations manager or a disposal supervisor who will log it with the cashier or file a separate Occurrence Report. A separate Incident Report Form is used for accidents involving vehicles or personal injury.

2.13.4 Inspection of Records

All site records are stored at:

Central Disposal Site
500 Mecham Road
Petaluma, CA 94952
(707) 565-7940

The records are available for inspection by appointment Monday through Friday, from 7:00 a.m. to 4:00 p.m., except for holidays previously noted.

2.14 <u>Site Capacity</u>

2.14.1 Introduction

The site capacity information in this section is provided in accordance with Section 21600(b)(3)(B) of Title 27, which states that the landfill operator shall "... *provide calculations for the volumetric capacity of the site*."

2.14.2 Landfill 1

The CDS began operations in 1971, and as far as the records show never had a base grading plan. Records indicate that in December 1988, it was estimated that 9,500,000 cubic yards (yd^3) of waste were in place, however, there are no calculations to support this estimate. The 1992 Closure Plan estimated that there was a total capacity within the 1971 Permitted Area (Landfill 1) of 23,259,000 yd^3 (17,796,500 m^3). Based on a 1993 aerial survey, updated calculations indicated that the total capacity of the Landfill 1, within the 1971 Permitted Area, was an estimated **25,650,000 yd^3** (19,622,300 m^3), as presented in the October 1997 RDSI.

Based on a recent aerial survey, subsequent ground surveys, and gate tonnage records (converted to cubic yards), as compared to the current preliminary closure plan topography, the County-estimated remaining air space in Landfill 1, as of December 2004, is 5,100,000 yd^3, excluding additional volume for the final cap assumed to be 2-ft thick (i.e., 12 in. of the foundation layer and 12 in. of vegetative layer). Assuming that daily and intermediate covers require approximately 20% of in-place volume, the net capacity is 4,080,000 yd^3 or 2,448,000 tons based on in-place densities of 1,200 lb/yd^3.

The County performed remaining airspace calculations using a computer method. In this method, generally, the topographic surfaces of any given area are input or digitized and stored. By setting the boundary and the grid size, a terrain model of the given topographic surface can be created and stored in the computer. By comparing two stored terrain models (i.e., "bottom" and "top" topographic surfaces) of the same area, the total available airspace, fill, or cut volumes between the two topographic surfaces can be calculated. The results of these calculations are presented in Table 2-3.

2.14.3 Landfill 2

The Siting Element of the CoIWMP has estimated a waste disposal need through the year 2009. However, the Integrated Waste Management Act (AB 939) requires that all counties reduce their waste stream by a total of 25% by the year 1995, and by a total of 50% by the year 2000.

The EIR [WCC, 1997] mentions that the daily and annual waste volumes disposed at the site would change over time. The CoIWMP for Sonoma County considered that by the year 2000 the County and cities will attain their 50% waste diversion goal and will maintain it at that level in the future. Following the year 2000 the actual quantity of waste will increase as a result of the increasing population. After 2009, wastes are projected to increase at a rate of

1.6% per year, according to this plan. The projections are presently, as of November 2002, being updated and revised. When the revisions are completed, they will be submitted in future JTD updates.

The total available airspace for the East Canyon Area estimated by GeoSyntec is approximately 6,673,800 yd^3 excluding additional volume for the final cap assumed to be 2-ft thick (i.e., 12 in. of the foundation layer and 12 in. of vegetative layer). As of December 2004, the County-estimated remaining airspace in the ECA is approximately 4,500,000 yd^3. Assuming that daily and intermediate covers require approximately 20% of in-place volume, the net capacity is 3,600,000 yd^3 or 2,160,000 tons based on in-place densities of 1,200 lb/yd^3 (Table 2-3).

Table 2-3
ESTIMATED LANDFILL CAPACITY
Central Disposal Site

Disposal Unit	Total Capacity (yd^3)	Remaining Capacity[(3)(4)] (yd^3)
Landfill 1[(1)]		
Total Landfill 1:	25,650,000	5,100,000
Landfill 2[(2)]		
- Part 1 of Phases I & II	752,200	Note (5)
- Part 2 of Phases I & II	1,431,600	Note (5)
- Phase III	1,500,000	1,500,000
- Phase IV	1,500,000	1,500,000
- Phase V	1,500,000	1,500,000
Total Landfill 2:	6,673,800	4,500,000
CDS TOTAL AIRSPACE	**32,323,800**	**9,610,000**

Notes:
CDS – Central Disposal Site
(1) Landfill 1 also known as the 1971-Permitted Waste Area of the CDS
(2) Landfill 2 also known as the 2000-Permitted East Canyon Area (ECA) of the CDS
(3) Sonoma County [2004]
(4) As of December 2004
(5) Parts 1 and 2 of Phases I and II expected to be filled to capacity in approximately July 2005 or later depending on on-going waste flow rates

2.15 Site Life Estimate

The site life estimate information in this section is provided in accordance with Section 21600(b)(3)(C) of Title 27 which states that the landfill operator shall *"... provide an estimate of the site life based on the capacity of the site and the waste flow projections"*

Based on the current available airspace at the CDS, i.e., in Landfill 1 and Landfill 2, and current and anticipated waste disposal rates, the County of Sonoma projected life expectancy of the landfill until 2019.

2.16 Airport Safety

Section 20270 of Title 27 states that *"... owners or operators of... existing Municipal Solid Waste Landfills... that are located within 10,000 feet of any airport runway end used only by piston-type aircraft must demonstrate that the units are designed and operated so that the MSWLF does not pose a bird hazard to landfills"*; and *"... (b) owners or operators proposing to site new... lateral expansions located within a five-mile radius of any airport runways end used by turbojet or piston-type aircraft must notify the affected airport and the Federal Aviation Administration (FAA)."*

The nearest airports to the CDS are the Petaluma Airport and the Sonoma County Airport. The Petaluma Airport is approximately 8.4 mi (13.5 km) southeast of the CDS and the Sonoma County Airport is approximately 15.6 miles (25 km) north of the CDS. Given this distance, the CDS does not pose a bird hazard to either airport.

2.17 End Use of Site

No specific proposals have been developed at this time for use after closure, since the CDS will remain in operation until 2019. Consideration is being given to converting the closed landfill into a regional park. The County General Plan indicates the CDS as a proposed park (excerpted from the RDSI, [Sonoma County, 1997]).

2.18 Permits and Approvals

Section 21600(b)(9) of Title 27 states that the landfill operator shall "... *provide a list of all approvals having jurisdiction over the disposal site..."* pursuant to the requirements of

Section 20517 of Title 27, which states that *"...approvals, determinations and other requirements the enforcement agency is authorized to make shall be documented in writing to the operator and placed in the operating record by the operator."* Tables 2-4 and 2-5 list permits and approvals that govern design and operations of the landfill and compost facilities. These documents are kept in the CDS operating record. Copies of these permits are included in Appendix A-8.

Table 2-4
LANDFILL PERMITS AND APPROVALS
Central Disposal Site

Permit or Approval	Issuing Agency
Solid Waste Facilities Permit No. 490-AA-0001	Enforcement Agency California Integrated Waste Management Board
Standardized Composting Permit Permit No. 49-AA-0260	Enforcement Agency
Waste Discharge Requirements Order No. R1-2004-0040	California Regional Water Quality Control Board - North Coast Region
Monitoring and Reporting Program Order No. R1-2004-0040 Order No. 97-49	California Regional Water Quality Control Board - North Coast Region
Storm Water Monitoring Permit	California State Water Resources Control Board
Wastewater Discharge Permit Permit No. SR-IW5202	City of Santa Rosa - Utilities Department
Permit to Operate (Includes gas wells and collection system, gas flare, 8 IC engines, landfill operations, 2 IC engines rated at 0.8 Mw each, pending completion of construction)	Bay Area Air Quality Management District

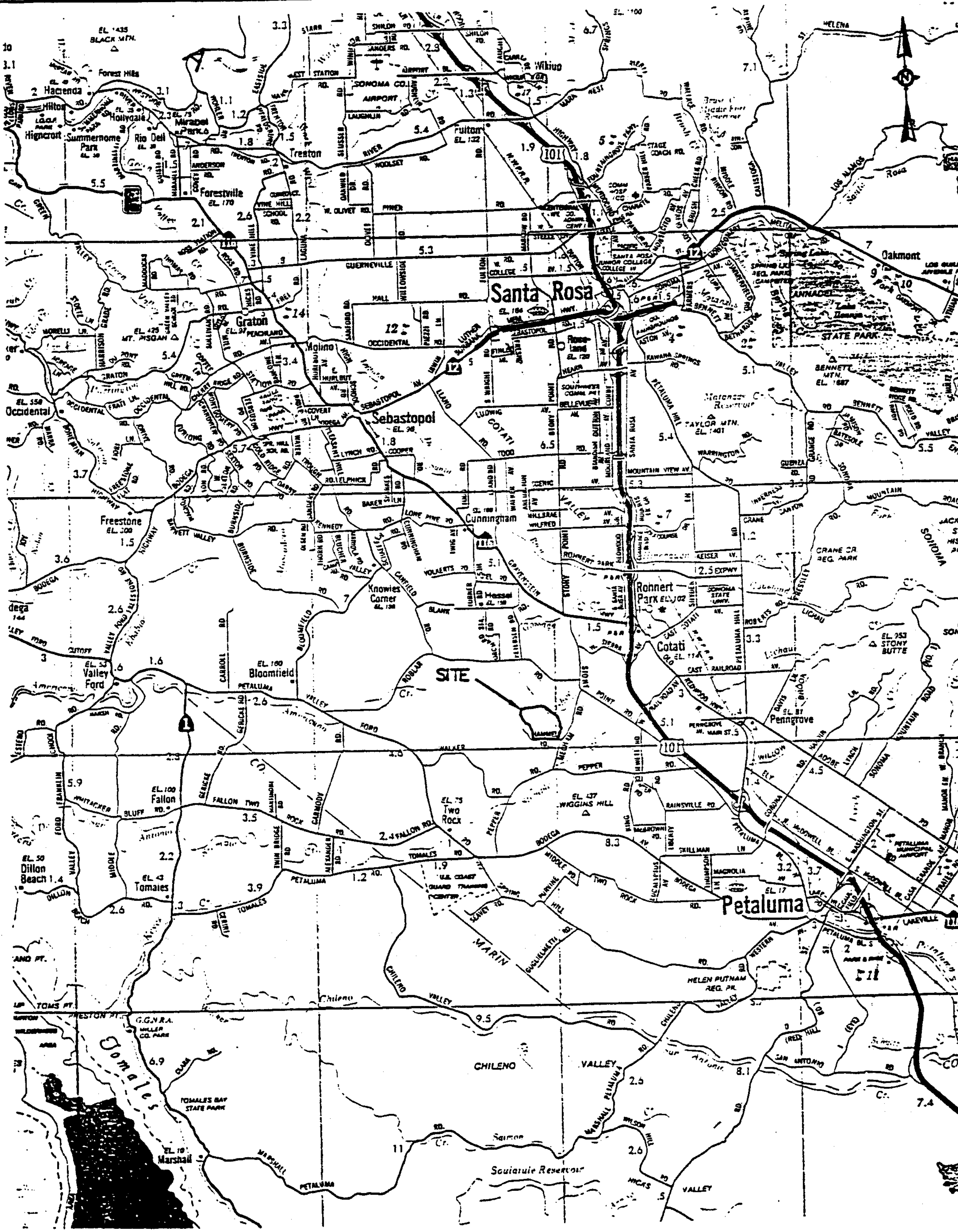
Table 2-5
PERMITS AND APPROVALS
Sonoma Compost

Permit or Approval	Issuing Agency
Permit to Operate (Permit No. 9341: Tub Grinder, Wood Debris Stockpile, Screen, and Conveyor Belt and Load Out Operation)	Bay Area Air Quality Management District

2.19 CEQA and Conformance Finding Information

As part of CEQA requirements, the County has prepared an Environmental Impact Report (EIR), mitigation monitoring reports, and a County-Wide Waste Management Plan. Resolutions and excerpts from these documents are contained in Appendix A-10, which includes the following:

- Excerpts from the County-Wide Waste Management Plan, April 1996;
- Non-Disposal Facility Element, an element of the Sonoma County Integrated Waste Management Plan, amended June 1998;
- Board of Supervisor's Resolution Number 98-1103 certifying the Final EIR for the CDS Rock Extraction Program, dated 18 August 1999;
- Board of Supervisor's Resolution Number 98-1524, certifying the Final EIR for the CDS Improvement Program, dated 8 December 1998;
- Mitigation Monitoring Program - CDS Improvement Program, approved 15 December 1999; and
- Mitigation Monitoring Program - CDS Rock Extraction Project, approved 18 August 1998.



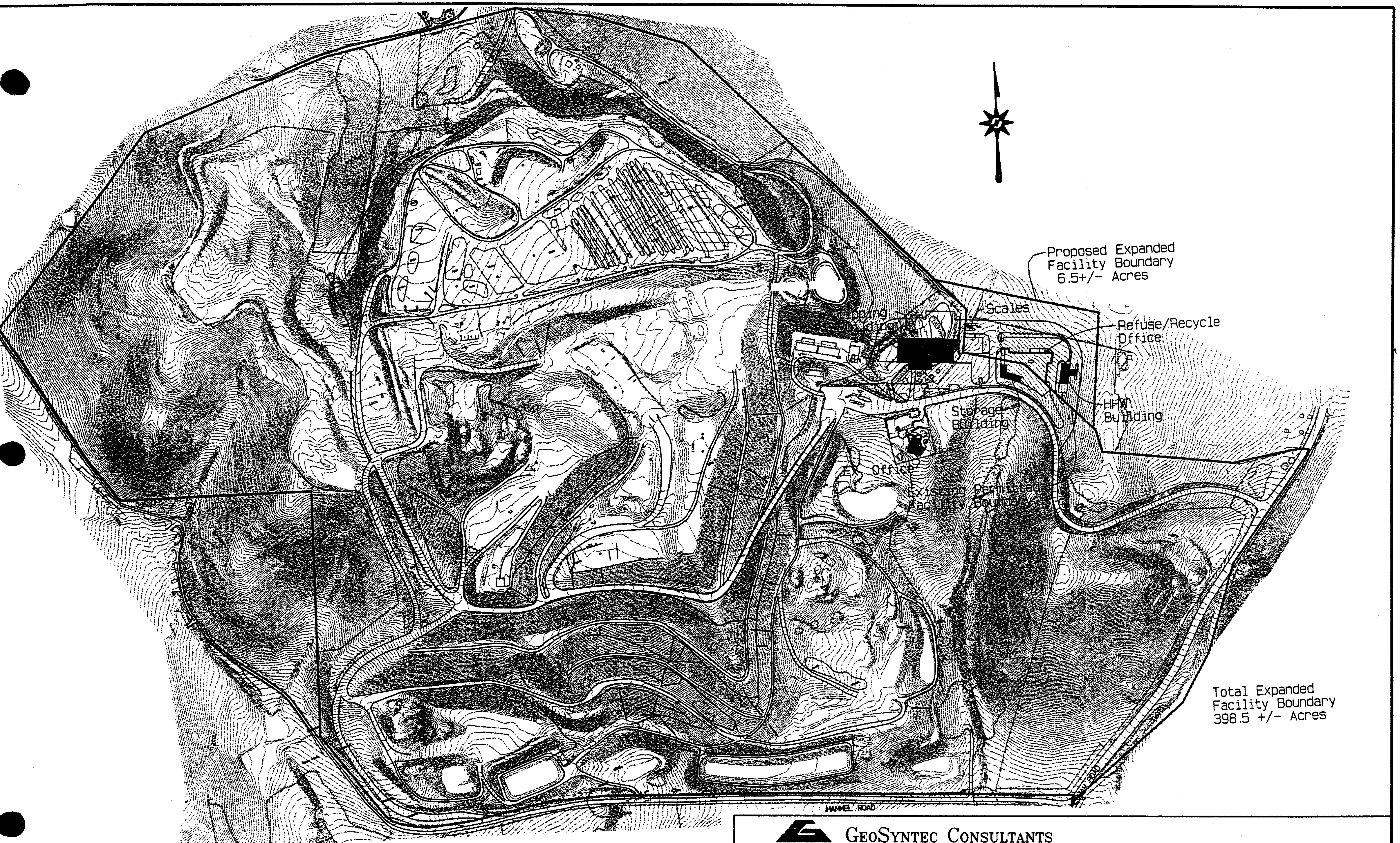
LOCATION MAP

1 : 16500

GeoSyntec Consultants

WALNUT CREEK, CALIFORNIA

FIGURE NO.	2-1
PROJECT NO.	WL0062
DOCUMENT NO.	WC97552
FILE NO.	

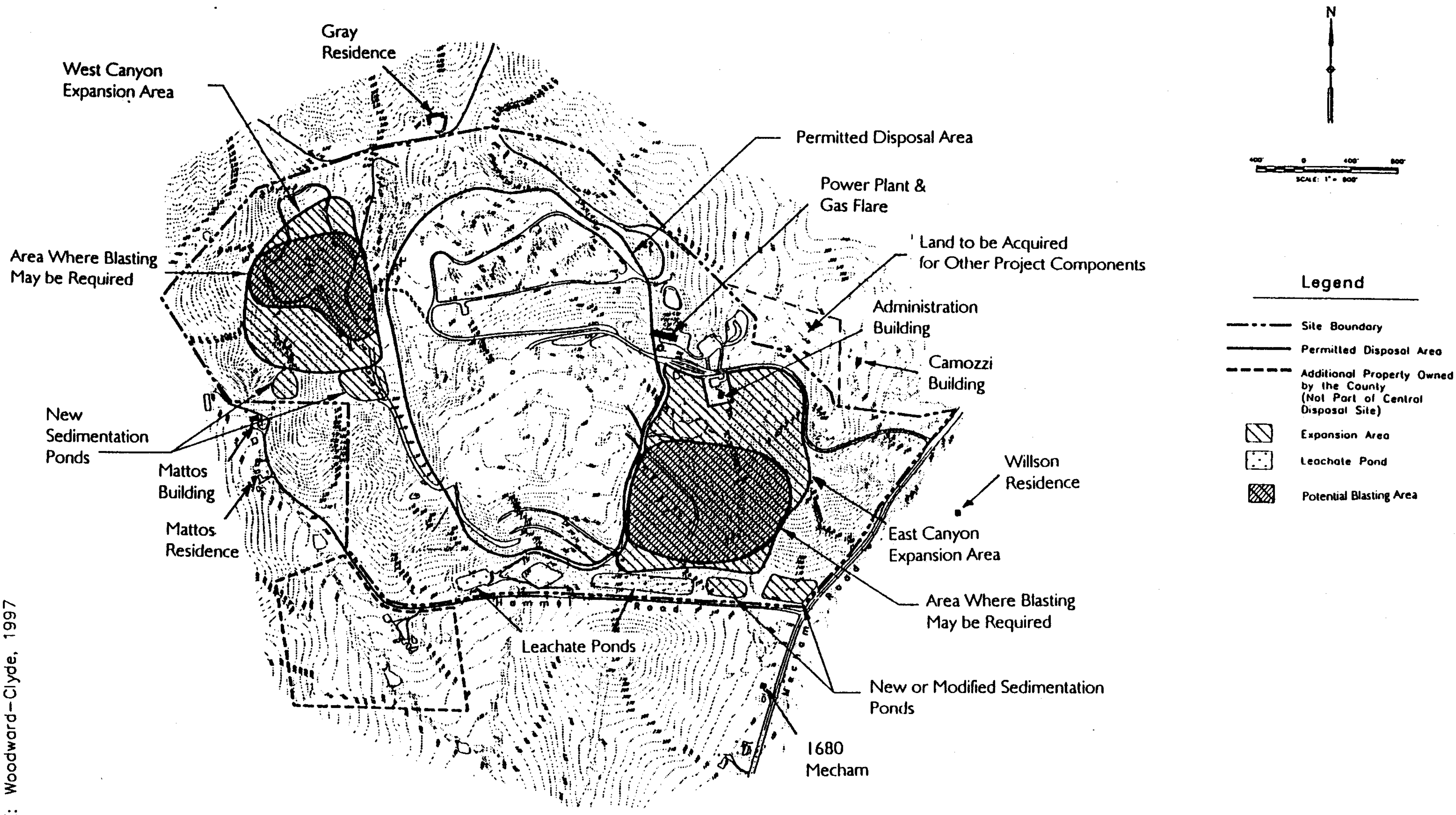


SOURCE: SONOMA COUNTY [JANUARY 2000]

GEOSYNTEC CONSULTANTS

PROPERTY BOUNDARIES
CENTRAL DISPOSAL SITE
SONOMA COUNTY

FIGURE NO.	2-2
PROJECT NO.	WL0062
DATE:	21 JANUARY 2000



PROPOSED LANDFILL EXPANSION
SONOMA COUNTY – CENTRAL DISPOSAL SITE

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

FIGURE NO.	2–3
PROJECT NO.	WL0062
DOCUMENT NO.	
FILE NO.	

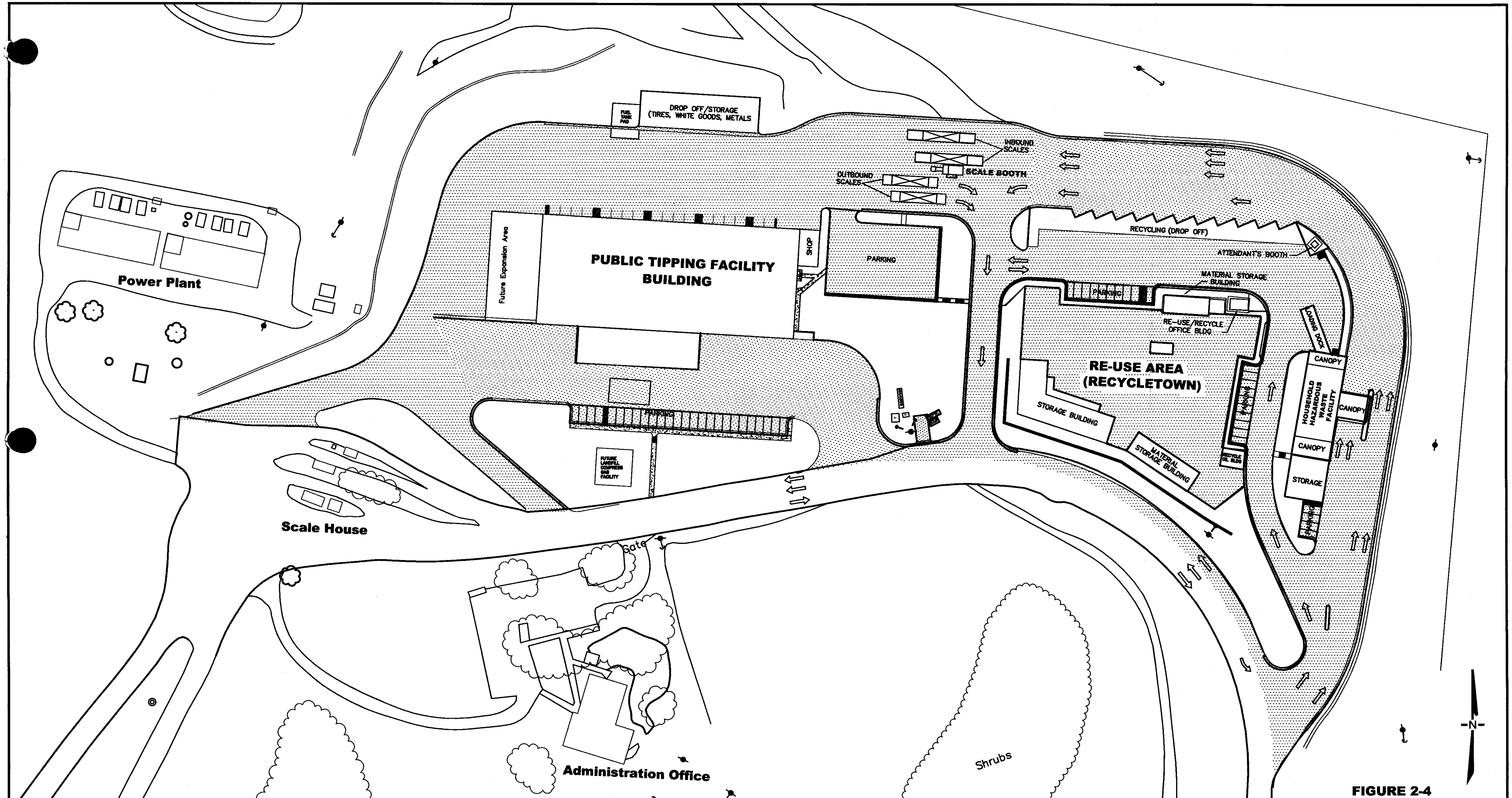


FIGURE 2-4

DESIGNED UNDER THE SUPERVISION OF	CIVIL ENGINEER, LICENSE EXPIRES:		
DESIGN		CHECKED	
DRAWING	R:\CAD\12-09-02TIP		

AS BUILT INFORMATION TO BE COMPLETED AFTER CONSTRUCTION

CONSTRUCTION COMPLETED:

AS BUILT DRAWINGS BY:

DATE	REVISION	BY	APPROVED

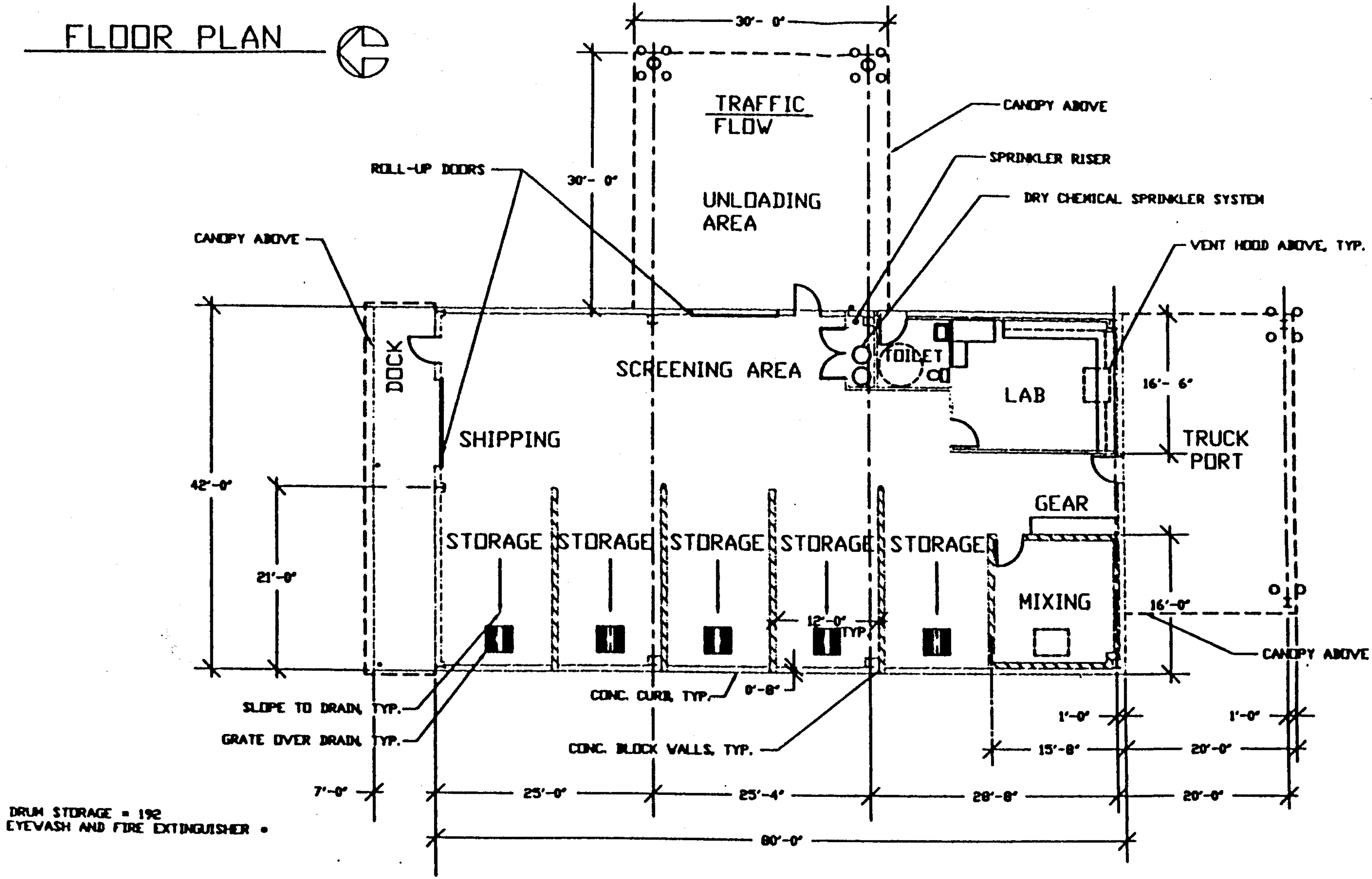
SONOMA COUNTY - CENTRAL DISPOSAL SITE

BUDGET NUMBER	FISCAL YEAR	SHEET NUMBER	TOTAL SHEETS

COUNTY OF SONOMA DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
DAVID D. KNIGHT, DIRECTOR

TITLE: LOCATION OF HHW FACILITY, GAS FUEL FACILITY PUBLIC TIPPING FACILITY, AND RECYCLING / RE USE AREA

DATE: DECEMBER 1, 2002 SCALE: 1 : 100

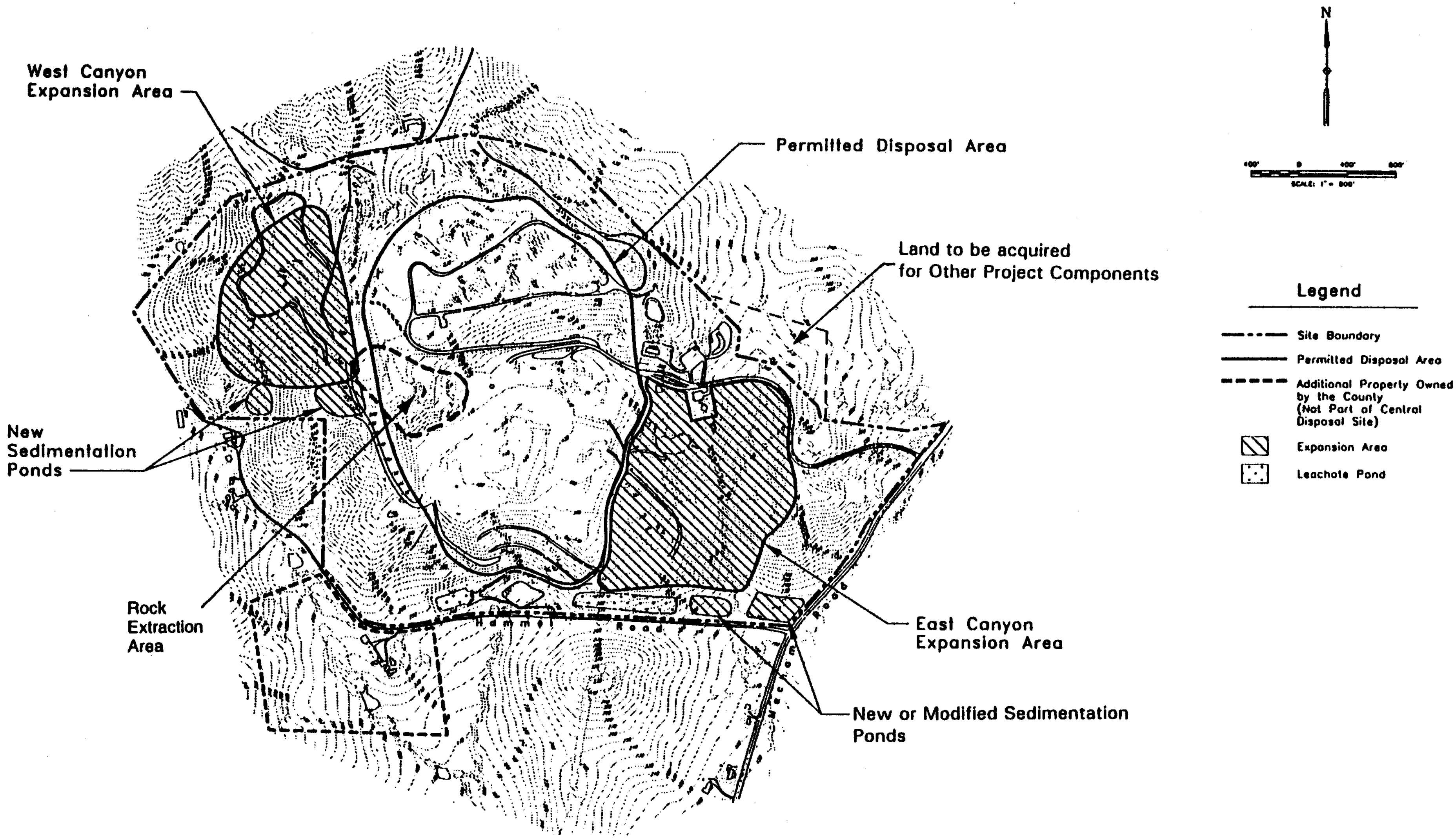


SOURCE: EBA, Floor Plan – Alternate No. 4, 1995

HOUSEHOLD HAZARDOUS WASTE COLLECTION FACILITY
SONOMA COUNTY – CENTRAL DISPOSAL SITE

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

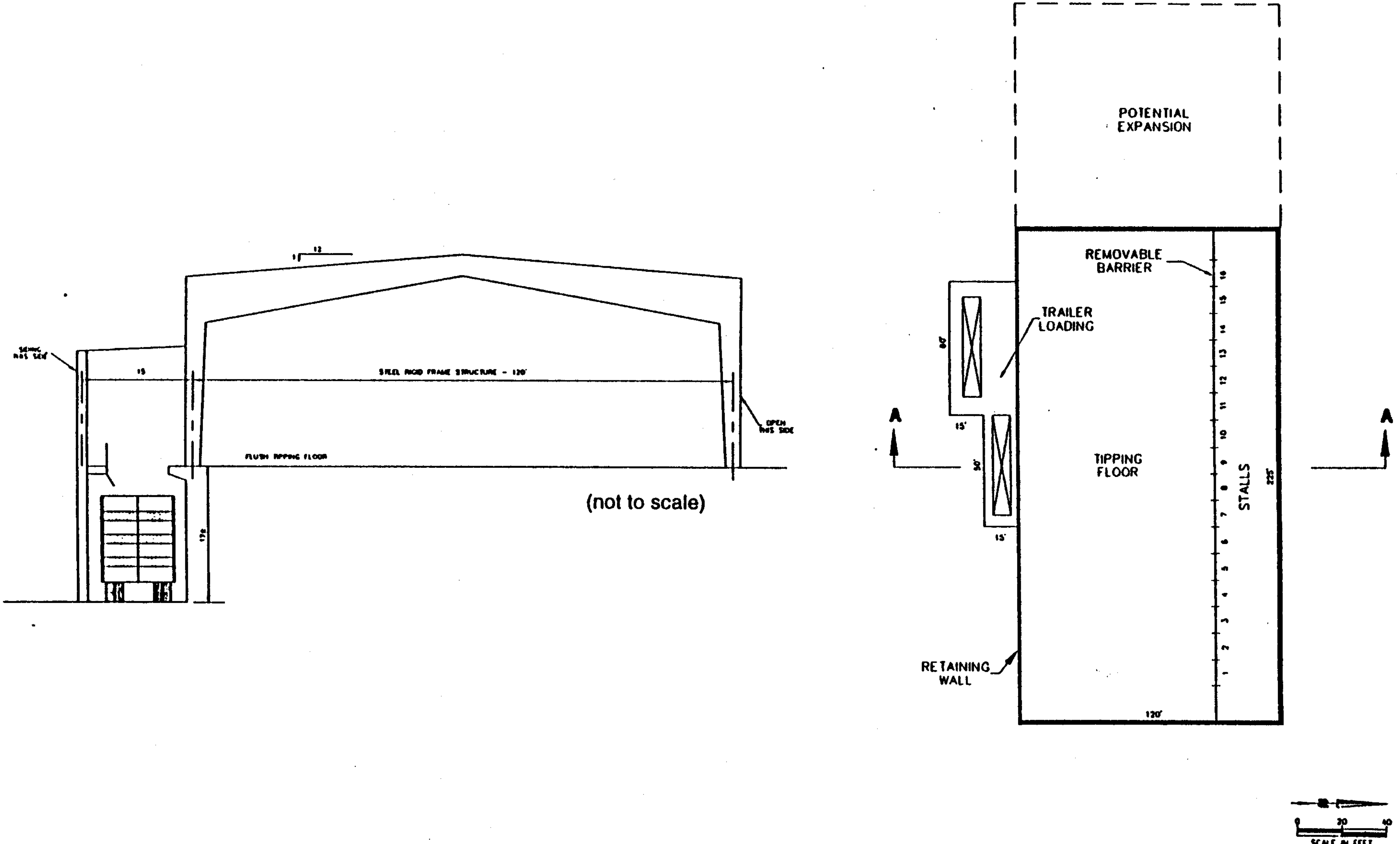
FIGURE NO.	2-5
PROJECT NO.	WL0062
DOCUMENT NO.	
FILE NO.	



SOURCE: WOODWARD-CLYDE [1998]

GeoSyntec Consultants

ROCK EXTRACTION PROJECT CENTRAL DISPOSAL SITE SONOMA COUNTY	FIGURE NO. 2-6 PROJECT NO. WL0062 DATE: 21 JANUARY 2000

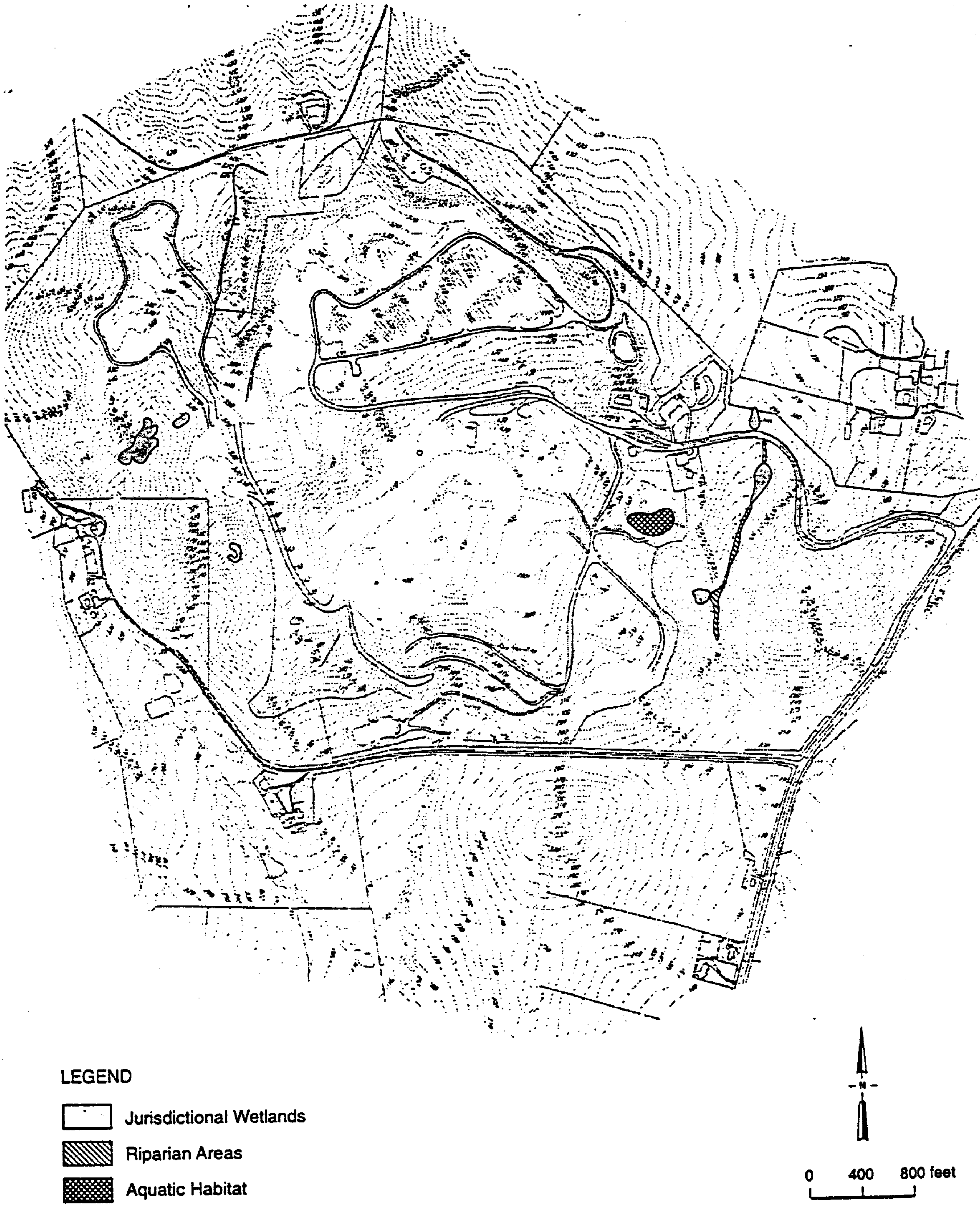


SOURCE: EBA, 1996

PUBLIC TIPPING FACILITY
SONOMA COUNTY – CENTRAL DISPOSAL SITE

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

FIGURE NO.	2-7
PROJECT NO.	WL0062
DOCUMENT NO.	
FILE NO.	

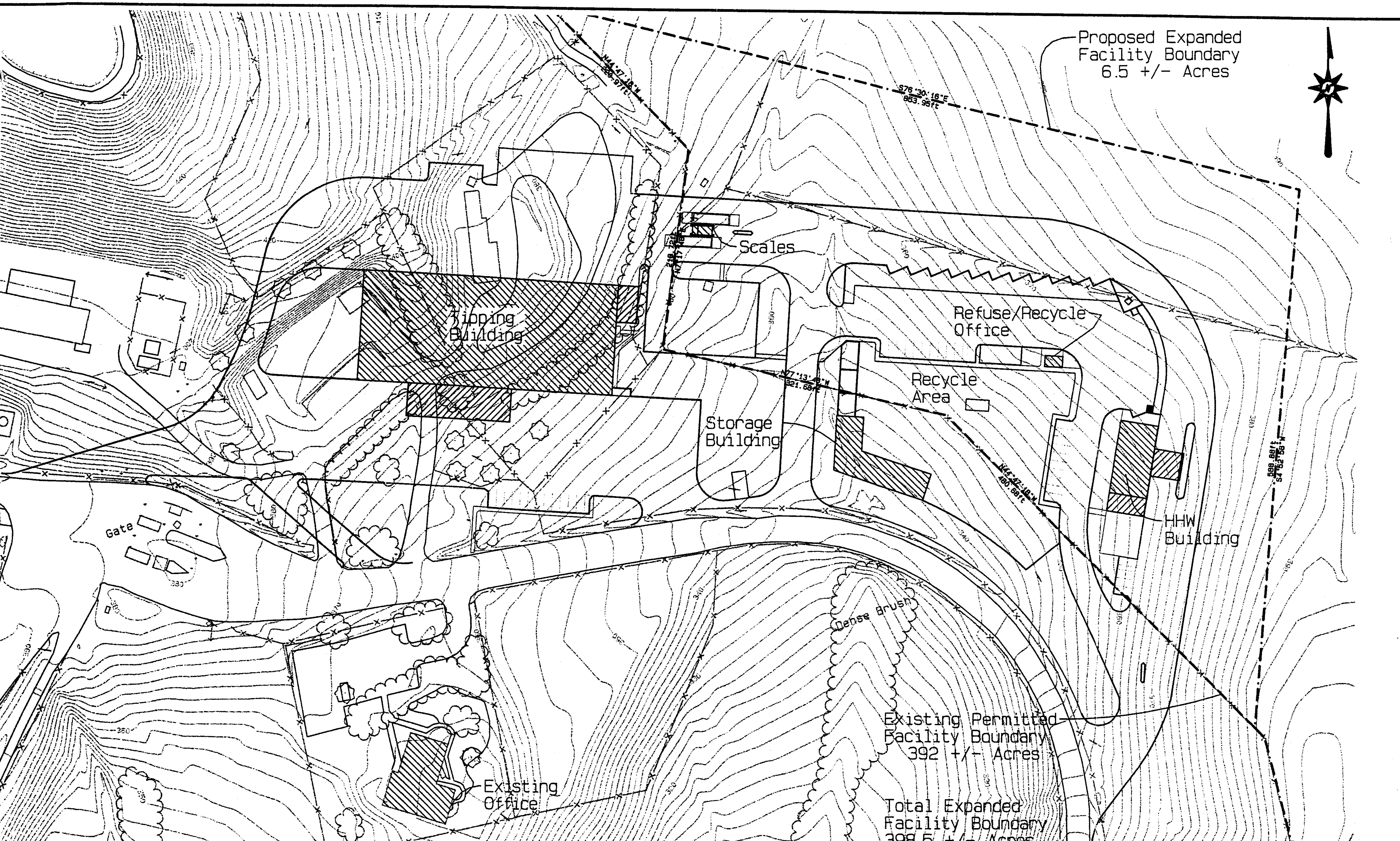


WETLANDS AND OTHER HABITATS AT CENTRAL DISPOSAL SITE

After Woodward-Clyde, 1997

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

FIGURE NO.	2-8
PROJECT NO.	WL0062
DOCUMENT NO.	WC99
FILE NO.	



SOURCE: SONOMA COUNTY [JANUARY 2000]

GEOSYNTEC CONSULTANTS

PROPOSED EXPANDED FACILITY BOUNDARY
CENTRAL DISPOSAL SITE
SONOMA COUNTY

FIGURE NO.	2-9
PROJECT NO.	WL0062
DATE:	21 JANUARY 2000

3. WASTE

3.1 Introduction

This section of the JTD presents background information about the characteristics and quantities of wastes which are currently disposed of at the Central Disposal Site (CDS), including the East Canyon Area[1] (ECA) and transfer station (TS), the handling and disposal methods, waste quantities, waste by-products resulting from the decomposition process, and waste salvaging and volume reduction practices.

Section 21600(b)(2)(A) of Title 27 states that each operator of a disposal site shall describe *"... the types of wastes accepted or proposed for acceptance, estimated waste volumes, and specific mention shall be made concerning the receipt of liquid, designated, special wastes or hazardous waste, if taken."*

Further, Sections 21600(b)(7)(B)(C) and (E) state, respectively, that each operator of a disposal site shall:

- for salvaging activities *"... describe types of materials handled, and procedures to ensure that salvaging and other waste activities are conducted in a planned and controlled manner... "*;
- for volume reduction activities *"... describe procedures to ensure proposed operations are conducted in a controlled manner... "*; and
- for waste handling *"... describe the dimensions of the unloading area and unloading practices."*

The information presented in Section 3 satisfies these requirements.

3.2 Waste Types

The CDS, including the ECA expansion and TS, accepts mixed municipal solid wastes (MSW), clean gypsum (see Section 2.8.8 - Gypsum Diversion Program), construction and demolition debris (C&DD) wastes (see Section 2.8.6 – C&DD Diversion Program), agricultural

[1] East Canyon Area is also known as Landfill 2

wastes, landscaping wastes, and non-hazardous industrial wastes defined in Sections 20220[2] and 20230[3] of Title 27.

Detailed descriptions of the various waste types are given below.

3.2.1 Residential Waste

Residential wastes are non-hazardous materials originating in residential households or apartments. These waste materials include food wastes and miscellaneous discarded household items such as paper, rubber, plastic, garden waste, yard trimmings, lumber, metals, glass and ashes.

3.2.2 Commercial Waste

These are solid wastes that originate in businesses, such as office buildings, stores, markets, theaters, hospitals, schools, and other institutional establishments. These wastes may include paper, cardboard, food wastes, metal, glass, plastics and ceramics.

3.2.3 Construction and Demolition Debris Waste

The construction/demolition category includes inert and other waste building materials and rubble resulting from the construction, remodeling, repair and demolition operations of houses, commercial buildings, pavements, and other structures. These wastes may include lumber, scrap metal, asphalt, roofing materials, gypsum, plaster, cement, rubber products, wallpaper, shingles, and insulation (excluding asbestos), rock and earth. See Section 2.8.6 for a description of the program for construction and demolition debris (C&DD) waste.

---

[2] Section 20220 states that non-hazardous waste means "*... all solid, semi-solid and liquid wastes including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes,... manure, vegetable or animal solid and semi-solid wastes - provided that such wastes do not contain wastes which must be managed as hazardous wastes, or wastes which contain soluble pollutants in concentrations which exceed applicable water quality objectives...*"

[3] Section 20230 defines that inert waste as "*... that subset of solid waste that does not contain hazardous waste or soluble pollutants in excess of water quality objectives.*"

3.2.4 High Liquid Content Wastes

Dewatered sludge is accepted at the CDS between March and October, seven days per week, provided that the sludge meets the County's pre-disposal testing requirements, as described in Refuse Bulletin No. 117 "Landfill Procedure for Handling and Disposing of Dewatered Sludge."

The solids content of the sewage sludge received at the facility ranges between 15% and 20% in accordance with Sections 20220 (c) (2) and (3), and any sludge that is too wet is not accepted. Sludge is transported to the waste cell by discharging it off of the tipping apron. Since all waste dumped off the apron is pushed from just below the apron into the current waste cell, the sludge and waste become mixed with one another. A copy of this procedure is in Appendix B-1 [Sonoma County, 1997a].

3.2.5 Designated Wastes

Designated wastes are not accepted at the CDS [Sonoma County, 1997a].

3.2.6 Hazardous Wastes

Hazardous wastes are not accepted at the CDS. Household hazardous waste (HHW) intercepted by the hazardous waste screening program is stored in hazardous waste storage lockers. The EPA Generator Identification Number for the CDS is CAD 983597485 [Sonoma County, 1997a]. The procedures used for handling household hazardous wastes are presented in Appendix B-2 Household Hazardous Waste Exclusion Program.

3.2.7 Other Wastes Requiring Special Handling

Other wastes requiring special handling that are accepted at the CDS include dead animals, autoclaved medical waste, and contaminated soils. Procedures for autoclaved medical wastes are included in Appendix B-7. Procedures for contaminated soils are included in Appendix B-8 and procedures for handling these materials are described in Section 3.4 of this JTD.

3.3 <u>Waste Quantities</u>

Table 3-1 indicates the quantities of wastes by category as recorded by the gatehouse cashier and entered into the Refuse Inventory Management System (RIMS System) for Fiscal

Year (FY) 2003-2004. As shown in Table 3-1, the CDS accepted a net tonnage of 437,411 tons in FY 2003-2004. It is acknowledged that materials that are recycled are counted as part of permitted tonnage. However, these materials including appliances, CCU/recycle, tires and tipping floor metals are removed from the site as part of the diversion program.

On 1 April 2004 the County began exporting approximately 30% of its solid waste to Solano County as a temporary measure while the County researched alternative solutions to its problem at the CDS. This 30% out-hauled waste came almost exclusively from the Healdsburg and Sonoma Transfer Stations. Beginning 1 September 2005, however, the County has decided that it must begin exporting 100% of all Class III solid waste generated within the County to alternative permitted facilities for a period of approximately 3 years or until such time that the CRWQCB grants permission to proceed with either Phases III or IV of the Landfill 2 expansion project or the Rock Extraction Area (REA) project. To this end, the County will use the existing tipping facility (TF) to either load and transfer solid waste directly to the landfill operation at the CDS or to load and out-haul solid waste to an alternative permitted facility outside the County.

Table 3-1
TONNAGE BY CATEGORY – FY 2003-2004
Central Disposal Site

Category	Total (tons)
SITE TONNAGE	536,572
RECYCLED MATERIALS TO COMPOST SITE.	
Wood Waste	7,448
Yard Debris	48,471
MOM[4]	34,946
Other	8,296
Net Landfill Tonnage	**437,411**

Source - Sonoma County Records

For the 12-month period, beginning 1 April 2004 and lasting through March 2005, 289,314 tons of Class III solid waste were placed in the Phase 1 and 2 area of Landfill 2 unit for

[4] Mixed Organic Materials (yard and wood waste from transfer station)

a daily average of 806 tons. The daily peak for the 12-month period was 1,443 tons per day and the average of the daily peak for the 12-month period was 1,176 tons per day.

Based on current equipment availability, the operational design capacity of the Central Disposal Site is 2,500 tons per day [Sonoma County, 1997a].

The 1995/96 Waste Stream Characterization Study, dated May 1996, prepared by Cascadia Consulting Group, Inc., estimated the origin of waste by vehicle count. From the study, waste volumes can be estimated as shown in Table 3-3.

Table 3-2
TONNAGE DIVERTED, EXPORTED AND LANDFILLED[5]
Central Disposal Site

YEAR	Waste Generation (tons/year)	Waste Diversion (tons/year	Waste Exported out of County (tons/year)	Waste Landfilled (tons/year)	Daily Average (tons/day)
2000	880,323	348,873	36,607	494,843	1,378
2001	908,479	363,361	47,128	497,990	1,387
2002	935,024	415,024	25,000	495,000	1,379
2003	962,273	452,273	25,000	485,000	1,351
2004	990,569	505,569	25,000	460,000	1,281
2005	1,019,670	529,670	25,000	465,000	1,295
2006	1,024,335	554,635	469,700	0	1,308
2007	1,054,917	580,517	474,400	0	1,321
2008	1,086,722	607,522	479,200	0	1,335
2009	1,144,284	635,284	25,000	484,000	1,348
2010	1,178,141	664,241	25,000	488,900	1,362

[5] From 2003 CoIWMP, Facility Capacity Component, Table 4-42, p. 4-165

Table 3-3
VEHICLE COUNT BY CITY OF ORIGIN
Central Disposal Site

City	Percent
Cloverdale	0.7%
Cotati	3.5%
Healdsburg	2.4%
Petaluma	17.5%
Rohnert Park	7.3%
Santa Rosa	35.8%
Sebastopol	8.7%
Sonoma	3.0%
Unincorporated County	19.8%
Windsor	1.3%
Total	**100.0%**

3.4 Waste Handling and Disposal

The reference for the information in this section is the superseded the Report of Disposal Site Information (RDSI) [Sonoma County, 1997] that was replaced by the current JTD for the CDS.

3.4.1 Construction Sequencing

There is no excavation at this time within the active disposal portion of the CDS as most of the landfill has been covered with waste, nor is there any base preparation or liner placement. The Phasing, Excavation, & Stockpiling Plan in Appendix B-3 indicates where waste will be placed through closure. Excavated cover materials from areas adjacent to the landfill are generally transported directly to the waste cell. Any material that is stockpiled is placed as indicated in the Phasing, Excavation, & Stockpiling Plan. Approximately 1,524,000 yd^3 (1,166,077 m^3) of waste and cover were placed during the first phase, from June 1994 through 1995; approximately 5,640,000 yd^3 (4,315,403 m^3) of waste and cover will be placed during the second phase from 1995 through 2002; and approximately 1,316,000 yd^3 (1,006,927 m^3) of waste and cover will be placed during the final phase from 2002 through closure.

In the ECA, operations are sequenced (i.e., in phases) in areas sized to provide efficient construction, landfilling, and surface-water control. Additional discussion of the phasing is presented in Section 8. Once a phase of the ECA is constructed in accordance with approved construction drawings and specifications, and approval to receive waste is granted by the CRWQCB, waste disposal operations will begin. Proposed East Canyon Sequencing Plans are presented in Appendix I-2.

3.4.2 Unloading at Commercial Tipping Facility

Section 20630 of Title 27 states that "*... unloading of solid wastes shall be confined to as small an area as possible to accommodate the number of vehicles using the area, and waste materials shall normally be deposited at the toe of the fill.*" Accordingly, at the CDS, signs are used to direct commercial customers to the correct unloading area, which is defined, by fences and barriers. Unloading areas for licensed haulers and select public are separated by fences and barriers. Waste is dumped from off of the 400-ft (122-m) long tipping apron. During the dry months, appropriately placed signs direct traffic to unloading areas that are as close as possible to the waste cell. The public Tipping Facility/Transfer Station (TF/TS) is discussed in Section 2.8.2. Appendix B-15 contains additional information on the TF.

In the ECA, accepted waste is transported by truck to the working face and unloaded, except for occasions when a tipping apron, as described above, may be utilized when considered convenient for operations or during winter months.

3.4.3 Spreading and Compacting

Waste is moved from the unloading area to the daily waste cell with grading equipment, and spread into cells that are approximately 50 to 100 ft (15 to 31 m) in width and 100 to 175 ft (31 to 54 m) in length. The depth of each daily cell is approximately 10 to 15 ft (3 to 4 m).

Pursuant to the requirement in Section 20640 of Title 27 which states that "*... solid waste shall be spread and compacted in layers with repeated passages of the landfill equipment to minimize voids within the cell and to maximize compaction...,*" the waste is spread into 2-ft thick layers prior to compaction. The maximum slope of the lift is 3H:1V (horizontal to vertical), and the graded slope is generally 2%. The waste is compacted with the previously designated compactors with special wheels in three to six passes.

3.4.4 Periodic Cover

Waste is covered daily in the active disposal area, wherever it is, with a minimum of 6 in. (150 mm) of soil at the end of the working day prior to closing in accordance with requirement in Section 20680 of Title 27, which states that "*... owners and operators of all MSWLF units shall cover disposed solid waste with six inches of compacted earthen material at the end of each operating day.*" The Disposal Supervisor directs the placement of cover as necessary to prevent wastes from remaining exposed for more than 24 hours. The soil is placed to serve as a barrier to the emergence or attraction to the landfill of flies, rodents, or other vectors; to hinder the progress of any fires that may occur within the landfill; and to minimize the escape of odor. Daily cover is also placed and graded to hinder the infiltration of excess surface water runoff in accordance with Section 20650 of Title 27, which states that "*... covered surfaces of the disposal area shall be graded to promote lateral runoff of precipitation and to prevent ponding.*"

Prior to disposal of waste over the daily cover, the soil placed the previous day as daily cover is removed as much as practicable and stockpiled for later use. Removal is limited to prevent excavating covered waste with the soil being removed. Removal and use of a portion of the daily cover promotes continuity of waste within the disposal cells and thus enhances the performance of the landfill gas and leachate collection systems.

In addition to soil, the County has available the use of alternative daily covers (ADC) of ELC Synthetic Cover (ELC), Shredded Green Waste (SGW), and a spray-on material called Posi-Shell. The ELC is a 3-mil thick degradable polyethylene film containing a photo/thermal degradient to ensure complete degradation after burial in the landfill. The ELC can be made available, but is not currently in use. The SGW is green waste that has been chipped. It is placed in at a maximum 12-in. loose lift thickness. SGW is not used during rainy periods to reduce odors. The Final Report for the ELC and SGW as ADC at the CDS is included in Appendix B-4.

Posi-Shell was shown to be a suitable ADC during a year-long demonstration project conducted at the CDS in 1999-2000. Posi-Shell uses a cementitious material, with a noncombustible blend of recycled materials, providing a thin cover (approximately 1/8- to 1/4-in. thick) that hardens over the surface of working face of the landfill. Non-toxic, the stucco-like coating performs all functions of landfill daily and, with additional testing and review, may be considered for intermediate cover. The conclusions of the year-long demonstration project were presented in a DTPW final report dated August 2001. The use of Posi-Shell as ADC was accepted by the EA in a letter dated 20 May 2002 and the CIWMB concurred in a letter dated 8 August 2002. A description of the Posi-Shell Demonstration Project and related correspondence are in Appendix B-9.

3.4.5 Intermediate Cover Placement

Section 20700 of Title 27 states that "... *compacted earthen material of at least twelve (12) inches shall be placed on all surfaces of the fill where no additional solid waste will be deposited within 180 days*". A detailed sequencing plan for the placement of waste for an 18 month period is prepared every year for the CDS. This plan is used to determine areas, which will not receive additional waste for more than 180 days and which will hence require intermediate cover. In accordance with Section 20700, intermediate soil cover is placed in layers a minimum 12 in. (30 cm) thick. The placement of cover is observed during construction to insure adequate thickness and compaction of cover. Areas that have placed waste to final waste grades will receive intermediate cover, per regulations, which will be maintained until the final cover system is constructed during closure.

3.4.6 Final Cover Placement

Final cover placement is anticipated to be completed during the closure of the CDS. The majority of the footprint of the landfill will remain active until just prior to closure. The final cover design is discussed in Section 10 of this report, which contains certification that the cover was designed by a licensed civil engineer. In the ECA, the final cover will also be constructed during closure of the landfill after all waste placement has been completed.

Standard control procedures, to ensure the required thickness and properties of cover materials are met, will be included in the quality assurance control (CQA) plan for the final closure plan.

3.4.7 Cover Availability

Section 20670 of Title 27 states that "... *a sufficient quantity of cover material of a suitable quality shall be available*." Cover material volumes are calculated based upon a 4:1 waste to soil ratio. Cover material includes daily cover soils, intermediate soils, foundation soils and operational layer soils, composting materials and ADCs. As of December 2002, approximately 800,300yd^3 of stockpiled soils exists on the site. This volume includes two stockpile areas within the proposed Phase IV expansion area (224,900 yd^3), Phase IV excavation material (88,900 yd^3) and a soil stockpile (486,500 yd^3) located north of Leachate Pond # 1. For the assumed waste to soil ratio , this quantity of cover material will be exhausted in early 2006 when Phase IV will be about one year into its 2-year and four month life. Cover soils will then need to be acquired from surface soils in the West Expansion Area.

Upon using the stockpiled soils, only three remaining sources of cover soils will exist on the site. Those borrow sources include the REA (26,250 yd^3), the Compost Operations Area (266,550 yd^3) and the West Expansion Area (2,669,315 yd^3), totaling 2,962,115 yd^3. Projecting the usage of these cover soils to future years and comparing those volumes to an annual 2% waste volume increase, all on-site cover soils shall be expended by year 2015. Therefore, there are adequate cover materials available for the 1971-Permitted Area and the ECA.

3.4.8 Special Handling Procedures

In response to regulatory requirements, the County has prepared Refuse Bulletins describing specific procedures to be followed when handling various special wastes. The bulletins for special wastes are included in Appendix B-5 and cover the following specific waste types:

- contaminated soil;
- Special Waste (Note: Refuse Bulletin No. 116)
- infectious wastes;
- asbestos;
- drained oil filters;
- small animals;
- soils from residential areas;
- dewatered sludge; and
- waste suspected of being a hazard.

A household hazardous waste (HHW) exclusion program is in effect at the site. Details of the program are included in Appendix B-2.

The East Canyon Area (ECA) accepts wastes for disposal only, not for treatment or storage. Solid waste disposal is accomplished by traditional sanitary landfilling methods, and in accordance with Title 27 and Subtitle D requirements and industry standards.

3.5 <u>Waste Decomposition Process and Waste By-Products</u>

3.5.1 Landfill Gas and Waste Decomposition

Wastes placed in the 1971 Permitted Area and East Canyon Area will undergo natural chemical and biological decomposition following landfilling. The products of biological decomposition of organic wastes are solids, liquids and gases.

The waste decomposition process begins with organic waste products undergoing aerobic (characterized by the presence of free oxygen) decomposition during storage and transport, and for a limited period after placement in the landfill. Aerobic decomposition continues until available oxygen is depleted. When oxygen is depleted, anaerobic (i.e., characterized by the lack of oxygen) decomposition becomes dominant and proceeds until all biodegradable materials are decomposed or until environmental conditions (e.g., moisture content, pH) no longer support the decomposition process.

Typical primary products of aerobic decomposition of municipal solid waste are carbon dioxide, water, and nitrate. Typical primary products of anaerobic decomposition are methane, carbon dioxide, water, organic acids, nitrogen, ammonia, iron sulfides, manganese, and hydrogen. These products, along with the original composition of the waste, are the primary factors controlling the quality of leachate and the quality and quantity of landfill gas produced at a landfill. The percentage by volume of methane in the gas may range from 50% to 60% and that of carbon dioxide from 30% to 50%.

In the early stages of anaerobic decomposition of refuse, carbon dioxide is the principal component of the landfill gas. During the second stage of anaerobic decomposition - anytime from six months to several years after refuse placement - methane is generated by the action of methane-producing bacteria on the organic components of the refuse.

The presence of methane within landfill gas is the driving force in using thermal combustion or energy recovery facilities as a means of disposing of gas produced from the landfills. Methane, an odorless hydrocarbon, is the principal constituent of natural gas, with a heating value of approximately 1,000 Btu per standard cubic foot (Btu/SCF). Since methane comprises only about 50% to 60% by volume of the landfill gas composition, however, the heat content of gas is about 500 to 600 Btu/SCF. As a result, the use of energy recovery facilities is highly contingent on the percentage of methane present in landfill gas.

Methane production from a given refuse fill will continue for many years as the active gas production life is dependent on site-specific conditions. Generation life may range from a few years to hundreds of years, in certain environments. The rate of gas production depends on a number of parameters, principally on refuse composition, level of oxygen present, refuse moisture content, environmental pH, alkalinity, and temperature.

Refuse decomposition directly affects the rate of methane production. Methane production is stimulated by waste that has a high percentage of biodegradable materials (food and garden waste, paper, textiles and wood). Inhibitory materials present in the waste hamper the growth and activity of methane-forming bacteria. With municipal wastes, heavy metals are the major inhibitors. Industrial wastes may contain inhibitory concentration of common salts of sodium, potassium, magnesium, calcium, ammonium, or sulfide.

The maximum methane production from composite refuse by methane fermentation has been estimated stoichiometrically to be approximately 4 cubic feet per pound of refuse (ft^3/lb) (0.25 m^3/kg) [Kleinfelder, 1992]. Estimates utilizing an empirical chemical formula for composite refuse are in good agreement with those in which individual biodegradable constituents of composite waste are assessed separately and then summed. Because of system inefficiency, the production ultimately obtained probably lies in the range of 1 to 4 ft^3/lb (0.6 to 0.25 m^3/kg).

As moisture infiltrates through a landfill cover and into the refuse, it dissolves soluble components of the refuse, and carries various hydrophilic colloidal and other suspended matter. The soluble components consist of: a variety of alkaline earth and heavy metals; a variety of soluble organic compounds, such as intermediate or end products of refuse decomposition; and a variety of other soluble constituents, which may be present in part of the fill materials. The landfill will generally absorb moisture until its moisture retention capacity is reached and will then discharge liquid as leachate.

At the landfill, contributions of moisture from outside sources will be extremely limited, because:

- the site has an average annual precipitation of approximately 29 in. (74 cm) and an average annual evaporation of approximately 73 in. (185 cm.);

- a surface-water management system (SWMS) has been constructed to divert surface-water run-on away from active areas of the landfill;

- interim cover will be placed daily which will limit infiltration of precipitation that falls directly on the landfill; and

- a final cover will be constructed which will essentially eliminate infiltration into the waste mass.

The factors described above should result in limited biological decomposition of waste in Landfill 1 and Landfill 2 and, consequently, landfill gas and leachate generation rates that are, and will be lower than those typically found at other solid waste landfills.

3.5.2 Leachate

3.5.2.1 Introduction

Leachate is defined as liquid that has come in contact with the waste. Leachate is produced primarily as a result of water infiltration through the waste mass, waste settlement (i.e., compression), and to a lesser extent, as a result of waste decomposition.

The quantity, and to some extent quality, of leachate generated in a landfill is directly proportional to the amount of water entering and exiting the waste mass. The quantity of leachate generated in municipal solid waste landfills is dependent on factors such as:

- infiltration;
- surface-water run-on;
- evapotranspiration;
- final cover design;
- waste field capacity (i.e., capacity to hold moisture);
- waste compression; and
- age of the site.
- other factors which primarily affect the quality of leachate produced include:
- composition of the waste; and
- stage and rate of waste decomposition.

3.5.2.2 Leachate Characteristics

Leachate from municipal solid waste landfills is a complex mixture of soluble organic and inorganic constituents, suspended solids, and bacteriological constituents, all in an aqueous medium. Leachate quality varies substantially from landfill to landfill and is a function of the waste source, climate, season, site hydrology, cover soil, landfill age, and other factors.

Municipal solid waste (MSW) landfill leachate compositions have been presented in the literature by Bagchi [1990], Kmet and McGinley [1982], Pfeffer [1992], and Brunelle et al., [1987]. Generally, these concentrations are for relatively young landfills.

Average concentrations of common leachate constituents and other parameters (e.g., pH) are listed in Table 3-4. The composition of leachate from the CDS may differ from that presented in Table 3-4.

Table 3-4
TYPICAL SOLID WASTE LANDFILL LEACHATE CHARACTERISTICS(1)

Parameter	Concentration or Values (mg/L)			
	Source 1	Source 2	Source 3	Source 4
pH (S.U.)(2)	3.7 - 8.9	1.5 - 9.5	3.7 - 8.5	7.5
Hardness	0.1 - 225,000	0 - 22,800	540 - 22,800	N/A(3)
Specific Conductance (μS)	480 - 72,500	2,810 - 16,800	N/A	2,300
Alkalinity	ND(4) - 5,050	0 - 20,850	240 - 20,500	N/A
Chloride	2 - 11,375	5 - 4,350	5 - 2,467	5.3
Sulfate	ND - 1,850	0 - 84,000	1 - 1,558	5.3
Ammonia-nitrogen	ND - 1,200	0 - 1,250	0 - 1,106	427
Nitrate-nitrogen	ND - 250	0 - 10.29	0 - 10.3	N/A
COD	6.6 - 99,000	0 - 89, 520	81 - 33,600	800
BOD	ND - 195,000	9 - 54,610	40 - 89,500	N/A
Phosphorus	ND - 234	0 - 130	0 - 130	3.8
Total Dissolved Solids	584 - 55,000	N/A	584 - 44,900	4,270
Total Suspended Solids	2 - 140,900	6 - 3,670	10 - 700	N/A
Cyanide	ND - 6	ND - 0.08	N/A	0 - 0.11
Phenols	N/A	0.17 - 6.6	N/A	N/A
Arsenic	ND - 70.2	ND - 40	N/A	0.038
Barium	ND - 12.5	ND - 9.0	N/A	0.08
Cadmium	ND - 0.4	ND - 1.16	0 - 17	0.0037
Chromium	ND - 5.6	ND - 22.5	N/A	0.053
Copper	ND - 9.0	ND - 9.9	0 - 10	0.024
Lead	ND - 14.2	ND - 6.6	0 - 2.0	0.054
Mercury	ND - 3.0	ND - 0.16	N/A	0 - 0.064
Manganese	ND - 400	0.06 - 678	0.1 - 125	0.6
Selenium	ND - 1.85	ND - 0.45	N/A	N/A
Zinc	ND - 731	0 - 1,000	0 - 370	0.5
Iron	ND - 4,000	0.2 - 42,000	0 -2,820	24
Sodium	12 - 6,010	0 - 8,000	34 - 7,700	800
Calcium	3.0 - 2,500	5 - 7,2000	60 - 7,200	170
Magnesium	4.8 - 780	12 - 15,600	17 - 15,600	100
Potassium	ND - 3,200	2 - 3,770	28-3,770	490
Nickel	ND - 7.5	ND - 1.7	N/A	0.069
TOC	ND - 40,000	N/A	N/A	350

Notes (on the next page)

Table 3-4 Notes:

Source 1 - Bagchi [1990] derived from work from McGinley and Kmet [1984] and Lu et al., [1981].
Source 2 - Kmet and McGinley [1982], range of results reported by Clark and Piskin [1976], Chian and Dewalle [1977], Uloth and Mavinic [1977], Myers et al. [1980], and James [1977].
Source 3 - Pfeffer [1992] derived from Gardner and Conrad [1986].
Source 4 - Brunelle et al., [1987] represents a "typical" leachate based on the work of Daniel and Liljestrand [1984].
(1) Data from active, young landfills
(2) S.U. = Standard Units
(3) N/A = Not Reported
(4) ND = Not Detected

Leachate monitoring is performed on a routine basis for the CDS. Appendix B-10 contains leachate monitoring data that are summarized in Table 3-5.

Table 3-5
LEACHATE SAMPLE ANALYTICAL RESULTS
TREATMENT PLANT EFFLUENT & LEACHATE POND
Central Disposal Site

Analyte	Units	17 November 1998		Reporting Limit (1)
		Treatment Effluent	Pond Composite	
Antimony	mg/L	ND	ND	0.2
Arsenic	mg/L	0.0024	0.017	0.002
Beryllium	mg/L	ND	ND	0.01
Cadmium	mg/L	ND	ND	0.001
Chromium	mg/L	ND	0.0092	0.002
Copper	mg/L	ND	ND	0.002
Cyanide	mg/L	ND	ND	0.005
Lead	mg/L	ND	ND	0.002
Mercury	mg/L	ND	ND	0.0002
Nickel	mg/L	0.028	0.041	0.002
Selenium	mg/L	ND	ND	0.005
Silver	mg/L	ND	ND	0.0002
Thallium	mg/L	ND	ND	0.2
Zinc	mg/L	0.052	0.029	0.01
pH	pH Units	7.3	7.5	0-14
BOD	mg/L	22	411	2
Total Suspended Solids	mg/L	41	43	1
Total Toxic Organics (2)	mg/L	0	0	(3)

(Notes on the next page)

Table 3-5 Notes
Source - EBA Wastechnologies, December 1998.
ND = Not Detected at or above the reporting limit.
BOD = Biological Oxygen Demand.
mg/L = milligrams per Liter
(1) Please be advised that the actual reporting limits may deviate from those presented herein in cases of elevated concentrations or matrix interferences. Based on information provided by the County of Sonoma, the majority of actual reporting limits for the County of Sonoma landfill sites have historically been consistent with the minimum reporting limit requirements.
(2) Please note that Total Toxic Organics (TTO) is a summation of the volatile (EPA Method 8260) and semi-volatile (EPA Method 8270) organics for all quantifiable compounds with detected values greater than 0.01 mg/L. There were organic compounds detected at levels less than 0.01 mg/L however they were not included in the calculation of the TTO value. Please refer to the Certified Analytical Report (CAR) for the actual values.
(3) The detection limits for organic compounds vary for each compound. Please refer to the CAR for the actual detection limit.

Leachate characteristics in Table 3-4 are derived from data from the early 1980s, and earlier, for municipal solid waste landfills. Leachate characteristics from modern landfills should benefit from improved waste disposal practices (e.g., household hazardous waste programs) and stricter environmental regulations that are in place today. This view is reflected by the U.S. Environmental Protection Agency (USEPA), which stated (56 CFR 50982): "*Furthermore, the Agency has many reasons to believe that the quality of the leachate from MSWLFs will improve over time. Increasingly, communities are instituting household hazardous waste programs and removing toxics from waste prior to its disposal in a municipal landfill. In addition, the Agency expects there to be positive changes in leachate resulting from the 1986 lowering of the cut-off levels for small quantity generator waste and the addition of new RCRA hazardous waste listing and characteristics*".

For these reasons, leachate characteristics at the ECA (i.e., Landfill 2) may differ somewhat from those given in Table 3-4. In addition, leachate compositions at older landfills, such as Landfill 1, are likely to differ from those presented in Table 3-4.

3.5.2.3 Leachate Quantity

In general, the rate of leachate generation at a landfill is highest early in the operating life of the facility, approaches a steady-state condition during the latter stages of filling, and decreases after placement of the final cover system. The long-term reduction in leachate generation rate due to final cover placement is dependent on the degree of impermeability of the cover. If the cover essentially prevents infiltration, leachate will eventually cease to be generated from that source.

Typically, leachate generation rates for the design of landfills are estimated using the USEPA model "Hydrologic Evaluation of Landfill Performance," or "HELP" model [Schroeder, 1994a, b]). The HELP model is a quasi-two-dimensional water balance method for evaluating daily run-off, evapotranspiration, percolation (i.e., infiltration), and LCRS flow at landfills. Input parameters to the model include cover, waste, and liner system properties, landfill geometry information, and climatological data.

Regulations contained in Section 20340(b) of Title 27 require that the LCRS be *"... designed, constructed, maintained, and operated to collect and remove twice the maximum anticipated daily volume of leachate from the Unit."* The individual components of the LCRS (e.g. as the gravel drainage layer, the geocomposite drainage layer and the perforated pipes) for the 1971 Permitted Area (Landfill 1) and East Canyon Area (Landfill 2) were designed on the basis of the leachate generation expected in each phase of the landfill. In each case, the components were designed to correspond with the regulations in effect at the time.

Experience at other landfills, and the conservative nature of the HELP model assumptions, suggest that the actual leachate flow will be less than that predicted by the HELP model. Actual leachate production from lined landfills is frequently 20% to 50% less than predicted values [Lane et al., 1992]. Therefore, the anticipated peak flow shall be handled by the designed LCRS system.

The leachate generated at the CDS is diverted and handled in two on-site storage ponds before hauled off site. The leachate will be processed, when necessary, through a filtration system depending upon concentrations of mercury in the leachate. If the levels of mercury are low enough to meet the conditions of the Santa Rosa wastewater treatment plant Waste Discharge Permit, then the leachate is hauled directly off-site to the POTW, which has been the case up to this point. Otherwise, the leachate would be filtered through the on-site mercury filtration plant before being hauled off-site. The filtration plant is designed to process up to approximately 86,000 gallons of leachate per day. The landfill is also permitted to spread leachate in designated areas on native ground around the landfill and on haul roads for use as dust control. Records (Central Disposal Site files) of cumulative leachate hauled for several recent fiscal years (ending June 30 each year) are included in Table 3-5.1.

Table 3-5.1
CUMULATIVE LEACHATE HAULED
Central Disposal Site

Fiscal Year	Gallons
1999 - 2000	18,175,800
2000 - 2001	14,265,800
2001 - 2002	16,924,300
2002 - 2003	26,581,586
2003 - 2004	22,361,200

3.5.3 Landfill Gas

3.5.3.1 LFG Composition

As discussed earlier, landfill gas (LFG) composition in a landfill varies based on the types of wastes and conditions that exist during decomposition. Table 3-6 gives information about typical landfill gas compositions that might be expected from the CDS. Data in this table were compiled from the Environmental Impact Report [WCC, 1997]. Table 3-7 includes actual landfill gas composition data from the CDS. Appendix B-12 contains the actual test data.

Table 3-6
TYPICAL LANDFILL GAS COMPOSITIONS

LFG Component	% of LFG (by volume)
Methane	45 - 60
Carbon Dioxide	40 - 60
Nitrogen	2 - 5
Oxygen	0.1 - 1.0
Sulfides, Disulfides, Mercaptens, etc.	0 - 1.0
Hydrogen	0 - 0.2
Carbon Monoxide	0 - 0.2
Trace Constituents	0.01 - 0.6

Table 3-7
ACTUAL LANDFILL GAS COMPOSITION
Central Disposal Site

Compound	Concentration (%)		
	Gas Well #5	Gas Well #34	Gas Well #55
Oxygen	0.21	<0.13	19
Nitrogen	11	5.0	81
Methane	57	57	0.12
Carbon Dioxide	32	38	0.14

Source - Air Toxics Ltd.

3.6 Salvaging and Volume Reduction

Recycling/salvaging activities which occur within the permitted facility are described below in accordance with requirements in Sections 20710, 20720 and 20730 of Title 27. which state, respectively, that "*salvaging..shall be conducted in a planned and controlled manner and shall not interfere with other aspects of site operations*"; "*drugs, cosmetics, foods, beverages, hazardous chemicals, poisons, medical wastes, syringes, needles, pesticides, and other materials capable of impairing public health shall not be salvaged*; and "*... volume reduction such as incineration, baling, shredding, composting, pyrolysis, and materials and energy recovery operations shall be confined to clearly identifiable areas of the site.*" The information in this section was excerpted from the RDSI [Sonoma, County, 1997] or can be referenced to the same.

3.6.1 Salvaging

The area for salvaging tires, scrap metal and reuse material is along the route to the tipping floor. This location has room for vehicles to pull off the road, unload, and then continue on to the waste unloading area. For the public, there will be opportunities for separation and salvaging of materials at the public tipping facility. However, the commercial debris boxes will bypass the public tipping facility and go directly to the active commercial tipping area or separate area within the TF/TS. Clean commercial loads with salvageable materials will be diverted, as appropriate, to permit salvaging on-site.

3.6.1.1 Tires

Salvaged tires are collected in debris boxes. Full boxes are removed by a contractor. They are then transferred to a temporary holding facility in Petaluma, California. From there, the tires are shipped to Waste Tire Products in Orland, Glenn County, California. At this facility they are recycled for use as erosion control. Waste tire storage meets the requirements of 14 CCR Division 7 Chapter 3 Article 5.5.

3.6.1.2 Scrap Metal and Reusable Materials

Salvaged scrap metal is collected in roll-off bins that are removed by a private contractor when full and hauled to the scrap metal baler on the landfill or, as appropriate, to a scrap metal facility off-site. Refer to Section 2.8.5 for a description of the metal recycle operation at the CDS.

3.6.1.3 Appliances

To comply with federal mandates that commenced 1 July 1992, appliances containing freon are collected at the scrap metal area. The freon, oil and capacitor(s) are removed prior to removal for scrap. The County's freon recovery program is staffed by two Disposal Workers. Appliances at the transfer station are treated in the same manner. Following removal, the capacitors are collected in the hazardous waste lockers for storage. The waste oil from the compressor is drained and put in the waste oil tanks. Mercury switches from appliances, such as refrigerators, freezers, clothes washers, gas stoves, and water heaters are removed. The mercury switches are disposed of along with load check waste. CRTs are diverted from the landfill, processed for shipping, and shipped to a contracted electronics recycler due to the presence of lead and other contaminants.

As part of the appliance recycling program, the disposal workers have been trained using an appliance recycling guide. This guide was provided by the California Integrated Waste Management Board (CIWMB).

3.6.1.4 Wood and Yard Debris

Clean loads of wood debris, yard debris, and tree stumps entering the disposal site are diverted, stockpiled, chipped or split, and removed from the site for firewood, wood chips, soil amendments, and building materials. Traffic is directed by signs off of the main road to the unloading area for wood and yard debris and can then reenter the main road to exit the site or continue to the waste unloading area. Wood and yard debris are chipped for transfer to the composting site. Chipped yard debris is hauled to the compost site within the permitted boundaries of the Central Disposal Site. Tree stumps and other wood may be stockpiled separately for splitting for firewood or other reuse. Wood chips and mulch not used in the composting operation or for cogeneration fuel are stored at the Organic Material Recovery and

Processing Area. This activity located as indicated on the Site Plan in Appendix A-2. A percentage of the processed yard waste/wood waste may also be hauled off-site to other permitted compost facilities or other facilities.

3.6.1.5 Construction Debris

General construction debris is accepted at the CDS. Concrete, asphalt-concrete, and large rock and rebar will be diverted from the site to nearby recyclers. However, refer to Section 2.8.6 for a description of the Construction and Demolition Debris (C&DD) Diversion Program.

3.6.1.6 Latex and Oil Based Paints, Motor Oil and Used Oil Filters, and Automobile Batteries

The County has implemented programs that inform the public on the proper disposal of latex and oil based paints, motor oil and used oil filters, automobile batteries, and other hazardous materials, that are not accepted for disposal at the CDS. Primarily, as described above, the commercial tipping facility and public TF/TS will provide an opportunity for separation of these hazardous materials. The household waste exclusion program is described in detail in Appendix B-2. The County has personnel on the public tipping floor checking loads and assisting the public with the handling and disposal of the hazardous materials. As part of the load checking program, which is included in Appendix B-11, any latex or oil based paints, motor oil and used oil filters, and automobile batteries that are retrieved are temporarily stored on site until a licensed contractor hauls them away for proper disposal.

3.6.2 Storage of Salvage

The site has a recycling drop-off center and reuse yard. Recycled materials include glass, aluminum, bi-metal cans, scrap metal, cardboard, brown paper bags, newspaper, computer/office paper, chipboard, magazines, plastic bottles, juice boxes, milk cartons, and telephone books. The recycling area is shown on the CDS Plan in Appendix A-2.

Salvaged tires, scrap metal, appliances, and reuse material are stored in bins or trailers after they are collected. Tires are removed within three days of the container reaching capacity, and appliances, metal, and reuse materials are removed within two days of the containers reaching capacity.

Wood debris and yard waste are also diverted for salvaging. Wood and yard wastes are stockpiled for no more than 72 hours prior to being chipped, and chipped, and are stored for no more than 72 hours prior to removal. No more than 600 tons each of unchipped yard waste and wood waste are stored at the Organic Material Recovery and Processing Area (OMRRPA), and no more than 600 tons each of chipped yard waste and wood waste are stored at the OMRRPA.

A fire hydrant is located in the organic waste diversion area for fire protection.

3.6.3 Non-Salvageable Items

No salvaging is allowed of mixed waste. To prevent the drop off of non-salvageable items, salvaging drop off areas are staffed at all times.

3.6.4 Volume Reduction and Energy Recovery

The Compost Site and the Gas Electrical Power Plant, are both located within the permitted boundaries of the CDS.

The Compost Site has been issued a standardized Composting Permit. A Report of Compost Site Information (RCSI) is appended in a separately bound document to this JTD as Appendix B-6 to support the compost operations. A negative declaration for the composting at the CDS was certified by the board of Supervisor's, 24 March 1992, and is located in the RCSI.

The Gas Electrical Power Plant presently generates 7.6 megawatts of power. A complete discussion of the compressed landfill gas fuel facility is included in Section 2.8.7.

4. GEOLOGY AND HYDROGEOLOGY

4.1 Geology

4.1.1 Introduction

This section of the JTD describes the regional and site geology of the 1971 Permitted Area and East Canyon Area at the Central Disposal Site. The information included is intended to meet the requirements of Section 21750(f) of Title 27 which requires dischargers to assess the geologic condition of the site to provide information about: the geologic setting; faults, seismicity and seismic hazards; and groundwater hydrology. The information in this section includes the following:

- description of the regional geology:
- a geologic map and geologic cross-sections through the site;
- a description of the natural geologic materials in the vicinity of the site;
- a description and assessment of the geologic structure within the East Canyon Area and surrounding areas;
- information about the seismicity and seismic hazards; and
- a description of the hydrogeology at the landfill.

This information is provided to demonstrate that the California Central Disposal Site and the East Canyon Area meet the Class III classification criteria set forth in Section 20240 of Title 27 which states that *"Waste management units shall be classified according to their ability to contain wastes. Containment shall be determined by geology and hydrology...relating to the ability of the unit to protect water quality."* and the siting criteria in Section 20260.

The information in this section is based on the current Report of Waste Discharge [Sonoma County, 1997b], and other reports referenced herein.

4.1.2 Regional Geology

The Central Disposal Site is located in the Coast Ranges geomorphic province which is characterized by northwest-trending ranges and valleys that parallel major folds and strike-slip faults. These folds and faults control the geomorphology of the region.

Geologic units in the region include the Franciscan Formation, the Wilson Grove Formation, the Sonoma Volcanics Group, and alluvial/colluvial deposits [Hallenbeck, 1988]. The Franciscan Formation is the basement rock in the region. The Franciscan Formation ranges in age from Jurassic to through Cretaceous (165 million to 65 million years old). The Franciscan Formation consists of deformed, uplifted, and eroded marine sandstones and shales mixed with chert and limestone, greenstone (altered volcanic rock) and various metamorphic and volcanic rock types. These rocks have been intruded by and interbedded with serpentinized peridotite [California Division of Mines and Geology, 1966].

Isolated occurrences of the Wilson Grove Formation, Sonoma Volcanics, and alluvium/colluvium overlie the Franciscan Formation in the site vicinity. The Wilson Grove Formation (formerly mapped as the Merced Formation) is a marine sandstone of Late Miocene to Pliocene age. The Sonoma Volcanics are also Late Miocene to Pliocene age and consist of volcanic flow and ash deposits, locally interbedded with sand, gravel, and conglomerate [The Mark Group (TMG), 1994b]. Quaternary alluvial materials are present as valley fill; colluvial materials typically occur on natural slopes. These units are discussed further in the next section.

4.1.3 Site Geology

Geologic units in the site vicinity include the Franciscan Formation basement rock, the Wilson Grove Formation, the Sonoma Volcanics group, and Quaternary alluvial and colluvial deposits primarily at lower elevations. Franciscan Formation underlies the Central Canyon landfill and the East Canyon and West Canyon expansion areas [WCC, 1997]. A geologic map for the site vicinity is provided in Figure 4-1. Details of the site geologic units are provided below.

- Franciscan Formation – The Central Disposal Site is underlain by Franciscan Sandstone, shale, and metavolcanic rocks. The sandstone occurs both interbedded with shale layers, and as large blocks surrounded by extensive bodies of shale. These rocks exhibit deformation ranging from simple fracturing and consolidation of layered units to complete mixing of heterogeneous rock-types, or melange.

The Franciscan bedrock generally occurs at the surface, or beneath a thin layer generally less than 2 ft (0.6 m) of colluvial soil on ridgetops and at upper elevations of hillsides. However, beneath the alluvial terrace, adjacent and to the east of the center of the East Canyon Area, the depth to bedrock may be greater than 35 ft (10 m) in some cases.

- Wilson Grove Formation - Locally, the Wilson Grove Formation consists of poorly consolidated massive to interbedded silty sandstone to fine sandy gravels. The unit unconformably overlies the Franciscan Formation northeast and south of the landfill site. A small exposure of the Wilson Grove Formation in the East Canyon Area was reported by Herzog and Associates [1993], however, it has since been removed during grading at the site.

- Sonoma Volcanics Group - Sonoma Volcanics have not been encountered in exploratory borings on site, however, a thin segment of the Sonoma Volcanics Group was mapped to the southwest of the Dunham Fault near the southwestern border of the site. In addition, outcrops of basaltic lavas are present approximately 500 ft (150 m) to the west of the lower portion of the site, just north of Hammel Road.

- Alluvium and Colluvium - Quaternary alluvium and colluvium occur on and near the site as valley fill and on natural slopes, respectively. These deposits consist of thin layers of silt and clay with apparently discontinuous layers of sand and gravel. These materials are removed in the landfill areas as part of grading and refuse cover operations.

4.1.4 Faults, Seismicity, and Seismic Hazards

In general, faults may be described as active, potentially active, and inactive based upon recency of movement. Seismicity may be described as fault specific and non-specific, depending upon whether it is associated with a recognized fault or is random seismicity associated with general area sources.

Active faults are defined as faults which have had surface displacement in the Holocene epoch (in the past 11,000 years) based on Division 2, Title 14 of the California Code of Regulations, also known as the Alquist-Priolo Earthquake Fault Zoning Act [the Act]). Potentially active faults are defined by the Act as faults showing surface displacement during Quaternary time (about 1.6 million years before present). Inactive faults are defined as faults without recognized Quaternary displacement has not occurred in the past 1.6 million years, since the start of the Quaternary period.

Regional active faults include the Rodgers Creek – Healdsburg, San Andreas, Maacama, Hayward, West Napa, Green Valley, and Concord Faults (Figure 4-2). Table 4-1 lists these faults, and others, together with the following information:

- predominant motion;
- approximate distance from the site;
- the moment magnitude;
- the Maximum Probable Earthquake (MPE) the fault would produce; and
- the peak horizontal ground acceleration (PHGA) that would result from the MPE.

The MPE is the design event for Class III landfills. The MPE is defined as the maximum earthquake considered likely to occur in a 100 year period.

As shown in Table 4-1, the MPE for the Rodgers Creek - Healdsburg fault is the governing seismic event for the Central Disposal Site. This event can generate as estimated PHGA of 0.32 g in a hypothetical bedrock outcrop at the site [GeoSyntec, 1995].

Local faults include the Americano Creek; Bloomfield; Dunham; and Tolay faults. The Americano Creek and Bloomfield faults are potentially active (Quaternary) faults. Faults closest to the site are the Dunham, Tolay, and an unnamed fault. The Tolay fault extends northwest from Sears Point in south Sonoma County, to northwest of Cotati. The Tolay fault approaches to within 1 mile northwest of the site. The Tolay fault is a potentially active (Quaternary) fault.

The Dunham Fault and the unnamed fault lie within the limits of the Central Disposal Site. The Dunham Fault enters the southwest boundary of the landfill, and trends to the northwest. The unnamed fault trace is located in the East Canyon area just north of Hammel Road. The trace trends east and slightly north.

Trenching of the Dunham Fault was performed in 1992. The fault was observed to offset soils estimated to be between 10,000 and 50,000 years old, but it did not offset overlying soils estimated to be 5,000 to 30,000 years old. It was concluded that the fault was "probably pre-Holocene", but this could not be confirmed. The Dunham fault is considered to be potentially active [Huntingdon Herzog Associates, 1993].

Trenching of the unnamed fault was performed by Taber Consultants (Taber) in 1993, and the unnamed fault trace was concluded to be pre-Holocene and likely pre-Quaternary. This conclusion was supported by the observed absence of geomorphic evidence such as fault scarps, closed depressions, offset streams, etc., and ground features including anomalous topography, springs, fissures, etc. [Taber, 1993a].

Table 4-1
SUMMARY OF ACTIVE FAULTS USED IN SEISMIC HAZARD EVALUATION
East Canyon Area

FAULT	STYLE OF FAULTING	APPROXIMATE DISTANCE	MOMENT MAGNITUDE	MPE MAGNITUDE(1)	MPE PHGA(2)
Rodgers Creek-Healdsburg	Strike-slip	5.7 mi. (9.2 km)	7	6.75	0.32 g
San Andreas (Northern)	Strike-slip	15 mi. (24 km)	8	7.5	0.22 g
Maacama	Strike-slip	15.5 mi. (25 km)	7.6	7.1	0.18 g
Hayward	Strike-slip	27 mi. (44 km)	7.5	7.0	0.09 g
West Napa	Strike-slip	20 mi. (32 km)	6.5	6.0	0.08 g
Green Valley	Strike-slip	28 mi. (46 km)	7.0	6.5	0.06 g
Concord	Strike-slip	36 mi. (59 km)	6.7	6.2	0.04 g

Notes:

(1) It is assumed that it is unlikely that a fault ruptures along its full length in a MPE event.
(2) Peak Ground Acceleration.
Source: GeoSyntec, 1995.

4.1.5 Geologic Assessment of the East Canyon Area

4.1.5.1 Introduction

A California Certified Engineering Geologist (C.E.G.), working for GeoSyntec, reviewed relevant documents and visited the Central Disposal Site in April 1997 to observe the conditions at the East Canyon Area. The scope of the document review consisted of reviewing reports prepared by previous consultants and several sets of aerial photographs provided by Sonoma County. The C.E.G. also performed a field reconnaissance of the East Canyon Area. The following sections summarize observations made on the basis of the review of materials and the reconnaissance visit. This information is applicable only to the East Canyon Area.

4.1.5.2 Bedrock

Most of the expansion area is underlain by sheared rocks of the Franciscan Formation. Small islands of Wilson Grove formation are present on the western edge of the expansion area (an area now being used as a source for daily cover), and just outside the southern boundary of the expansion area, along Hammel Road. Generally, the Franciscan rocks are not exposed at the surface, except for several prominent outcrops of an extremely hard recrystallized mylonite that occur along the southern shoulder of the hill which forms the eastern boundary of the expansion area.

4.1.5.3 Surficial Deposits

Surficial deposits on central and eastern portions of the expansion area consist of colluvium derived from downslope transport of weathered rock and soil particles shed by the surrounding slopes. On the west-facing slope that forms the eastern side of the expansion area, three earthflow-type shallow landslides have developed in topographic hollows in the slope. Earthflows are a relatively common type of recurring, generally shallow earth movement in northern California. Earthflows tend to form on steeper slopes, usually in relatively clay-rich soils. The movement tends to occur episodically (during wet weather), and at a rate of a few inches to a few feet per day. The movement tends to stop when the area dries out, and resumes during the next wet season. Repeated downhill movements over many years can lead to the development of a relatively thick sequence of earthflow and colluvial soils at the base of the slope.

During the site visit, the earthflows within the expansion area did not appear to be moving, although all three showed sharp boundaries, small scarps, hummocky surfaces and other evidence of recent displacement, most likely occurring during the previous winter. Huntingdon-Herzog Associates (HHA) [1993] concluded that these earthflows were on the order of 5 to 8 ft (1.5 to 2 m) deep, on the basis of test pits excavated on the site and field observations. Field observations of the GeoSyntec Engineering Geologist supported this conclusion, although it should be noted that the landslide boundaries shown on the Huntingdon-Herzog map are not precise, and include large areas of presently non-mobile colluvium surrounding the earthflows.

4.1.5.4 Landfill Construction Considerations

Deep Landslides

Visible evidence was not observed that suggested large or deep bedrock landslides occur within the East Canyon Area. The existing earthflows and the colluvium that acts as a source for the earthflows will be removed during construction of the new portion of the landfill. Therefore, it is unlikely that recurring earthflows will affect the stability or operation of the landfill in this area.

Slope Stability

At present the slope on the east side of the expansion area consists of highly weathered and sheared Franciscan bedrock overlain by a relatively thin veneer of colluvial soil, which will be removed during construction. The colluvium has been observed to thicken in the base of East Canyon to depths of approximately 30 feet. This thicker colluvial material will also be removed during grading of Phase I of the East Canyon expansion. It is possible that the relatively localized deposits of the colluvium might remain in place after grading of the base of East Canyon. However, they will not adversely affect stability of the slopes. The slope is now standing at inclinations of approximately 2.25H:1V to 3H:1V. Evaluations indicate that the cut bedrock slopes are stable at the proposed average cut slopes of 2.5H:1V, and at 2H:1V in the limited areas planned, in the absence of unfavorably-oriented bedrock discontinuities. In view of the tectonically damaged nature of the bedrock in this site, cut slopes should be well-drained, and they should be monitored and mapped as they are excavated, to reduce the chance of adverse slope movements. If substantial adversely oriented shears or other discontinuities are observed, local dental work, rock reinforcement or adjustments of slope angle may be required. Additional information on slopes is presented in Section 9 and Appendix F-5

Rippability

The Franciscan outcrops visible toward the south end of the eastern slopes appear to be mylonite and are extremely hard. This rock may be extremely difficult to rip, especially if the mylonite is found to be laterally extensive.

4.2 Hydrogeology

4.2.1 Introduction

This section presents information about the water-bearing characteristics of the natural geologic materials in the site vicinity. This information is intended to satisfy the requirements of Section 21750 (g) of Title 27. The information contained in this section regarding site hydrology was developed using reports prepared by others, and is referenced, as appropriate.

Section 4.2.2 describes the hydrogeology of the Central Disposal Site and Section 4.2.3 describes hydrogeology of the East Canyon Area.

4.2.2 Hydrogeology of the Central Disposal Site

This section discusses surface water and ground-water characteristics of the Central Disposal Site.

4.2.2.1 Surface Water

Surface water at the Central Disposal Site occurs intermittently in canyon drainages and springs. A ridge along the eastern and northern property line of the Central Disposal Site forms a drainage divide that separates surface water within the site from surface water north of the site. Before the Central Disposal Site was developed, surface water at the site was drained by a southeasterly-trending valley (central canyon) with a sharply-cut channel, which drained south towards an unnamed intermittent tributary to Stemple Creek. This main drainage has since been filled with refuse. Smaller drainages associated with the east and west canyon areas also drain southward into unnamed tributaries to Stemple Creek [WCC, 1997]. Stemple Creek is located about

1,000 feet south of the Central Disposal Site. It is an intermittent creek near the site and increases to a perennial creek near Two Rock, approximately 2.5 miles downstream from the site [WCC, 1997]. Stemple Creek flows west into Estero San Antonio, which in turn discharges into Bodega Bay.

Of the 413 major springs identified in Sonoma County, none are located within a 1-mile radius of the site [DWR, 1975; Taber, 1987]. Minor springs have been observed in the three canyon areas (central, east, and west). Prior to site development, Terratech (1970) identified a number of springs/seeps within the central canyon area. A spring located at the head of the canyon had reported flows ranging from 10 to 40 gallons per hour (0.2 to 0.7 gallons per minute). The majority of the springs/seeps identified by Terratech were located along the east sidewall of the central canyon. In September and October, 1987, Hallenbeck & Associates (H&A) also observed springs in a side drainage channel extending up in a northwest direction from the main channel [H&A, 1988a]. The area identified by Hallenbeck & Associates appears to coincide with one of the spring locations noted earlier by Terratech [1970].

Minor springs have also been identified in the east and west canyon areas. In 1993, Huntingdon-Herzog Associates identified two (2) minor springs in the east canyon and three (3) in the west canyon. They also measured flow rates in the canyon streams from April through August 1993. Flow rates in the east canyon were 3 to 25 gallons per minute (gpm) in April, decreasing to less than 0.1 gpm in July. In the west canyon, flow rates ranged from less than 1 gpm to about 17 gpm in April, diminishing to dry conditions in July and August [HHA, 1993].

4.2.2.2 Ground-water Occurrence

The Franciscan Formation comprises the regional bedrock and represents the primary geologic unit underlying the site. The Wilson Grove Formation and Sonoma Volcanics overlie the Franciscan Formation and occur discontinuously throughout the region. The alluvium/colluvium consists of surficial materials that occur in localized areas such as creek bottoms and valley sides. Within each of these formations, ground-water flow direction and hydrologic parameters (permeability, hydraulic conductivity, and specific yield) are variable [WCC, 1997]. Further details regarding the general hydrogeologic characteristics of these units are summarized below.

- Franciscan Formation - Rock types, ground-water yields, hydrogeologic parameters, and ground-water quality vary within this formation. Ground water typically occurs in joints, fractures, and shear zones. In general, the formation is characterized by low permeability, low well yields, and variable well water levels. The Franciscan Formation in the southern portion of the landfill consists of cemented shale and siltstone. Cemented sandstone underlies the northern portion of the landfill [The Mark Group, 1996]. Ground-water chemistry in the Franciscan Formation varies, and dissolved solids can be high in some areas [WCC, 1997]. Some of the domestic water supply and agricultural (stock watering and pasture irrigation) wells within a 1-mile distance downgradient (south) of the site produce water from the Franciscan Formation and display very low yields (less than 3 gpm). Several domestic wells in the area reported inadequate supplies in dry years [Taber, 1987].

  Ground-water flow in the Franciscan Formation is controlled by topographic slope, the number and orientation of open fractures, and the continuity of the highly cemented sandstone. Open fractures are those in which the surfaces of the fracture have separated, as opposed to sealed or "healed" fractures which are fractures that were once open but have become filled with clay or mineral precipitates.

  With the Franciscan, the depth to which fractures are open and capable of transmitting useable quantities of ground water is typically limited to a near surface zone of weathering and rock relaxation (rock relaxation occurs as the weight of the overlying rock is removed through erosion) [WCC, 1997]. The depth of open fractures in the Franciscan rarely exceeds 70 to 80 feet and may be much less. Seismic refraction data for a rock outcrop area within the Central Disposal Site show seismic velocities of 10,000 to 14,000 feet per second below depths of 14 to 20 feet below ground surface [Taber, 1993]. These high velocities suggest that the fractures below these depths are very tight and/or healed and therefore, will not transmit appreciable quantities of ground water. Seismic refraction data collected in 1992 for the West Canyon expansion area also showed similar seismic velocities in bedrock in that canyon [WCC, 1997].

- Sonoma Volcanics – This formation is comprised of volcanic flow and ash deposits and outcrops locally only in a small northwest trending band, southwest of the landfill. Ground water occurrence within the Sonoma

Volcanics is reported to be highly variable and unpredictable, with dry holes and variable well yields (ranging from 10 to 50 gpm). Large drawdowns are common, and well depths greater than 500 feet are typical. Water from this formation is reported as generally sodium-bicarbonate water, with locally high boron concentrations (up to 1.0 milligrams per liter [mg/L]) [WCC, 1997].

- Wilson Grove Formation - The Wilson Grove Formation is a marine sandstone and it is a principal water-producing formation and a primary ground-water recharge formation in Sonoma County [Taber, 1987]. This formation has reported permeabilities higher than the underlying Franciscan formation. Water derived from deep within the formation is reported to be of excellent quality and of calcium bicarbonate/magnesium bicarbonate/sodium bicarbonate composition. Wells screened in unoxidized (blue) sandstone locally yield water containing high amounts of iron and manganese [Taber, 1987]. Wells located deep within this formation within a 1-mile radius of the site were reported by Taber [1987] to have moderate to high yields (20 to 1,000 gpm) with minimal lowering of the water table. In 1993, Huntingdon-Herzog Associates identified 10 domestic wells downgradient of the west canyon area, several of which, based on well locations and depths, appear to draw water from the Wilson Grove Formation.

  Wilson Grove Formation outcrops are located in northwesterly trending bands over extensive areas both to the northeast and southwest of the landfill. On the landfill property, small exposures of Wilson Grove Formation materials were encountered within the central and eastern canyons. However, these exposures have been removed as part of waste disposal and rock extraction operations. As a result, no Wilson Grove Formation materials are in contact with (underlie) refuse [TMG, 1994a].

- Alluvium/Colluvium - Alluvium/colluvium deposits do not represent a major source of ground water in the region. These young surficial deposits vary in thickness but are generally thin layers of silt and clay with some discontinuous sand and gravel lenses. The amount of water produced with this material depends on the amount of clay present and the thickness of the deposit. The alluvium/colluvium typically has a low specific yield and variable permeabilities. However, permeability can be relatively high where coarse-grained, unconsolidated soils are present in this formation [WCC, 1997].

Within the landfill property boundary, alluvial/colluvial deposits are limited to the bottom and side slopes of the east and west canyons and vary in thickness from a few feet up to 40 feet [WCC, 1997]. Alluvium/colluvium was also present at the base of the central canyon but was reportedly removed during base grading operations. Ground-water flow in the alluvium/colluvium is expected to occur, during the wet seasons, along a direction mimicking topography and generally towards the south [Taber, 1987; HHA, 1993].

As discussed above, Sonoma Volcanics and Wilson Grove Formations are not present beneath the footprint of the landfill or the expansion areas. Ground water within the alluvium/colluvium is limited in extent and confined to the isolated drainage channels. The Franciscan Formation comprises the primary water bearing geologic unit beneath the landfill. Hydrogeologic conditions within this unit are considered variable. Available information on ground-water flow characteristics within the Franciscan Formation is summarized below.

4.2.2.3 Ground-water Flow

Taber [1987] described that regional groundwater flow within the Franciscan Formation was expected to follow the northwest-southeast rock structural trends. Subsequent work [TMG, 1994a and 1994b; EBA Waste Technologies (EBA), 1996c, 1996e and 1997c] has reported similar descriptions, and ground-water monitoring data indicate ground-water flow is to the south-southeast down the axis of the Central Canyon, consistent with regional structure. This hydrogeologic model was used to develop the existing ground-water detection monitoring program currently in place at the landfill.

Ground-water flow characteristics have been evaluated using ground-water elevation contour maps developed from monitoring well data and by plotting ground-water elevations versus ground surface elevations. Ground-water elevations in site monitoring wells are recorded on a routine basis as part of the existing monitoring and reporting program. Ground-water elevation in site monitoring wells completed in the Franciscan Formation indicate that ground-water flow is generally to the south-southeast.

Graphs of ground-water elevation versus ground surface elevation were prepared by WCC [1992] as part of alternative siting studies conducted at a location southwest of the landfill property, and by Huntingdon-Herzog Associates in the east and west canyon areas as part of the Phase II landfill expansion investigation [1993]. In both cases, a strong correlation was demonstrated between ground-water elevations and ground surface elevations. EBA [1997] demonstrated a similar correlation in the on-site monitoring wells. Results of these analyses illustrate that the potentiometric surface for monitoring wells completed in the Franciscan Formation appears to mimic the topography.

Work conducted by Huntingdon-Herzog Associates [1993] in the east and west canyon areas concluded that shallow ground water in the Franciscan Formation flowed under an upward hydraulic gradient towards the axes of the respective canyons. The average hydraulic gradients measured down the axis of each canyon (southward) ranged from 0.07 to 0.14 feet/foot (ft/ft). Subsequent work conducted by The Mark Group [1994a and 1994b] and EBA Waste technologies [1996c, 1996e, and 1997c] for the central canyon area, concluded that ground-water flow in the Franciscan Formation is south-southeasterly down the axis of the canyon with hydraulic gradients ranging from 0.06 to 0.2 ft/ft.

Whereas this flow model is considered representative of shallow ground-water flow, it may not represent ground-water flow conditions at greater depths. Additional data is being collected as part of the County's Evaluation and Monitoring and Corrective Action Program to establish structural/hydrogeological trends and relationships in the competent bedrock zone at depths.

Ground-water flow within the Franciscan Formation is fracture-controlled and faults have the capability of influencing ground-water flow by acting as ground-water barriers or conduits. Previous work conducted by Taber [1987] suggests that regional deep ground-water movement within the Franciscan is considered likely to move parallel to rock structural trends (i.e., northwest to southeast). Other research [Wong, 1991] suggests that open fractures in the right-lateral strike-slip regime that characterizes the San Andreas fault system are typically oriented parallel to the regional trend of the maximum principal stress and perpendicular to the minimum principal stress; i.e., north-south to northeast-southwest in the Sonoma County area [County of Sonoma, 1997b].

The effect of a fault on ground-water flow is typically governed by the nature of the fault surface. Locally, the Dunham fault and the unnamed fault traces (i.e., East

Canyon Area and northwest corner of the property) are subsurface features that may influence the local hydrogeology. Review of available data does not reveal any apparent inconsistencies or anomalies that would suggest that these features are influencing ground-water flow in the shallow flow system. This observation is based on the absence of any large discrepancies in ground-water elevations between monitoring wells HA-2 and MW-3A, which are on opposite sides of the Dunham fault. Similarly, the piezometers (PZ-4 and PZ-6) installed by Huntingdon-Herzog Associates [1993] on opposite sides of the unnamed fault trace in the east canyon showed no deviation from the shallow flow system pattern discussed earlier in this section. The only anomaly that may or may not be related to local faulting corresponds to the absence of ground-water in the boreholes drilled for piezometers F-7 and F-9. These boreholes are located 100 and 400 feet south of the unnamed fault trace, respectively.

A map showing the potentiometric surface in East Canyon and 1971 Permitted Areas is shown in Appendix A-4. The ground water contours were constructed by interpreting monitoring data from 22 wells, an observed spring, and general observation of the East Canyon Area. The general ground water flow through the Central Disposal Site is to the southeast.

4.2.3 Hydrogeologic Conditions of the East Canyon Area

Previous sections described the overall hydrogeologic condition of the Central Disposal Site. The following sections specifically detail the hydrogeologic conditions of the East Canyon area.

4.2.3.1 Surface Water

The East Canyon area is drained by two stream channels that merge near the center of the area into a single southern-trending channel. This channel drains into an unnamed tributary to Stemple Creek, located approximately 1,000 feet south of the landfill [WCC, 1997]. Huntingdon-Herzog identified two minor springs in the East Canyon Area [Huntingdon, 1993]. They are located near the head of the two primary drainage channels. East Canyon springs and drainage are depicted in Appendix A-4, Hydrogeologic Map. Surface water flow rates were measured in the central stream channel over a six-month period. Results are included in Table 4-2. The surface water flow rates were steadily decreasing over the monitoring period, to less than 0.1 gpm in July 1993.

TABLE 4-2
SURFACE WATER FLOW RATE MEASUREMENTS [(1)]
East Canyon Area

STREAM FLOW RATE MEASUREMENT STATION	DATE MEASURED	STREAM FLOW RATE (gal/min)
FR-E1 (South end of East Canyon)	27 Apr 93	25
	24 May 93	2.3
	7 Jun 93	7.9
	6 Jul 93	0.10
	13 Aug 93	standing water
FR-E2 (North end of East Canyon)	27 Apr 93	7.6
	24 May 93	0.8
	7 Jun 93	2.0
	6 Jul 93	0.5
	13 Aug 93	standing water
FR-E3 (400-ft South of FR-E2)	27 Apr 93	17
	24 May 93	2.7
	7 Jun 93	6.7
	6 Jul 93	0.1
	13 Aug 93	standing water
FR-E4 (600-ft South of FR-E3)	---	---
	24 May 93	2.7
	7 Jun 93	8.1
	6 Jul 93	0.1
	13 Aug 93	standing water

Notes:

(1) HHA [1993].

4.2.3.2 Groundwater Occurrence

Hydrogeologic conditions in the East Canyon Area are generally consistent with those described for the Central Disposal Site in Section 4.2.2.2. To further characterize the groundwater conditions in the East Canyon Area, geologic cross-sections have been developed and are included in Appendix A-4.

Groundwater conditions in the East Canyon Area are monitored by 12 wells. Four piezometers (P-4, P-4A, P-6, MW-4) were installed by Huntingdon-Herzog in 1993 in conjunction with their hydrogeologic characterization of the landfill [Huntingdon, 1993]. Monitoring wells, A-1 and F-11, were installed in 1993 and 1995, respectively, for use in the Central Disposal Site detection monitoring well network. Six monitoring wells were recently installed in the East Canyon Area. F-14, F-15, and F-16 are background wells located at the northern boundary of the East Canyon Area. F-17, F-18, and F-19 are downgradient compliance wells located along the southern boundary. Well construction details are included in Table 4-3. Well logs are provided in Attachment/Appendix D-5.

As shown in the cross sections and well logs, the East Canyon Area is underlain by Franciscan Formation shale, sandstone, siltstone, and greenstone. Alluvium and colluvium overlies the Franciscan and ranges from a few feet to 40 feet thick. The alluvium/colluvium consists of silty clay to clayey silt with some discontinuous sand and gravel lenses. Groundwater occurrence in the alluvium/colluvium is relatively shallow, ranging from standing water at the surface to about 15 feet below ground surface (bgs) in 1993 and 1994 [WCC, 1998]. Most of the alluvium/colluvium will be removed from the East Canyon Area during landfill development. Alluvial/colluvium will remain in place south of the East Canyon Area landfill footprint and monitoring well A-1 will be used to monitoring groundwater conditions in the alluvium south of the landfill (see Section 7).

The Franciscan Formation underlies the East Canyon Area, at or near the surface. As discussed in Section 4.2.2.2, groundwater occurs within open joints and fractures in the rock. Monitoring wells completed in Franciscan Formation in and near the East Canyon Area include: PZ-4, PZ-4A, MW-4, PZ-6, F-11, F-14, F-15, F-16, F-17, F-18, and F-19. Wells F-17, F-18, and F-19 were installed as detection monitoring wells in June 1999, and monitoring data are not yet available for these three wells. Along the axis of the East Canyon, (PZ-4, PZ-4A, MW-4, PZ-6, F-11), depth to groundwater in the Franciscan Formation ranges from about 4 feet bgs in the north, upper reaches of the East Canyon Area, to about 10 feet bgs at the south end of the East Canyon. Groundwater level fluctuations measured in 1998 and 1999 in these wells ranged from ± 2 feet to ± 6 feet (Appendix D-9).

Upgradient well F-14 is located northeast of the East Canyon Area. The well was drilled in 1997 and encountered hard, dry sandstone. F-14 was constructed as a monitoring well, but remained dry until April 1998. Since then, the water level in F-14 has shown an overall trend of increasing from 239.7 feet elevation in April 1998 to 248.9 feet elevation in March 1999. Upgradient wells F-15 and F-16 are completed in weathered sandstone and siltstone, respectively, and have had measurable water since their construction. From September 1997 to March 1999, depth to water in upgradient wells F-15 and F-16 ranged from about 10 to 15 feet bgs in F-15 and 20 to 30 feet bgs in F-16.

Table 4-3
WELL CONSTRUCTION DETAILS
East Canyon Area

Piezometer or Well Number	Well Depth (ft)	Ground Elevation (ft >MSL)	Stand-Pipe Height	Top of Casing Elevation (ft >MSL)
PZ-4	50	310	0.5	310.5
PZ-4A	40	310	0.5	310.5
PZ-6	33.5	218	0.5	218.5
MW-4	73.5	285	1.0	286
F-14	155.5	389.4	2.5	391.5
F-15	41	370.8	2.0	372.6
F-16	139.5	384.2	1.0	384.4
F-17	62.5	280.2	Flush Mount	279.8
F-18	76.5	235.7	3.5	238.9
F-19	41	262.4	3.5	265.9
A-1	15	201.1	1.2	202.9
F-11	32.5	202.2	1.6	203.8

Notes:

MSL = Mean Sea Level.

4.2.3.3 Groundwater Flow

Groundwater flow conditions in the East Canyon area were evaluated by considering groundwater elevations and topographic and geologic conditions. A summary of groundwater elevation measurements is included in Appendix D-9. A groundwater elevation contour map, incorporating available data for the East Canyon Area monitoring wells, is provided in Appendix A-4. The groundwater elevation contours map illustrates that groundwater flow within the Franciscan Formation of the

East Canyon Area appears consistent with the conceptual hydrogeologic model for the Central Canyon Area, in that groundwater flow generally follows topography down the axis of the canyon. The hydraulic gradient within the East Canyon Area ranges from about 0.08 to 0.2 ft/ft. This range is similar to the hydraulic gradients calculated for the Central Canyon Area [EBA, December 1998].

4.2.3.4 Domestic Well Survey

An initial well survey was completed in 1986 as part of the Solid Waste Water Quality Assessment Test (SWAT) for the Central Disposal Site [Taber, 1987]. Ninety-one wells were identified through either records or observations. This number does not include monitoring wells for the landfill. This initial well survey was updated in 1997, and records of 10 additional wells were obtained [GeoSyntec, 1997c].

According to available records, water use within one-mile of the Central Disposal Site is mixed domestic and agricultural use. Agricultural use is primarily for watering stock. Figure 7-3 shows the locations of water supply wells located south and downgradient of the East Canyon Area. Wells depths range from about 10 to about 200 feet below ground surface. With the exception of well depth, little other information on construction is available for most of the wells. For those wells with available data, well yields are noted to be low (less than about 5 gallons per minute).

4.2.3.5 Groundwater Quality

In an effort to establish background groundwater quality characteristics, monitoring wells F-14, F-15 and F-16 were installed along the upgradient boundary of the East Canyon Area (Figure 7-1). Groundwater samples have been collected from these wells on a quarterly basis since August 1997. Water quality results for these three wells are summarized in Table 4-4. Water Quality Protection Standards were developed for the East Canyon Area, using monitoring data from these wells. Statistical analyses of groundwater monitoring program are discussed in detail in Section 7.

In June 1999, three additional groundwater monitoring wells, F-17, F-18 and F-19, were installed along the south, downgradient boundary of the East Canyon Area (Figure 7-1). Water quality results are not yet available for these wells.

Table 4-4:

Central Landfill Monitoring Results
East Canyon Background Wells
F-14, F-15, and F-16

Analyte	*Units*	*Date Sampled* 8/29/97	11/7/97	2/11/98	5/11/98	8/21/98	11/20/98	2/24/99	4/12/99
F-14									
Metals	mg/L mg/L mg/L mg/L mg/L	**DRY**	**DRY**	**DRY**	Arsenic 0.013 Barium 0.025	Arsenic 0.016 Barium 0.026 Lead 0.037 Molybdenum 0.13 Zinc 0.011	Arsenic 0.033 Barium 0.015 Molybdenum 0.052	Arsenic 0.025 Barium 0.01 Molybdenum 0.08	Arsenic 0.018 Barium 0.01 Molybdenum 0.09 Zinc 0.015
Indicator Parameters	mg/L mg/L mg/L umhos/cm mg/L mg/L mg/L mg/L mg/L mg/L mg/L	**DRY**	**DRY**	**DRY**	Alk.(total) = 65 Calcium = 89 COD = 62 Conductivity = 460 Chloride = 550 Fluoride = 0.93 Magnesium = 29 Nitrate (as N) = ND pH = 8 Sodium = 760 Solids, Dis. = 240 Sulfate = 560	Alk.(total) = 90 Calcium = 27 COD = 12 Conductivity = 1100 Chloride = 163 Fluoride = 1.1 Magnesium = 10 Nitrate (as N) = 5.6 pH = 8.6 Sodium = 340 Solids, Dis. = 720 Sulfate = 180	Alk.(total) = 78 Calcium = 9.1 COD = 7.4 Conductivity = 534 Chloride = 73 Fluoride = 0.97 Magnesium = 15 Nitrate (as N) = 1.5 pH = 8.4 Sodium = 83 Solids, Dis. = 342 Sulfate = 92	Alk.(total) = 94 Calcium = 15 COD = 20 Conductivity = 879 Chloride = 166 Fluoride = 0.88 Magnesium = 11 Nitrate (as N) = 2.1 pH = 8.5 Sodium = 140 Solids, Dis. = 563 Sulfate = 92	Alk.(total) = 100 Calcium = 19 COD = 38 Conductivity = 1056 Chloride = 85 Fluoride = 1.1 Magnesium = 37 Nitrate (as N) = 8.5 pH = 8.3 Sodium = 150 Solids, Dis. = 676 Sulfate = 202
VOCs*	ug/L	**DRY**	**DRY**	**DRY**	Benzene 2.9[+]	Benzene 1.4[+]	ND	ND	ND**
F-15									
Metals	mg/L mg/L mg/L mg/L	Barium 0.038 Lead 0.013	Barium 0.017 Copper 0.022 Zinc 0.011	Barium 0.021 Copper 0.02 Zinc 0.015	Barium 0.03 Lead 0.013 Zinc 0.012	Barium 0.042	Barium 0.043	Barium 0.047 Zinc 0.011	Barium 0.081 Zinc 0.03
Indicator Parameters	mg/L mg/L mg/L umhos/cm mg/L mg/L mg/L mg/L mg/L mg/L mg/L	Alk.(total) = 110 Calcium = 25 COD = 43 Conductivity = NA Chloride = 60 Fluoride = 0.77 Magnesium = 16 Nitrate (as N) = 0.28 pH = 7.8 Sodium = 47 Solids, Dis. = 240 Sulfate = NA	Alk.(total) = 100 Calcium = 23 COD = 9 Conductivity = 390 Chloride = 31 Fluoride = 0.7 Magnesium = 11 Nitrate (as N) = 1.1 pH = 7.6 Sodium = 23 Solids, Dis. = 200 Sulfate = 12	Alk.(total) = 80 Calcium = 22 COD = ND Conductivity = 240 Chloride = 30 Fluoride = 0.7 Magnesium = 13 Nitrate (as N) = 6.8 pH = 7.4 Sodium = 26 Solids, Dis. = 130 Sulfate = 14	Alk.(total) = 76 Calcium = 21 COD = 4 Conductivity = 350 Chloride = 28 Fluoride = 0.63 Magnesium = 15 Nitrate (as N) = 8 pH = 7.4 Sodium = 26 Solids, Dis. = 210 Sulfate = 14	Alk.(total) = 92 Calcium = 24 COD = 0 Conductivity = 370 Chloride = 30 Fluoride = 0.66 Magnesium = 14 Nitrate (as N) = 1.6 pH = 7.4 Sodium = 28 Solids, Dis. = 240 Sulfate = 16	Alk.(total) = 90 Calcium = 23 COD = ND Conductivity = 287 Chloride = 31 Fluoride = 0.68 Magnesium = 13 Nitrate (as N) = 2 pH = 6.8 Sodium = 19 Solids, Dis. = 184 Sulfate = 14	Alk.(total) = 65 Calcium = 20 COD = ND Conductivity = 324 Chloride = 27 Fluoride = 0.59 Magnesium = 14 Nitrate (as N) = 11 pH = 6.9 Sodium = 22 Solids, Dis. = 207 Sulfate = 12	Alk.(total) = 64 Calcium = 18 COD = ND Conductivity = 309 Chloride = 25 Fluoride = 0.63 Magnesium = 12 Nitrate (as N) = 68 pH = 6.8 Sodium = 19 Solids, Dis. = 198 Sulfate = 9.3
VOCs**	ug/L	ND	ND	ND	ND	ND	ND	ND	ND**
F-16									
Metals	mg/L mg/L mg/L mg/L mg/L mg/L	Barium 0.1 Lead 0.048 Molybdenum 0.15 Nickel 0.031	Barium 0.051 Lead 0.014 Molybdenum 0.032	Barium 0.061 Zinc 0.015	Barium 0.028 Lead 0.021 Molybdenum 0.039 Zinc 0.018	Barium 0.039 Chromium 0.011 Lead 0.013	Barium 0.035 Molybdenum 0.037 Zinc 0.028	Barium 0.036 Molybdenum 0.037 Zinc 0.011	Barium 0.036 Molybdenum 0.037 Zinc 0.022
Indicator Parameters	mg/L mg/L mg/L umhos/cm mg/L mg/L mg/L mg/L mg/L mg/L mg/L	Alk.(total) = NA Calcium = NA COD = 220 Conductivity = NA Chloride = NA Fluoride = NA Magnesium = NA Nitrate (as N) = 0.44 pH = NA Sodium = NA Solids, Dis. = NA Sulfate = NA	Alk.(total) = 440 Calcium = 43 COD = 14 Conductivity = 1800 Chloride = 7.4 Fluoride = 0.48 Magnesium = 44 Nitrate (as N) = 0.79 pH = 7.8 Sodium = 210 Solids, Dis. = 870 Sulfate = 110	Alk.(total) = 440 Calcium = 40 COD = 30 Conductivity = 1300 Chloride = 8 Fluoride = 0.44 Magnesium = 44 Nitrate (as N) = 0.81 pH = 7.8 Sodium = 170 Solids, Dis. = 730 Sulfate = 110	Alk.(total) = 440 Calcium = 40 COD = 1 Conductivity = 1100 Chloride = 10 Fluoride = 0.37 Magnesium = 43 Nitrate (as N) = 0.45 pH = 8 Sodium = 140 Solids, Dis. = 640 Sulfate = 82	Alk.(total) = 430 Calcium = 45 COD = 0 Conductivity = 1100 Chloride = 2 Fluoride = 0.38 Magnesium = 43 Nitrate (as N) = 0.44 pH = 7.8 Sodium = 150 Solids, Dis. = 630 Sulfate = 75	Alk.(total) = 446 Calcium = 44 COD = ND Conductivity = 886 Chloride = 37 Fluoride = 0.42 Magnesium = 41 Nitrate (as N) = 0.25 pH = 7.4 Sodium = 91 Solids, Dis. = 567 Sulfate = 63	Alk.(total) = 441 Calcium = 45 COD = 5 Conductivity = 917 Chloride = 24 Fluoride = 0.43 Magnesium = 40 Nitrate (as N) = 0.2 pH = 7.7 Sodium = 96 Solids, Dis. = 587 Sulfate = 59	Alk.(total) = 453 Calcium = 38 COD = 33 Conductivity = 992 Chloride = 29 Fluoride = 0.4 Magnesium = 35 Nitrate (as N) = 0.65 pH = 7.6 Sodium = 91 Solids, Dis. = 635 Sulfate = 52
VOCs*	ug/L	ND	ND	ND	ND	ND	ND	ND	ND**

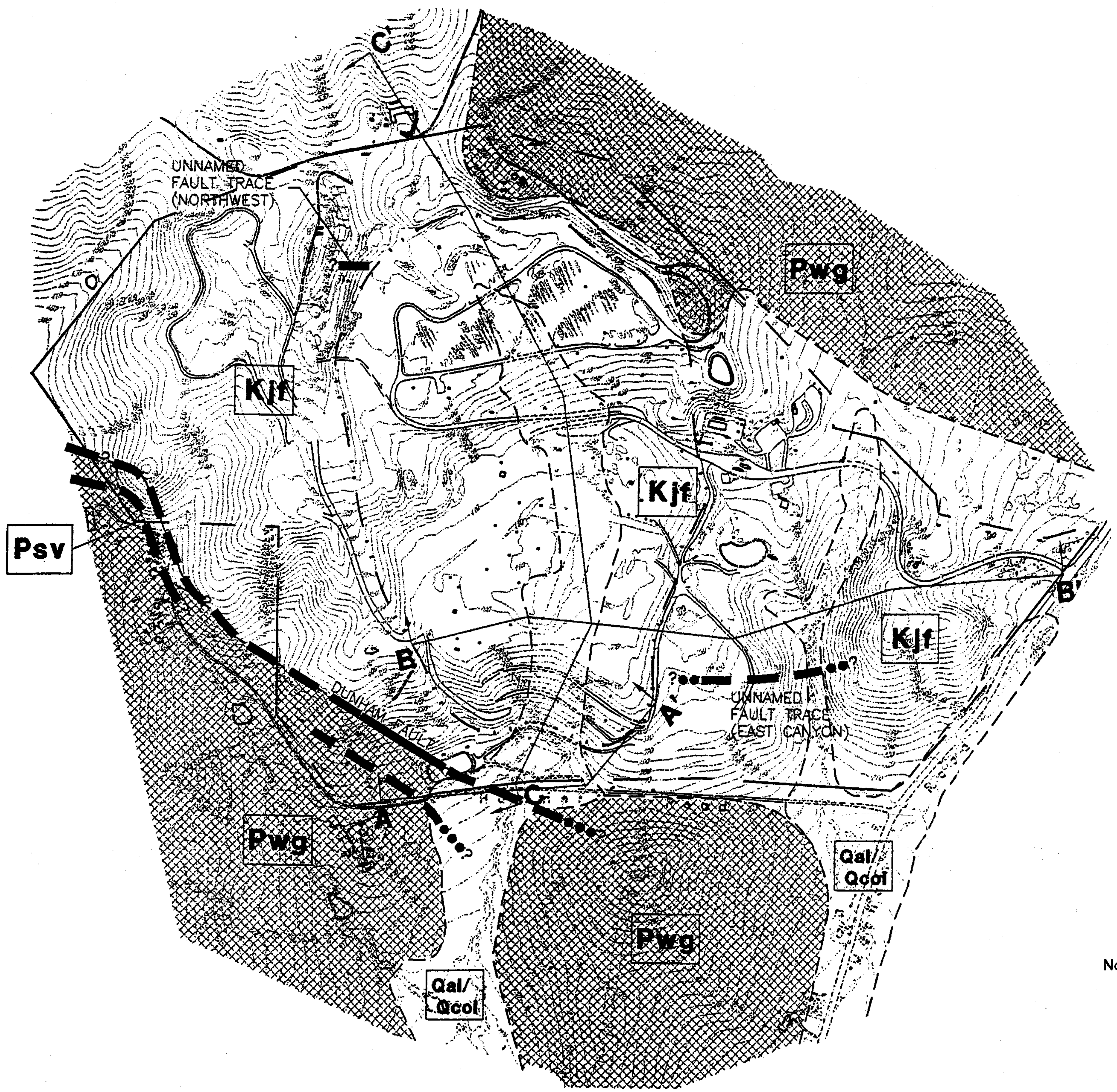
* Volatile Organic Compounds (EPA 601 and 602). Only those constituents detected are included in summary

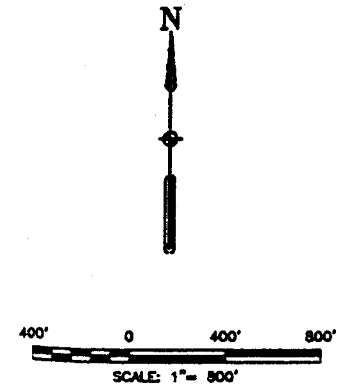
** Volatile Organic Compounds (EPA 601, 602, 8260, 8270 and 8150). Only those constituents detected are included in summary.

[+] Results unconfirmed in groundwater. Benzene detection attributed to use of gas powered mixer in construction of monitoring well. On 10/27/98 the well was developed with distilled water injection. No reported hits since development.

[++] EPA Methods 8150, 8080, (625 and 3510) or (8270 and 3550), and 8260B

NA = Not Analyzed





Legend

-··-··-··	Permitted Disposal Area
——- - ——	Property Boundary
Qal/ Qcol	Quaternary Alluvium/Colluvium
Pwg	Late Miocene to Pliocene Wilson Grove Formation
Psv	Late Miocene to Pliocene Sonoma Volcanics
Kjf	Late Jurassic to Late Cretaceous Franciscan Assemblage
A — A'	Trend of Cross Section
- - - - - -	Lithologic Contact
?●● ▬ ▬	Fault, dashed where inferred, dotted where concealed, queried where uncertain.

Note: Geology shown hereon was prepared based on previous geologic maps developed by Huntingdon–Herzog Associates (1993), The Mark Group (1994b) and Woodward–Clyde Consultants (1997).

Qal/Qcol shown within footprint of Landfill was reportedly removed/reworked as part of Landfill development operations.

SOURCE OF BASE MAP: WOODARD–CLYDE CONSULTANTS, 1997 (MODIFIED)

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

PROJECT NO. WL0062	FIGURE NO. 4–1
DOCUMENT NO.	FILE NO.

FROM: GEOLOGIC MAP OF THE SANTA ROSA QUADRANGLE, CALIFORNIA DIVISION OF MINES & GEOLOGY 1982

GEOSYNTEC CONSULTANTS

WALNUT CREEK, CALIFORNIA

PROJECT NO.	WL0062	FIGURE NO.	4-2
DOCUMENT NO.		FILE NO.	

5. PHYSICAL SETTING

5.1 Introduction

This section of the JTD presents information about the topography and climatology of the Central Disposal Site and the East Canyon Area, pursuant to Sections 21750(d) and (e) of Title 27. This information is provided to demonstrate that the 1971 Permitted Area and the East Canyon Area meet the Class III classification criteria set forth in Section 20240 of Title 27 which states that *"Waste management units shall be classified according to their ability to contain wastes. Containment shall be determined by topography, climatology and other factors relating to the ability of the unit to protect water quality."*

5.2 Topography

The Sonoma Central Disposal Site is located in the northern California Coast Ranges, which are characterized by northwest-trending ridges and valleys that parallel major folds and strike-slip faults. These folds and faults control the geomorphology of the region.

A topographic map of the East Canyon Area and vicinity is shown on Figure 5-1. The East Canyon Area is characterized by a north-south trending valley with a 175 ft (53 m) drop in elevation from the ridge top. The East Canyon drainage channel is not named. The drainage channel ranges in elevation from approximately 350 ft, County Local Datum (CLD) in the north (upstream) to 200 ft CLD in the south (downstream). Ridge elevations on either side of the east canyon range from about 370 ft CLD on the west, to 420 ft CLD on the east. The ratios of canyon side slopes vary from 11 to 24 percent, with steeper slopes on the east side of the canyon [Taber 1993a].

Numerous small intermittent south-southwest flowing creeks drain the hills around the site and discharge into Stemple Creek. Stemple Creek is located about 1,000 ft (305 m) south of the site's southern boundary. As discussed in Section 4, spring discharge in the region occurs primarily at locations where open bedrock fractures intercept the ground surface and seasonal shallow groundwater seeps/springs have been observed on side-slopes of the canyon downstream from the East Canyon Area.

The 1971 Permitted Area and East Canyon Area are not located within a 100-year floodplain hazard zone as defined by the Federal Emergency Management Agencies (FEMA). The FEMA map showing the site is provided as Figure 5-2.

5.3 Climatology

5.3.1 General

Climatology data for Central Landfill and East Canyon Area were obtained on the basis of the information for Sonoma from Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling published by the National Oceanic and Atmospheric Administration [NOAA, 1992]. Temperature, evaporation, estimated maximum, minimum and normal annual precipitation, and wind directions are addressed in this section.

5.3.2 Temperature

The mean daily maximum, minimum and normal temperatures for Sonoma are summarized in Table 5-1. Based on the information presented below, the estimated average annual maximum temperature in the vicinity of the landfill site is 74.8 °F (23.8 °C).

5.3.3 Precipitation

5.3.3.1 Mean Monthly and Annual Precipitation

Table 5-2 provides mean monthly precipitation as published by NOAA [1992] for Sonoma. Most of the annual precipitation occurs from November to April.

TABLE 5-1
MINIMUM, MAXIMUM AND NORMAL TEMPERATURES(1)
Central Disposal Site

MONTH	MINIMUM (°F)	MAXIMUM (°F)	NORMAL (°F)
January	36.2	58.0	47.1
February	39.1	64.1	51.6
March	40.2	67.1	53.7
April	41.4	72.2	56.8
May	45.0	78.4	61.7
June	49.4	85.4	67.4
July	50.4	90.2	70.3
August	50.5	89.8	70.2
September	49.0	87.6	68.3
October	45.3	80.1	62.7
November	40.6	66.3	53.5
December	36.5	57.9	47.2
Annual	**43.6**	**74.8**	**59.2**

Note:

(1) Based on data from 1961 to 1990 [NOAA, 1992]

Table 5-2
MEAN MONTHLY PRECIPITATION(1)
Central Disposal Site

MONTH	PRECIPITATION (INCHES)	MONTH	PRECIPITATION (INCHES)
January	6.44	July	0.05
February	4.66	August	0.11
March	4.11	September	0.34
April	1.63	October	1.76
May	0.38	November	4.72
June	0.17	December	4.63
		Annual	**29.00**

Note:

(1) Based on data from 1961 to 1990 [NOAA, 1992]

5.3.3.2 Isohyetal Map

Section 21750(e)(1) of Title 27 requires that dischargers submit a map showing isohyetal contours for the proposed Unit and its surrounding region within ten miles of the facility perimeter and its surrounding region. An isohyetal map for Sonoma County is shown in Figure 5-3.

5.3.4 Evaporation

Table 5-3 provides mean monthly evaporation as published by the California Department of Water Resources [1997] for Sonoma County from December 1996 through November 1997.

Table 5-3
MONTHLY WEATHER DATA FOR STATION #83 - SANTA ROSA IN THE NORTH COAST VALLEY REGION

DATE	EVAPORATION TOTAL (in)	PRECIPITATION TOTAL (in)
December 1996	0.53	13.21
January 1997	0.59	11.64
February 1997	1.96	0.80
March 1997	3.33	1.34
April 1997	4.80	0.98
May 1997	5.98	1.76
June 1997	6.27	0.80
July 1997	6.19	0.24
August 1997	5.35	1.22
September 1997	4.80	0.80
October 1997	2.94	1.79
November 1997	0.92	9.31
TOTALS AND AVERAGES	**43.67**	**43.89**

Reference: http://wwwdpla.water.ca.gov/cgi-bin/cimis/cimis/data/input_form.pl

5.3.5 Wind

The Sonoma Central Disposal Site is situated among the ridges and valleys of the northern California Coast Ranges. Flow from the Petaluma Gap is likely at the site, and due to the hilly topography and surface heating and cooling, up valley, down valley and up slope and down slope flows are like to occur producing winds which will probably deviate from typical regional patterns.

Wind rose information for the site was produced at the following Bay Area Air Quality Management District (BAAQMD) stations in the years shown: Valley Ford [BAAQMD, 1992]; Petaluma Airport [BAAQMD, 1992]; Santa Rosa Air Center [BAAQMD, 1988]; and the Sonoma Baylands [BAAQMD, 1992]. Figure 5-4 shows the approximate locations of all of the stations relative to the site, except the Sonoma Baylands, which is farther to the southeast of the site. The four wind roses give an overall picture of the wind conditions at the Central Disposal Site.

The Valley Ford and Petaluma Airport and Santa Rosa Air Center stations are located approximately 5.6 mi (9 km) west, 8.4 mi (13.5 km) east, and 7.5 mi (12 km) north of the site, respectively, and are likely to be the most representative of wind conditions at the site. The Valley Ford wind rose, shown in Figure 5-5 shows primarily westerly and southwesterly (approximately south 40 degrees west) winds blowing towards the site; the Petaluma Airport wind rose, shown in Figure 5-6, shows northwesterly winds; and the Santa Rosa Air Center wind rose, shown on Figure 5-7, shows southerly and southwesterly winds blowing towards the site. The Sonoma Baylands wind rose is shown in Figure 5-8. The Sonoma Baylands site is located approximately 20 mi (32 km) southeast of the site. In spite of the distance, the wind rose information for the Sonoma Baylands is for the most part, consistent with the wind rose information for the Petaluma Airport, which suggests that the winds coming in from the Pacific Coast have a wide range and strong potential to influence site conditions.

<u>LEGEND</u>

•••••••••• LIMIT OF EAST CANYON LANDFILL EXPANSION

TOPOGRAPHY, OCTOBER 7, 1996

GRAPHIC SCALE

350 0 175 350 700 1400

(IN FEET)
1 inch = 700 ft.

NOT FOR CONSTRUCTION

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

REV	DATE	DESCRIPTION	DR BY	APP BY

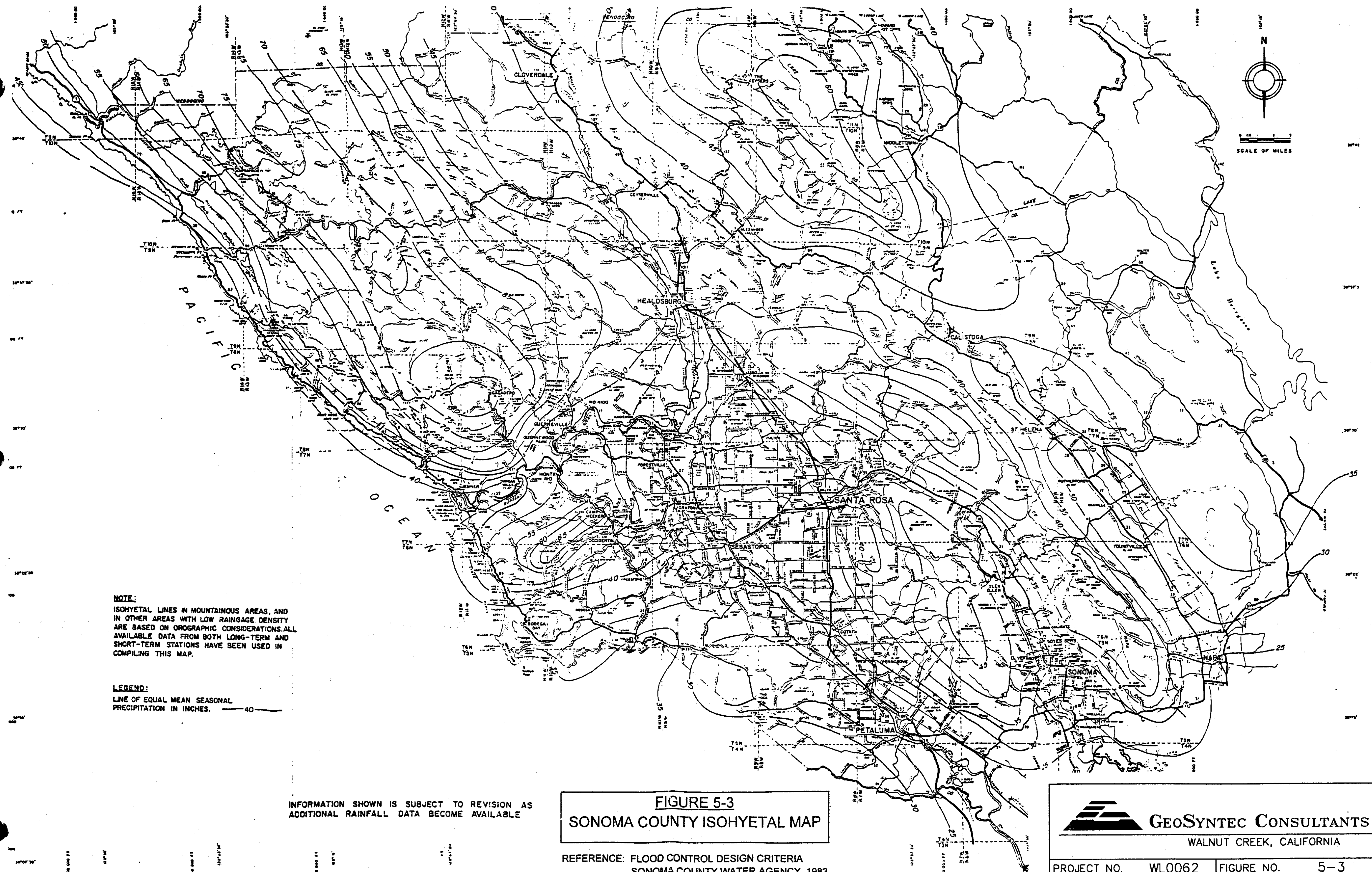
DATE: 20 OCTOBER 1997			PROJECT NO. WL0062	SCALE: 1" = 700'
DES BY	CRK	20OCT97	PROJECT: CENTRAL LANDFILL SONOMA COUNTY, CALIFORNIA	
DRN BY	ABK	20OCT97		
CHK BY	CRK		SHEET TITLE: TOPOGRAPHIC MAP	
REV BY	RJD			
APP BY	RJD			

SIGNATURE

DATE

INTEGRATED WASTE DIVISION
DEPARTMENT OF TRANSPORTATION
AND PUBLIC WORKS
COUNTY OF SONOMA

FILE NO. TOPOMAP.DWG
DOCUMENT NO. WC97380
FIGURE NO: 5-1 OF



NOTE:

ISOHYETAL LINES IN MOUNTAINOUS AREAS, AND IN OTHER AREAS WITH LOW RAINGAGE DENSITY ARE BASED ON OROGRAPHIC CONSIDERATIONS. ALL AVAILABLE DATA FROM BOTH LONG-TERM AND SHORT-TERM STATIONS HAVE BEEN USED IN COMPILING THIS MAP.

LEGEND:

LINE OF EQUAL MEAN SEASONAL PRECIPITATION IN INCHES. ——40——

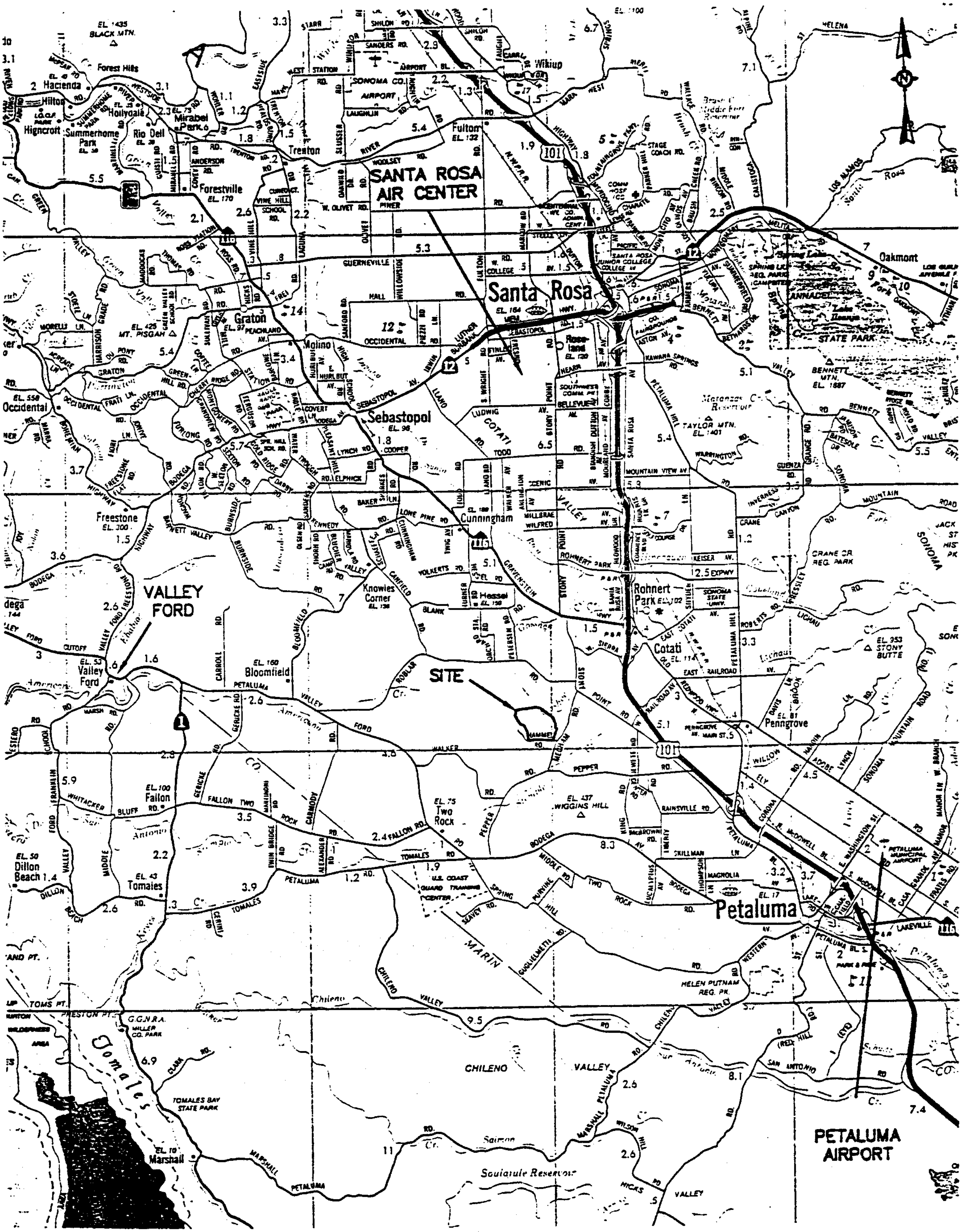
INFORMATION SHOWN IS SUBJECT TO REVISION AS ADDITIONAL RAINFALL DATA BECOME AVAILABLE

FIGURE 5-3
SONOMA COUNTY ISOHYETAL MAP

REFERENCE: FLOOD CONTROL DESIGN CRITERIA
SONOMA COUNTY WATER AGENCY, 1983

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

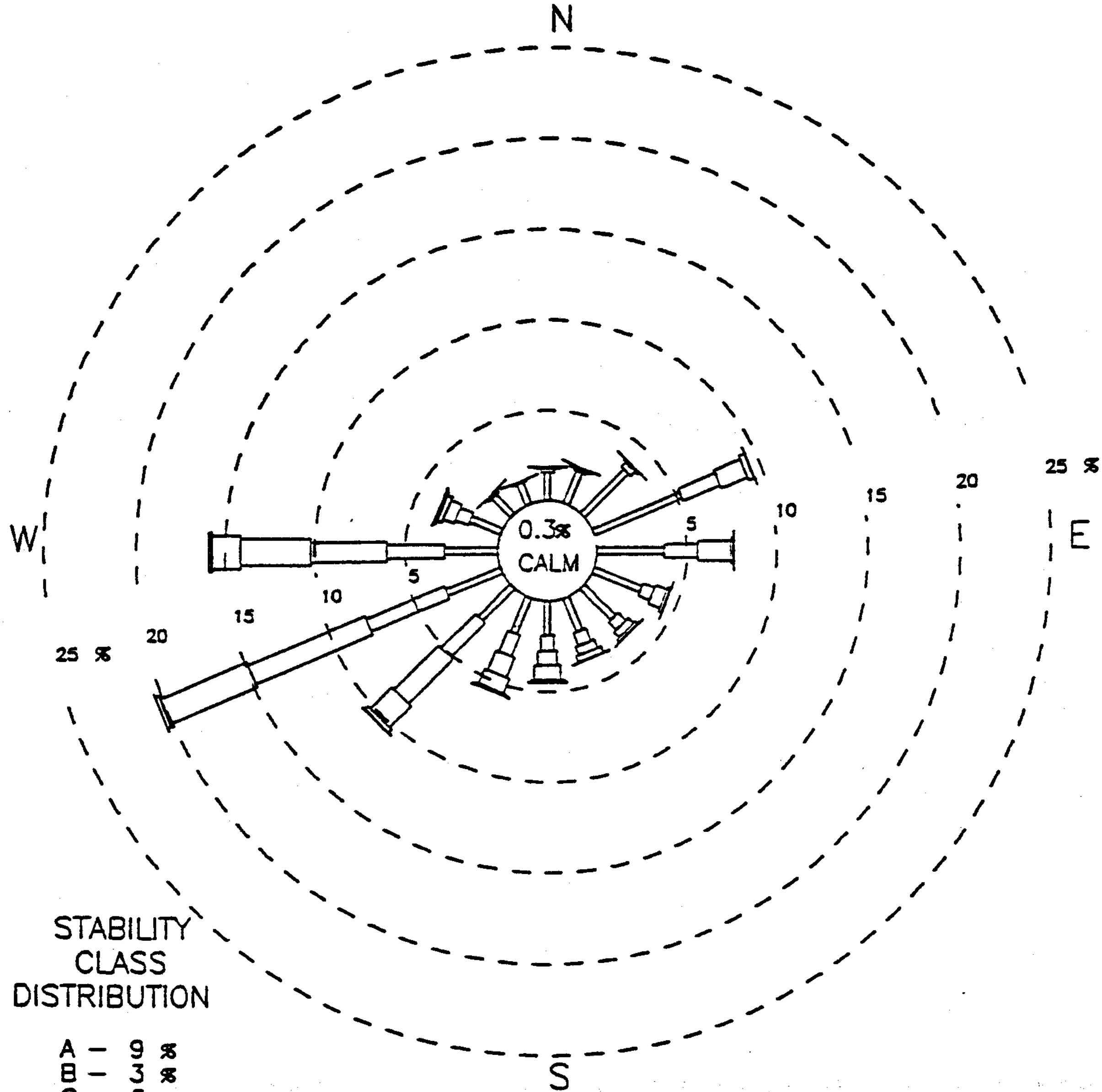
PROJECT NO.	WL0062	FIGURE NO.	5-3
DOCUMENT NO.		FILE NO.	



VICINITY MAP
1 : 16500

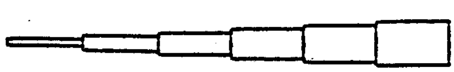
GeoSyntec Consultants WALNUT CREEK, CALIFORNIA	FIGURE NO.	5–4
	PROJECT NO.	WL0062
	DOCUMENT NO.	WC97552
	FILE NO.	VICINMAP.DWG

1992 VALLEY FORD WIND ROSE



STABILITY CLASS DISTRIBUTION

A – 9 %
B – 3 %
C – 6 %
D – 43 %
E – 9 %
F – 30 %



WIND SPEED SCALE (KNOTS)

Ave Speed is 6.0 kts, Data Recovery 99.9%

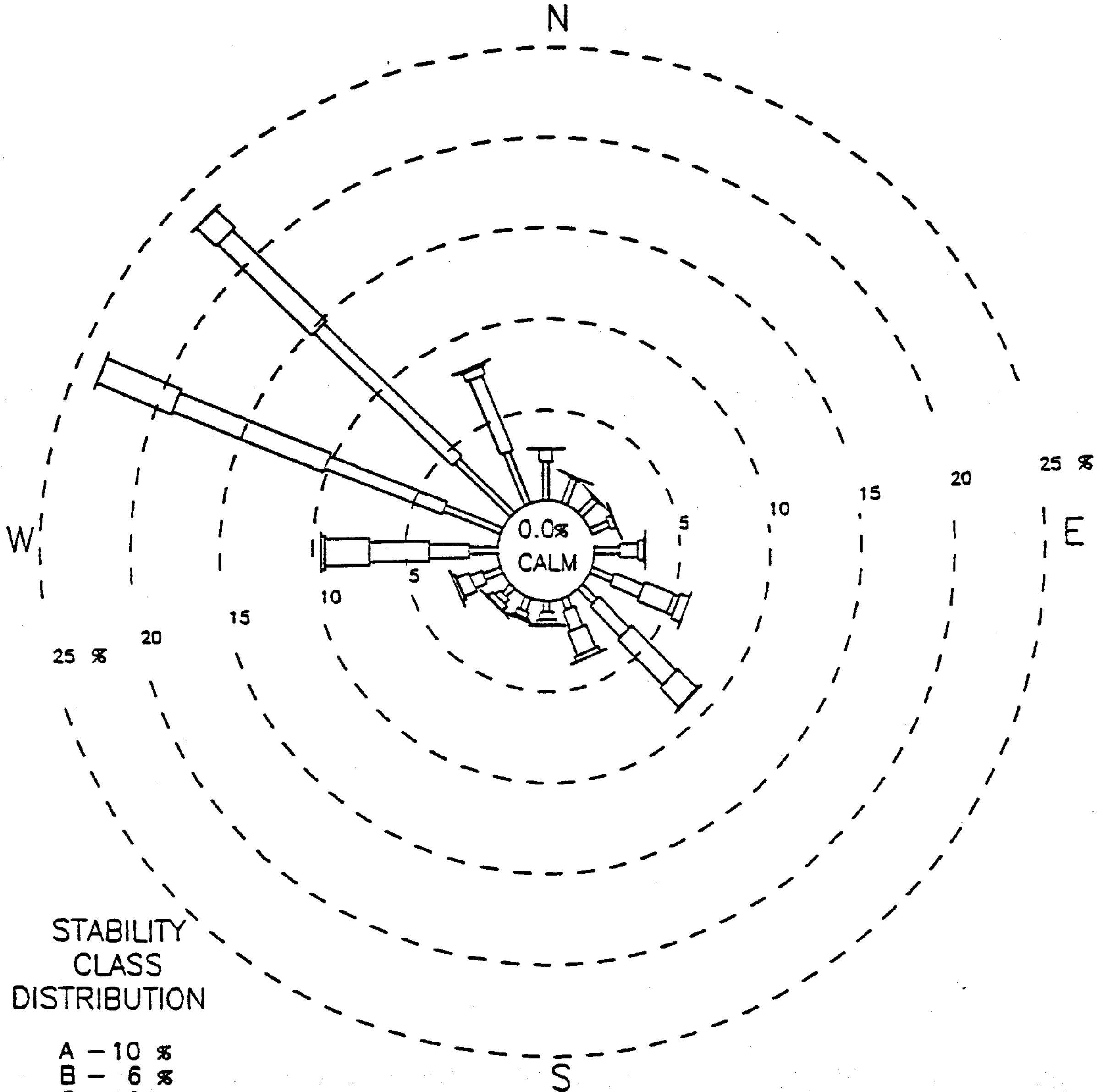
NOTE – WIND DIRECTION IS THE DIRECTION WIND IS BLOWING FROM

VALLEY FORD
VALLEY FORD, CA
509.1 UTME,4239.9 UTMN
DATES: 1/1/92–12/31/92
10.0M TOWER

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

FIGURE NO.	5–5
PROJECT NO.	WL0062
DOCUMENT NO.	WC97552
FILE NO.	VFWIND.DWG

1992 PETALUMA AIRPORT WIND ROSE



STABILITY
CLASS
DISTRIBUTION

A – 10 %
B – 6 %
C – 12 %
D – 44 %
E – 12 %
F – 16 %

WIND SPEED SCALE (KNOTS)

Ave Speed is 6.09 kts

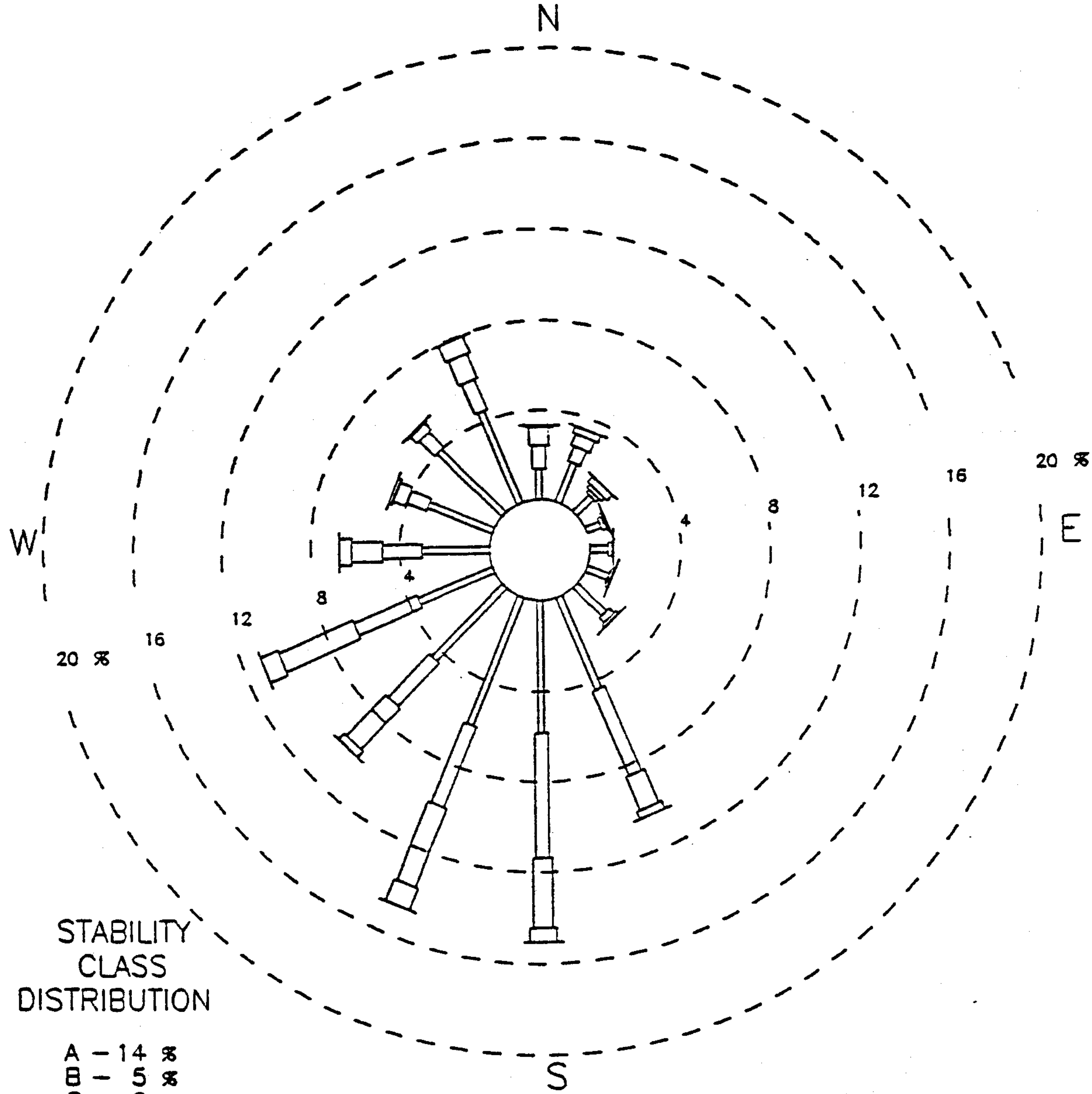
NOTE – WIND DIRECTION IS THE DIRECTION WIND IS BLOWING FROM

PETALUMA AIRPORT
PETALUMA, CA
534.1 UTME,4234.5 UTMN
DATES: 1/1/92–12/31/92

GeoSyntec Consultants
WALNUT CREEK, CALIFORNIA

FIGURE NO.	5–6
PROJECT NO.	WL0062
DOCUMENT NO.	WC97552
FILE NO.	PAWIND.DWG

1988 SANTA ROSA AIR CENTER WIND ROSE



STABILITY CLASS DISTRIBUTION

A – 14 %
B – 5 %
C – 9 %
D – 32 %
E – 16 %
F – 22 %

0–3	4–6	7–10	11–16	17–21	22–99
(47 %)	(27 %)	(20 %)	(6 %)	(0 %)	(0 %)

WIND SPEED SCALE (KNOTS)

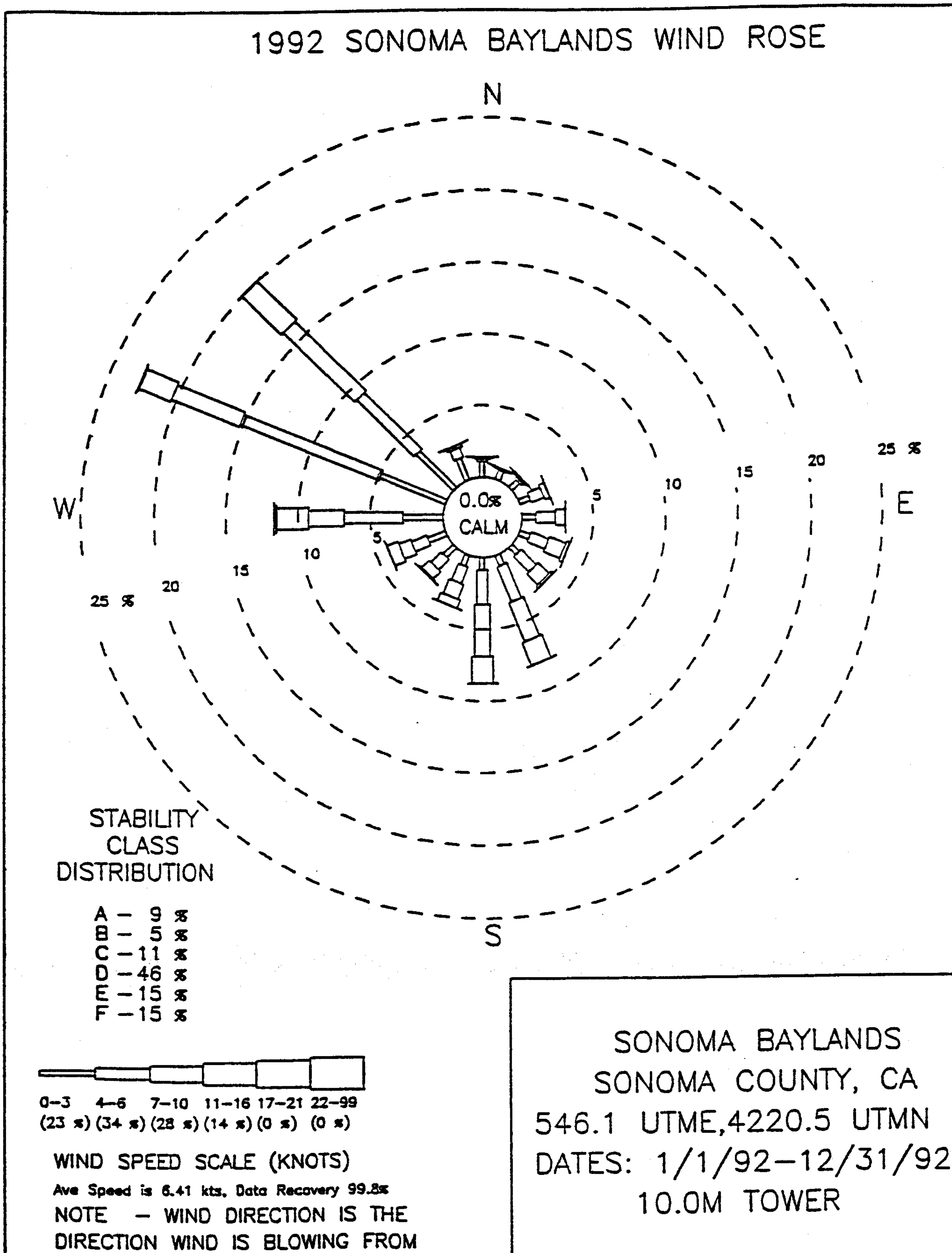
Ave Speed is 4.7 kts

NOTE – WIND DIRECTION IS THE DIRECTION WIND IS BLOWING FROM

SANTA ROSA AIR CENTER
SANTA ROSA, CA
521.0 UTME, 4252.1 UTMN

GeoSyntec Consultants
WALNUT CREEK, CALIFORNIA

FIGURE NO.	5–7
PROJECT NO.	WL0062
DOCUMENT NO.	WC97552
FILE NO.	SRWIND.DWG



SONOMA BAYLANDS
SONOMA COUNTY, CA
546.1 UTME, 4220.5 UTMN
DATES: 1/1/92–12/31/92
10.0M TOWER

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

FIGURE NO.	5–8
PROJECT NO.	WL0062
DOCUMENT NO.	WC97552
FILE NO.	SBWIND.DWG

6. 1971 PERMITTED AREA

6.1 Introduction

The information in this section was excerpted from the Report of Disposal Site Information (RDSI) [Sonoma County, 1997a].

6.2 Design Plans

Design plans for the 1971 Permitted Area are very limited. They are presented in Appendices B-3, C-1, and D-3.

6.3 Site Plan

A site plan delineating the legal property limits, proposed permitted limits, and limits of the permitted footprint of the landfill is located in Appendix A-2. This map was revised in December 1998. Ancillary facilities are also shown on this plan.

6.4 Construction Sequencing Plans

6.4.1 Excavation/Stockpiling Plans

The Phasing, Excavation, & Stockpiling Plan is located in Appendix B-3. Most daily excavation is not stockpiled, but is placed directly onto waste for cover. Cover is only stockpiled in advance of and preparation for wet weather when it may be difficult to access the on-site cover source. When material is stockpiled, it is placed adjacent to waste for convenience of use when needed or in the location indicated on the Phasing, Excavation, & Stockpiling Plan.

6.4.2 Base Preparation/Liner Placement Plans

There are no plans showing base preparation and liner placement. The Waste Containment Structures Plan, which shows the general areas where liner was and will be placed as well as the leachate collection and removal system is located in

Appendix E-1. A description of the liner placement is located in a later section of this document.

6.4.3 Fill Sequencing Plans

A detailed and slightly adjusted Sequencing Plan for 1997-1999 is in Appendix C-1. Phase I on this new map will bring waste up to a top elevation of 450 feet (CSD), and contains 908,186 cubic yards (CY) of air space. Phase II will bring waste up to a top elevation of 500 feet (CSD), and contains 1,333,526 cubic yards (CY) of air space. Phase III will bring waste up to a top elevation of 545 feet (CSD), and contains 135,431 cubic yards (CY) of air space. The Sequencing Plan also delineates the alignment for a new access road that will be required for implementation of this fill sequence.

6.4.4 Final Grading Plan

The Site Plans from the Preliminary Closure Plan which show final grades are located in Appendix E-1, Sheet 12 of 13.

6.5 Leachate Collection and Removal System

The general leachate collection and removal system for 1971 Permitted Area is shown on the previously described Waste Containment Structures Plan, located in Appendix D-3. The Base Grading Plan (Sheet 3 of 13) for the No. 2 leachate pond construction is included in Appendix E-1. This plan shows the grading and drainage plan for the No. 2 leachate pond. The lower piping from the sump at the base of the 1971 Permitted Area and the leachate pond No. 1 includes one pipe from the sump, two pipes from the gas main for condensate and leachate, one pipe from the French drain at the toe of the 1971 Permitted Area and one pipe from the French drain near the equipment maintenance area.

Leachate that occurs as a seep on the landfill surface is controlled as described in the Leachate Seep Control Plan, Central Landfill, Revised May 1999, which is included in the Storm Water Pollution Prevention Plan, May 1999. This document is attached in Appendix C-2. The landfill surface is inspected by site supervisors on a regular basis. Seeps that are found on the surface are handled in many ways. If possible, the seep will be contained by placement of soil on and around the seep area. If that is ineffective, the seep is collected with a leachate interceptor drain, where it drains by gravity down to the leachate storage ponds. If it is not possible to drain leachate by gravity from a seep to the leachate collection system for transfer to the leachate pond, leachate is be drained to a closed pit or a tank from where it will be pumped as needed.

The volume of leachate is handled as described in the Leachate Management Plan [August 1999], which is included in the Storm Water Pollution Prevention Plan (SWPPP), May 1999, which is in Appendix C-2. The County will empty both leachate ponds during the dry season of each year, so that a reserve permitted capacity of 4.2 million gallons will be available at the onset of winter and the first rains. The larger pond will be triple rinsed so that rain water collected in it can be discharged directly into the tributary to Stemple Creek. This direct discharge of rain water will save about 750,000 gallons of capacity for storage of treated water. Before any discharge, the water will be tested as required by the Regional Water Quality Control Board and no water will be discharged if it does not meet safe drinking water standards. Generally, all leachate from the landfill will be directed exclusively to the small pond (LP-1). The pond will be monitored daily for available capacity, with the aid of a permanently installed staff gauge and meter. As needed, the leachate may be removed and hauled by truck to the Santa Rosa Subregional Treatment Plant or other treatment facility as prearranged to maintain freeboard, provided that the leachate meets the water quality requirements of the plant. If necessary to meet water quality requirements, the leachate will be processed through an on-site 60 gallon per minute treatment plant prior to being transferred to the approved wastewater treatment plant or to the other leachate storage pond (LP-2). When the small pond reaches 80% of its permitted capacity the County will transfer the treated leachate from the small pond to the big pond, after treatment if necessary. As the transfer is taking place, both ponds will be monitored daily, the small pond for freeboard and the large pond for daily capacity and freeboard. When pond No. 2 reaches 90% of its capacity, the County will begin hauling the treated leachate to the Santa Rosa Subregional Treatment Plant or other treatment facility as prearranged to maintain freeboard. The County may use either leachate storage pond first, or both concurrently, for storage and may haul leachate to the wastewater treatment plant at any time, as necessary to maintain adequate freeboard. The County may also use the water from the ponds on dry winter days for construction water and dust control.

Leachate that is used for dust control is only used in areas where the public has no access. For example, leachate may be used for dust control in the borrow areas.

6.6 Surface Drainage Plans

The plan for final surface drainage is shown in the Site Plans from the Preliminary Closure Plan located in Appendix G-1. The Hydrology Map and the hydrologic calculations from the Preliminary Closure Plans are located in Appendix F-8. These maps indicate the permanent run-on controls for the site, which have been installed. The SWPPP (Appendix C-2) includes a map of the site titled, Site Drainage and Erosion Control Plan, May 1999. This map describes the temporary run-on controls for the fill area and excavation areas. Run-off control is accomplished by the design of the active tipping areas and the method of daily operation. The design directs surface water in the fill area such that it can be controlled. As a part of daily operations during times of surface water runoff, a berm is placed at the down gradient edge of the daily cell to collect surface water that might run off the exposed waste. At the end of the day after the cell is covered, the berm is either used for daily cover or moved to allow free drainage of the site.

6.7 Site Access Plan

Site access was described in Section 2.5 of this JTD. The Site Plan, located in Appendix E-1, shows access locations.

6.8 Gas Management Plan

The Landfill Master Plan, dated November 4, 1997 contains master plans delineating the layout of vertical gas collection wells, headers, vertical well laterals, and horizontal gas collectors. Details about gas management at the Central Disposal Site are included in Sections 7 and 8 of this JTD. The Landfill Gas Master Plan is located in Appendix E-2.

6.9 Groundwater Monitoring Plan

Ground water monitoring is done in accordance with RWQCB Monitoring and Reporting Program 93-83, located in Appendix C-3. Details about the groundwater monitoring and control at the Central Disposal Site are included in Section 7 of this JTD. The monitoring locations are shown on a map in Appendix D-1. A map showing all monitoring wells on the site is shown in Figure 7-1 and Appendix A-4.

6.10 Representative Cross Sections

There were never plans for subexcavation or elevations taken prior to construction of liners or waste placement in the 1971 Permitted Area. The current depth of waste ranges up to approximately 175 feet. The final depth of waste will be from 20 to 275 ft (6 to 84 m) deep, based on the pre-excavation topographical map.

6.11 Design Details

Design Details from the Preliminary Closure Plan is located in Appendix E-1. Additional information is included in this section.

6.12 Design Calculations

6.12.1 Site Capacity

As discussed in Section 2.14.2, the remaining capacity on 30 June 1999, was 5,453,600 cubic yards, based upon an aerial survey that was performed in February 1999.

6.12.2 Soil Availability

Daily and intermediate cover needs as of January 1998 are estimated to be 0.6 million cubic yards through closure of the 1971 Permitted Area. This is based on the approximation that daily and intermediate cover needs are ten percent by volume of in-place waste. Since the implementation of the alternative daily cover program, use of soil for daily and intermediate cover has been reduced from approximately twenty to ten percent of waste volume. The current sources for daily cover are on-site excavation adjacent to the landfill footprint and acceptance of clean fill from construction projects. The on-site sources of cover that have been developed are estimated to be 600,000 yd^3 (460,000 m^3) as of January 1998. This would provide cover through the closure of the 1971 Permitted Area. As previously mentioned, the on-site available cover could last through the year 2004, depending upon the uses of alternative daily cover. The estimate for imported clean fill is approximately 35,000 yd^3 (26,800 m^3) per year. This would extend the life of the on-site borrow areas and allow some of the on-site cover to be used for final closure. In addition to alternative daily cover, hydrocarbon-contaminated soil that has been bioremediated to permissible levels can be used as cover. This could contribute approximately 20,000 yd^3 (15,300 m^3) per year.

6.12.3 Seismic Stability

The Central Disposal Site will have no final slopes steeper than 3H:1V (H=horizontal: V=vertical), and is not located in an area subject to liquefaction or with poor foundation conditions.

6.12.4 Settlement Analysis

To prevent settlement causing future environmental problems all final slopes are graded to a minimum of 3% and good compaction effort is used when placing waste and cover. The ongoing operations of the site correct any differential settlement that may occur.

6.12.5 Leachate Generation

Leachate generation varies considerably during dry and rainy periods, as described in the Leachate Management Plan as part of the Storm Water Pollution Prevention Plan (Appendix C-2). The site includes two Class II surface impoundments with a total permitted capacity of 4.2 million gallons. Leachate is disposed of by evaporation and the use of leachate for construction water. Excess leachate is hauled to the Laguna Wastewater Treatment Plant near Santa Rosa for treatment and disposal.

Improvements to the leachate handling system planned or under consideration include treatment of leachate to lower the mercury level, construction of covers over the ponds and subsurface irrigation with leachate. The metal cover structure over pond

LP-1 was constructed during 1999. A metal cover structure over pond LP-2 is planned for the year 2000.

6.12.6 Drainage System Capacity Requirements

The permanent drainage structures were designed based on a 100-year, 24-hour storm using the final landfill grades as the model.

6.12.7 Gas Generation and Air Emission Calculations

There is no estimate of the emissions of landfill gas from the landfill. The Landfill Management Plan, dated 18 January 1993, prepared by SCS Engineers and subsequent design work by SCS Engineers estimates the unit landfill gas generation/capture rate ranges between 0.03 and 0.05 cubic foot per pound of refuse in-place per year. A new Landfill Gas Maser Plan, dated October 1997, was by Landfill Systems Engineering and is included in Appendix E-2.

6.12.8 Soil Erosion Analysis

Soil loss was predicted using the Universal Soil Loss Equation (USLE) using the final landfill grades as the model. The average annual soil loss due to erosion was calculated to range from 2.7 to 7.0 tons/acre/yr for the 1971 Permitted Area final cover 0.15 tons/acre/year for the East Canyon area under fully vegetated conditions. This value is within the acceptable range of 0 to 20 tons/acre/yr considered acceptable for municipal solid waste landfill covers [University of Wisconsin-Madison, 1988].

7. MONITORING AND CONTROL SYSTEMS

7.1 Introduction

The purpose of this section of the JTD is to describe the existing and proposed systems for meeting the water, leachate, and landfill gas monitoring and control requirements contained in the applicable federal regulations, and state regulations in Title 27. A monitoring and reporting program has been developed for the site, including the East Canyon Expansion, and is included as Appendix D-1-1. The information presented in this section has primarily been adopted from the Water Quality Protection Report [EBA Wastechnologies, 1999], which is included in Appendix D-1-1. Additional information has been extracted from the Evaluation Monitoring and Corrective Action Plan, which is included as Appendix D-1-2 to this report.

7.2 Water Monitoring and Control Systems

Section 20385 of Title 27 requires the institution of a monitoring program (under Section 20420) that includes systems capable of monitoring surface water quality, the unsaturated zone, and ground water. A key objective of the water monitoring programs is to provide an early detection of liner leakage or other system failure so that action can be taken to prevent the loss of beneficial uses of surface, ground and vadose zone waters. Other objectives include characterizing the natural ground-water quality beneath the landfill before, during, and after waste disposal, and monitoring ground-water elevations and gradient. A detection monitoring program is also required by default. These programs are described below.

7.2.1 Regulatory Basis

In accordance with the requirements of Section 20420 of Title 27, the Water Quality Protection Standard (Water Standard) was established by the RWQCB in the WDRs. The Water Standard consists of the list of constituents of concern (COC), the concentration limits, the point of compliance, and all monitoring points. The COCs under Section 20395 were specified in the WDRs and include those constituents mandated under SWRCB Resolution No. 93-62. A revised Water Standard for the site is presented in detail in Appendix D-1-1, Water Quality Protection Report. Monitoring of surface water, groundwater and leachate are discussed in this report. Vadose zone monitoring is not included in the Water Quality Protection Report and will be discussed in Section 7.2.2. The purpose of the revised Water Standard is three-fold. First, it expands the program to include new background and detection wells associated with the expansion of the site. Second, it responds to the need for more frequent sampling at the site. Third, it provides for monitoring points to be defined by specific and intended use. A site plan is included as Figure 1 to Appendix D-1-1, showing the location of all monitoring points. Monitoring and reporting requirements are also detailed in Appendix D-1-1.

Six new wells have been installed in conjunction with the planned expansion in the East Canyon area. These include three background wells (F-14, F-15 and F-16) and three downgradient wells (F-17, F-18 and F-19). Logs of these wells are provided in Appendix D-5 and their locations are shown on Figure 1 in Appendix D-1-1.

A minimum of four data points is required for any given non-anthropogenic Constituent of Concern and/or detection monitoring parameter at any given well in order to establish a concentration limit using the intrawell statistical procedure that is described in Appendix D-1-1. At wells where less than four data points have been collected for the Constituents of Concern and/or the detection monitoring parameters, such as F-17 through F-19, concentration limits will be established at a later date once adequate data have been collected through continued groundwater monitoring. The procedure used previously to establish concentration limits will also be used for F-17 through F-19, and is described in detail in Appendix D-1-1.

7.2.2 Vadose Zone Monitoring

Monitoring of the unsaturated zone is currently not performed. As per Section 20415 (d) of Title 27, vadose zone monitoring is intended for locations where soil-pore liquid samples or measurements can be collected to represent unaffected conditions or to provide the earliest possible detection of a release from the landfill. The fractured bedrock of the Central Disposal Site, including the East Canyon Area is not a soil media and liquid flow within the bedrock is controlled by secondary porosity features such as fractures and joints. Identifying appropriate monitoring points may not be possible or verifiable, consequently, vadose zone monitoring is not performed.

7.2.3 Domestic Well Monitoring

Currently the County is considering a program that may include sampling of domestic wells located in the vicinity of the Central Disposal Site. The location and uses of these wells are discussed in Section 2.4.5 of this JTD. Figure 2-8 shows the location of these wells. As noted by Herzog, the potential impacts to these down-gradient drinking water and stock water sources as well as to impacts to surface water quality down gradient of the proposed east canyon expansion area should be mitigated through the installation of a liner system and leachate collection and recovery system [Herzog, 1993]. Furthermore, there exist landfill groundwater monitoring wells down gradient from the east canyon between the down gradient domestic wells. Therefore, presumably any potential release from the east canyon expansion would first be detected by the groundwater monitoring wells that will be monitored on a regular basis, as described in this section.

7.3 Leachate Control and Monitoring Systems

The following information was excerpted from the ROWD [Sonoma County, 1997b], and RDSI [Sonoma County, 1997a] or can be referenced to the same.

7.3.1 Existing Leachate Control System

The leachate collection and removal system (LCRS) components include a leachate collection system, a series of subsurface barriers (upper and lower), and two (2) Class II surface impoundments. The first phase of the LCRS consists of a main collector (drain rock) installed at the bottom of the canyon drainage (under the waste). In the northerly approximately 1/3 of the existing landfill footprint. The native material under the collector was shaped into a bowl and compacted. The collector drains to a concrete sump, which is shown on the Waste Containment Structures Plan (WCSP) in Appendix D-3. In the middle 1/3 of the landfill area, the second phase of the leachate collection system consists of a main collector (perforated pipe) placed in a permeable backfill at the bottom of the canyon. The perforated pipe starts at the concrete sump and thus brings the leachate down the canyon. The second phase terminates upgradient of the upper subsurface barrier, which is currently buried under waste. A 30-in. (1-m) CMP standpipe rises at the barrier, which is shown on the WCSP located in Appendix D-3. Connected into this standpipe is a French drain which extends the length of this subsurface barrier. When the level of waste was placed above the subsurface barrier the CMP standpipe was abandoned in place.

The third phase of the LCRS was constructed between the upper and lower subsurface barriers, the lower of which is located at the toe of the landfill. This phase consists of a main collector (perforated pipe) which is located along the original drainage path of the canyon, and collection trench "fingers" which are laid out in herring bone pattern up the canyon walls to convey leachate to the main collector pipe. In addition, there is a solid pipe which conveys leachate from the upgradient French drain system to the main collector. The main collector consists of a 7-ft (2-m) thick clay base with a hydraulic conductivity of 1×10^{-6} cm/sec, 2-ft (0.6-m) of drain rock and a 4-in. (10-cm) diameter perforated schedule 40 polyvinyl chloride (PVC) pipe. The 7-ft (2-m) thick clay base is 15-ft (5-m) wide at the bottom and 10-ft (3-m) wide at the top. The perforated pipe was installed in the drain rock to collect leachate from the lower portion of the landfill. The solid pipe was installed in the top 2-ft (0.6-m) of clay to connect the standpipe upgradient of the upper barrier to a standpipe installed upgradient of the toe subsurface barrier. The collection trench "fingers" consist of a 3-ft (0.9-m) thick clay liner with a hydraulic conductivity of 1×10^{-6} cm/sec and 2-ft (0.6-m) of drain rock.

The lower portion of the canyon was lined as the fill progressed down-canyon. The valley bottom was graded at slopes ranging from 7% to 15% and lined with 3 ft (0.9 m) of clay with a hydraulic conductivity of 1×10^{-6} cm/sec. The canyon walls have 3H:1V slopes and were lined with 1 ft (0.3 m) of clay with a hydraulic conductivity of 1×10^{-6} cm/sec. The liner was installed in accordance with Title 27 construction standards in effect at the time. The leachate collection and waste containment system for this site is shown on the Waste Containment Structures Plan located in Appendix D-3.

As leachate accumulates in a standpipe at the lower barrier, it is removed using a submersible pump and discharged by pipe to either of the two (2) surface impoundments. In the event of pump or power failure, when leachate could rise in the standpipe, an emergency overflow will dump leachate directly into the pipe, which currently carries pumped flows to the impoundments.

The surface impoundments which have a combined capacity of 4.2 million gallons were constructed as Class II surface impoundments in accordance with Title 23, CCR, Chapter 15 requirements [Sonoma County, 1996], now included in Title 27. Both impoundments are double-lined leachate ponds. Leachate Pond No. 1 has a soil based liner system, and Leachate Pond No. 2, which was constructed in 1995, has a geosynthetic based liner system.

Leachate Pond No. 1 was constructed with the following layers from the bottom to the top:

- a 3-ft (0.9-m) layer of imported clay which meets the permeability requirement of 1×10^{-8} cm/sec; this layer was placed on top of the native soil;

- a 1-ft (0.3-m) thick layer of permeable drain rock;

- a second 3-ft (0.9 m) thick layer of imported clay also meeting the same hydraulic conductivity requirements as the bottom clay layer;

- a vapor barrier consisting of a geotextile fabric placed in contact with the underlying clay layer overlain by an impervious geomembrane layer; this layer was placed to prevent desiccation and subsequent cracking of the underlying clay layer;

- an 8-in (20-cm) thick layer of select soil to protect the geosynthetic fabrics from physical damage and deterioration caused by ultraviolet radiation; and

- a layer of drain rock for erosion protection.

Plans have made to construct a double HDPE geomembrane liner system with a LCRS over the existing clay liner system as an upgrade to the existing system due to the presence of possible leachate infiltration into the LCRS. The retrofit double liner is scheduled for completion in early 2000. In the interim, any liquid encountered in the LCRS will be removed by a pumping system to prevent any significant accumulation.

Leachate Pond No. 2 was constructed with the following layers from the bottom to the top:

- a groundwater collection underdrain system (consisting of underdrain geocomposite, geonet and filter geotextile);

- a geosynthetic clay liner (GCL) as the secondary containment component of the secondary composite liner;
- a 60-mil (1.5-mm) thick high density polyethylene (HDPE) geomembrane liner as the upper component of the secondary composite liner;
- an LCRS (including geonet, sump riser pipe, placement of sump granular material, and cushion geotextile); and
- a 60-mil (1.5-mm) thick HDPE primary geomembrane liner.

The final phase of the LCRS construction corresponds to the installation of a ground-water barrier system along the southern portion of the property (see Sheet 1 of Appendix C of the EMCAP in Appendix D-1). This system, which was constructed in 1988, consists of a compacted clay barrier that extends across the entire length of the central canyon drainage channel. The barrier is keyed into competent bedrock (Franciscan) along its base and its eastern flank. However, stratigraphic displacement along the trace of the Dunham Fault precluded keying the western flank (approximately 400 ft) (122 m) of the barrier system into Franciscan bedrock. The barrier system was installed as an additional safety precaution to intercept any leachate that may not be intercepted by the lower barrier system.

In addition to the LCRS components described above, several leachate interceptor drains and/or pits have been installed during the course of landfill operation to address leachate seepage areas within the landfill. These drains/pits are designed to intercept/collect the leachate and convey it (by gravity flow) to the leachate surface impoundments. In cases where discharge by gravity flow is not attainable, the leachate is either processed through the landfill gas (LFG) collection system where it drains by gravity flow to the surface impoundments or the leachate is drained to a closed pit or tank and is subsequently pumped as needed [Sonoma County, 1996]. A copy of the leachate management plan for the 1971 Permitted Area is included in the SWPPP in Appendix C-2.

7.3.2 Proposed Leachate Management System

The existing leachate management system for the 1971 Permitted Area will remain operational. The proposed East Canyon leachate management system will be separate from the 1971 Permitted Area system, except for the use of the leachate storage ponds and leachate treatment system. A liner, LCRS and separate leachate transmission pipe at the interface of the East Canyon Area waste fill where it overlies the 1971 Permitted Area will be constructed to prevent comingling of the 1971 Permitted Area leachate with leachate from the East Canyon Area.

The leachate collection and removal system components for the East Canyon Area will consist of a sump; a dual-containment leachate transmission pipe; and a leachate tank for temporary storage. A submersible pump will be used to remove leachate.

The quantity and quality of leachate produced at the East Canyon Area will be regularly monitored. Monitoring will be performed on a quarterly basis or as required by the CRWQCB. Samples of leachate will be submitted to a laboratory for chemical analyses. Monitoring results will be reported to the CRWQCB and LEA within 90 days after initiation of monitoring.

Section 8.3.4 includes a detailed description of the proposed leachate management system for the East Canyon Area.

A geocomposite leachate collection layer will also be installed under the liner which overlies waste in the 1971 Permitted Area to collect leachate moving toward the East Canyon Area. This layer will terminate at a French drain constructed along the east side of the 1971 Permitted Area which will collect additional leachate prior to reaching the East Canyon. Details of liner double leachate collection layers, French drain and transmission pipes are shown on Sheet 10 of the Development Drawings in Appendix E-1.

7.3.3 Leachate Monitoring, Sampling and Reporting

As required under the Waste Discharge Requirements, Monitoring and Reporting Program No. 89-8 and No. 93-83, the LCRS is tested and inspected annually to demonstrate proper operation. The leachate monitoring, sampling and reporting program is described in detail in Appendix D-1-1 and in the Leachate Management Plan which is included in the Surface Water Pollution Prevention Plan (SWPPP) in Appendix C-2.

7.3.4 Leachate Treatment and Disposal

Leachate has not been treated on-site in the past. In 1996, the Santa Rosa Subregional Treatment Plant (SRSTP) reduced the acceptable level for mercury to 0.0003 mg/L (0.3 ppb) which was below the actual level of mercury in the leachate at that time, and the County temporarily ceased discharging to the SRSTP. During 1998, the County installed a treatment system to reduce the mercury to acceptable levels. All leachate from the landfill is directed to the smaller pond. When the smaller pond reaches 80% of the permitted capacity, the County will treat the leachate as described below, if warranted by the current mercury level in the leachate, and pump it to the larger pond, or directly to the wastewater treatment plant. The leachate treatment includes flow through a activated carbon system to remove any BTEX and then through a resin bed filled with an ion specific resin designed for the removal of mercury. Once treated, leachate will be hauled to the SRSTP as necessary to keep leachate levels in both ponds within permitted levels.

Leachate is disposed of by evaporation and by spray irrigation for dust control and construction water on native land. After treatment, leachate is hauled, when necessary, to the SRSTP under Waste Water Discharge Permit No. SR-IW5202. A copy of the permit is in Appendix A-8.

The County is currently investigating several alternatives for long-term management and disposal of leachate such as tree irrigation, land irrigation, evaporation by landfill gas heat or burning, and subsurface irrigation of leachate for evapotranspiration.

7.3.5 Leachate Extraction Program

Based on information obtained during the sounding of gas collection and leachate monitoring wells, leachate levels within the fill were high. Elevated leachate levels and perched zones were likely caused by inadequate vertical drainage due to excessive use of cover soils in the past. Currently, the County has implemented a leachate extraction program that entails passive and active collection systems to mitigate the high levels of leachate in the waste. A detailed explanation of the Leachate Extraction Program [September 1999] is in Appendix B-14.

7.4 Gas Control and Monitoring Systems

7.4.1 Landfill Gas Control System

7.4.1.1 Landfill Gas

In compliance with Bay Area Air Quality Management District (BAAQMD) Regulation 8, Rule 34, a landfill gas (LFG) collection system and blower station/flare has been installed at the 1971 Permitted Area. The system became operational during January 1988, and undergone regular expansion and is currently controlling LFG emissions from the from the fill area. In 1993, the County built a 3 megawatt LFG power generation plant and started generating electricity for sale to Pacific Gas & Electric. In 1996, the power plant was expanded to a 6 megawatt capacity.

As of December 1998, the extraction system is comprised of sixty-three vertical gas collection wells strategically placed in the landfill, 16,000 linear ft (4,880 m) of horizontal collectors, and approximately 33,000 ft (10,060 m) of piping to feed the collected gases to the 6 megawatt LFG power generation facility and flare. When one or more engines in the power plant are down, the flare is started to burn LFG and control emissions.

The County is required by the Bay Area Air Pollution Control District to continue construction of horizontal and vertical collectors so that no more than 12 months of waste go uncontrolled. Expansion of the gas control system will follow the Landfill Gas Master Plan located in Appendix E-2.

7.4.1.2 Landfill Gas Condensate

Condensate that forms in distribution piping flows by gravity within the gas collection piping to a low point of the overall gas system in a 12 in. (30 cm) diameter gas main. At this low point, two condensate knockouts, one 4 in. (10 cm) in diameter, and the other 2 in. (5 cm), remove condensate from the gas line by gravity. A pair of PVC pipes, each contained within a single 10 in. (25 cm) diameter double containment pipe, convey the condensate to the smaller leachate pond. Condensate which is produced at the Central Landfill Gas Electrical Plant, is currently stored in a double containment tank near the flare and is then trucked to the leachate pond. Figure 7-2 is a map delineating the condensate conveyance to the leachate ponds.

7.4.1.3 Proposed Landfill Gas Management System

The purpose of the LFG collection system expansion into the East Canyon Area is to maintain conformance with BAAQMD Regulation 8, Rule 34, which requires the control of surface emissions from landfills.

The proposed LFG facilities installed for the East Canyon Area will be connected to the existing LFG collection system, and will include headers, laterals, and horizontal collectors.

As of December 1998, the LFG collection rate at the 1971 Permitted Area is approximately 2,625 cfm. An additional 900 cfm is expected to be collected after the East Canyon is completed in 2013 (assuming 3 million tons refuse placed). However, the LFG generation rate from the present refuse fill volume is expected to decrease during that time. Therefore, the estimate of the LFG treatment system reserve capacity is conservative.

The LFG Master Plan has been revised to add two LFG collectors installed in refuse fill areas at the border between the 1971 Permitted Area and East Canyon Area. These collectors will enhance LFG collection and reduce the potential for impact to ground water. The first would be a horizontal LFG collector installed in refuse at the eastern edge of the present refuse fill area, adjacent to the East Canyon. The second would be a dual purpose leachate/LFG collector installed in soil between the first horizontal collector and the East Canyon. Both collectors would be installed below the liner that is planned to extend from the East Canyon over the east quadrant of the 1971 Permitted Area. This amendment to the LFG Master Plan is included in Appendix E-2.

The LFG treatment facilities at the Central Disposal Site presently include both a flare station and an electrical generation plant. The combined capacity and present use rate are shown in Table 7-1.

Table 7-1
LANDFILL GAS CAPACITY
SONOMA CENTRAL DISPOSAL SITE

ITEM	GAS COMPONENT	cfm
Present Facilities Capacity	Flare Electrical Generation Total	1,750 2,100 3,850
Present Facilities Utilization	Flare Electrical Generation Total	0 2,100 2,100
Available Facilities Reserve Capacity		1,750
Anticipated LFG flow rate increase due to East Canyon Area		900
Available capacity after expansion		850

Based on the above considerations, it appears that the LFG treatment facilities at the Central Disposal Site are sufficient through closure of the site.

Condensate will be drained from the header system by gravity to leachate handling facilities at the landfill. Condensate formed in the header system will not be drained into the gas extraction wells, however condensate may be returned to the refuse of the East Canyon Area over the landfill liner. Landfill gas condensate that will be generated within the landfill itself will be contained and collected by liner system.

A detailed description of the landfill gas management system is included in Section 8.7.

7.4.2 Monitoring Systems

7.4.2.1 Landfill Gas Monitoring

The County has been responsible for implementing quarterly monitoring of the LFG collection system in accordance with BAAQMD requirements. The scope of the program includes the monitoring of wellhead seals, vaults, aboveground pipelines, and miscellaneous equipment components for methane. Periodic detections of methane at concentrations exceeding the regulatory compliance level of 1,000 parts per million by volume have been periodically detected during the course of the monitoring program. These detections have been primarily encountered in control valve vault boxes associated with the aboveground manifold system.

Continuous gas monitoring alarms are installed in the Headquarters Building, the two fee gate buildings, the household hazardous waste trailer, the disposal worker trailer near the tipping area, the trailers in the wood chipping area, the trailer in the composting area, and in the power plant. These alarms emit a loud noise when the methane in the structure exceeds 25% of the lower explosive limit (LEL) of methane. The perimeter probes are monitored for methane quarterly. Reports of monitoring are sent to the LEA and the CIWMB quarterly.

All other enclosed structures have gas monitoring alarms which emit a loud noise when methane level reaches 25% of the LEL in the building.

7.4.2.2 Perimeter Gas Monitoring

The references for the following information are the ROWD [Sonoma County, 1997].

Monitoring is performed quarterly at the 13 perimeter LFG monitoring probes MP-1R through MP-13, located at various locations along the landfill's perimeter. One probe was installed at the north end of the site in June 1992 as was required in the 1990 permit revision, and in 1994 the remaining 12 gas monitoring probes were installed in accordance with federal regulations. In August 1997, MP-1 was replaced with MP-1R at the property boundary. These probes range in depth from 10 to 60 ft (3.1 to 18 m) below the ground surface. In addition to perimeter monitoring, miscellaneous utilities in the proximity of the operations/administration building are also monitored for the presence and/or accumulation of methane gas.

Between July 1995 and October 1996, only one (1) detection of methane was recorded in the perimeter monitoring probes. This corresponded to the detection of methane in MP-1 at 0.5 percent by volume during the July 1995 monitoring event. In January 1997, methane was detected for the second time in MP-1 at a concentration of 4.65 percent by volume. In addition, trace concentrations of methane (0.05 percent by volume) were detected in MP-2 (deep) and MP-8. Finally, monitoring results from the monitoring event conducted in April 1997 identified methane as being present in nine (9) of the 13 perimeter monitoring probes. Monitoring probes with methane detections included MP-1 through MP-9 and MP-13. The highest methane concentrations were encountered in MP-1 (deep) and MP-9 at 5.35 and 3.95 percent by volume, respectively. Methane concentrations at the remaining locations ranged from 0.05 to 1.15 percent by volume. However, subsequent sampling in January, April, July, and November 1998, has revealed no detectable levels of methane in any probe other than MP-1, which has been replaced. Therefore, the methane identified in the probes in early 1997 was not confirmed and was probably due to instrument error. The consultant replaced the suspect instrument after April 1997. The regulatory compliance level for methane at the property boundary of a landfill is 5 percent by volume.

7.4.2.3 Monitoring Well Logs

The report titled Landfill Gas Probe Installation, Operation, and Maintenance Report, 1971 Permitted Area, prepared by EMCON Associates, dated December 1994 is in Appendix D-4 along with the MARK Group report on installation of MP-1R dated September 1998. This report includes gas probe logs, installation details, monitoring procedures and results of initial quarterly monitoring.

7.4.2.4 Temporary Gas Monitoring Wells

Four new temporary gas monitoring probes have been installed within the East Canyon area adjacent to the 1971 permitted area to provide temporary monitoring of gas migration in this area. These wells will be monitored by the County as part of normal gas sampling to evaluate movement of landfill gas toward East Canyon that could potentially impact groundwater. Well logs are included in Appendix D-4. The results of the monitoring will be submitted in a separate report.

7.4.2.5 Reporting

The results of routine gas monitoring are currently submitted in accordance with Section 20934 of Title 27 which states that "the results of gas monitoring shall be submitted to the enforcement agency within ninety (90) days of sampling." If methane levels exceed the limits in Title 27 CCR §20919.5, reporting will be done as required in that section.

7.5 Corrective Action Financial Assurance

Section 20380(b) of Title 27 requires that a discharger shall obtain and maintain financial assurance for initiating and completing corrective action for known or reasonably foreseeable releases from a unit. Sonoma County submitted to the RWQCB an estimate for this so called "leak fund" in 1994 and established a funding mechanism, which is currently in place. The fund was fully funded in 1998. The 1994 budget estimate and current Sonoma County budget summary information is included in Appendix D-7.

The East Canyon Area expansion will be constructed with a much higher level of environmental protection than the 1971 Permitted Area and the potential for ground water impact is much lower. Therefore, it is proposed that the existing fund only be modified by an additional $300,000 for East Canyon Area, providing sufficient financial assurance for the Central Disposal Site including the East Canyon Area. The revised 1999 budget estimate and summary information is also included in Appendix D-7.

LEGEND

TOPOGRAPHIC ELEVATION CONTOUR (FEET)

SW-1 ▲ SURFACE WATER STATION

A-1 ● GROUNDWATER MONITORING WELL

LW-1 ● LEACHATE MONITORING WELL

F-1 ○ PIEZOMETER LOCATION

F-9 SEALED EXPLORATORY BOREHOLE FOR PROPOSED MONITORING WELL LOCATION

NOTES:

WELL LOCATIONS ARE DERIVED FROM COUNTY BASE MAP AND "DATA REPORT INSTALLATION OF MONITORING WELLS (DRAWING NO. 2-1)" PREPARED BY THE MARK GROUP, INC. (DECEMBER 14, 1995)

ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

SITE MAP

GEOSYNTEC CONSULTANTS

WALNUT CREEK, CALIFORNIA

PROJECT NO.	WL0062	FIGURE NO.	7-1
DOCUMENT NO.		FILE NO.	FIGURE 7-1.DWG

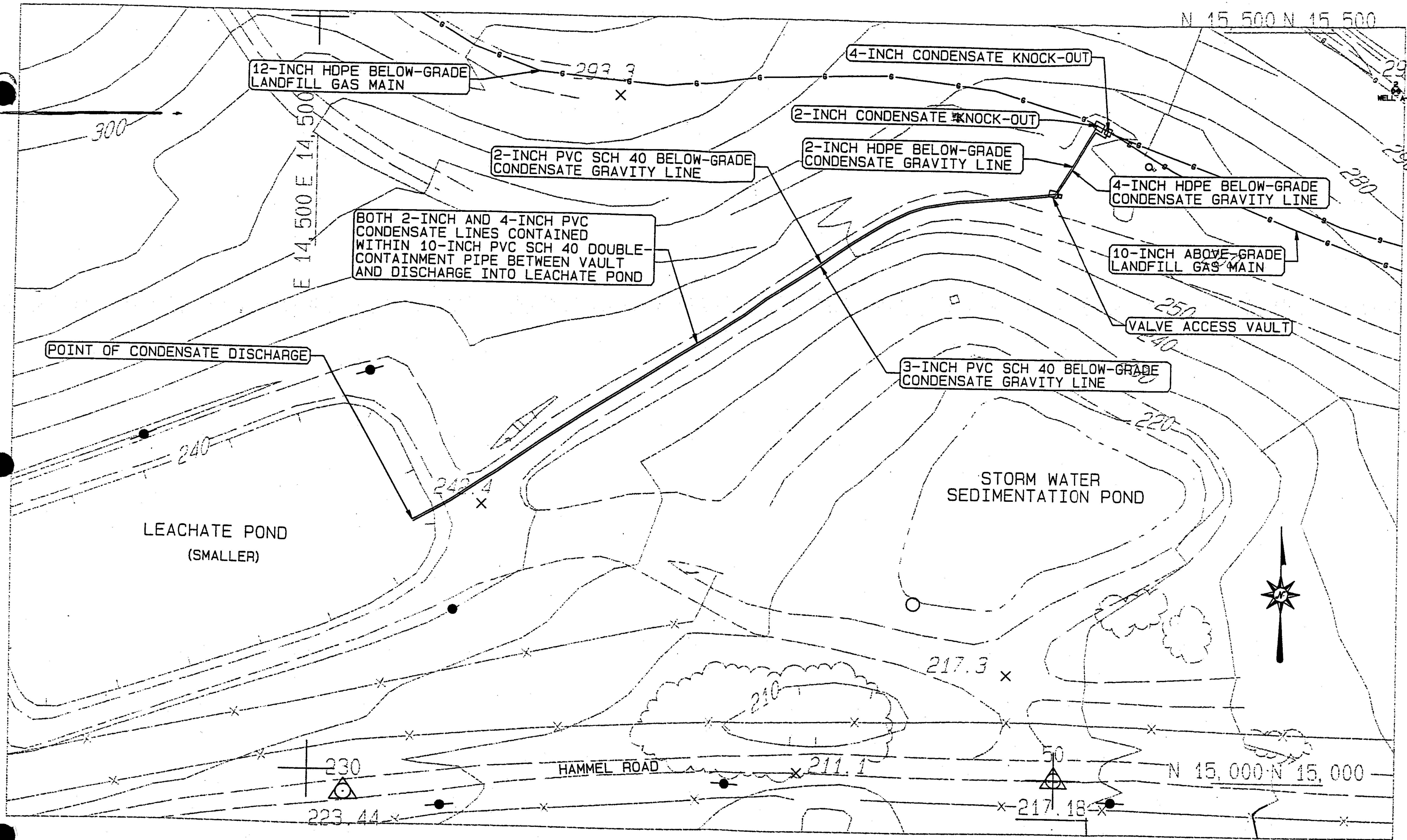


FIGURE 7-2
CONDENSATE DISCHARGE LOCATIONS

REFERENCE: REPORT OF DISPOSAL SITE INFORMATION SONOMA COUNTY, OCTOBER 1997

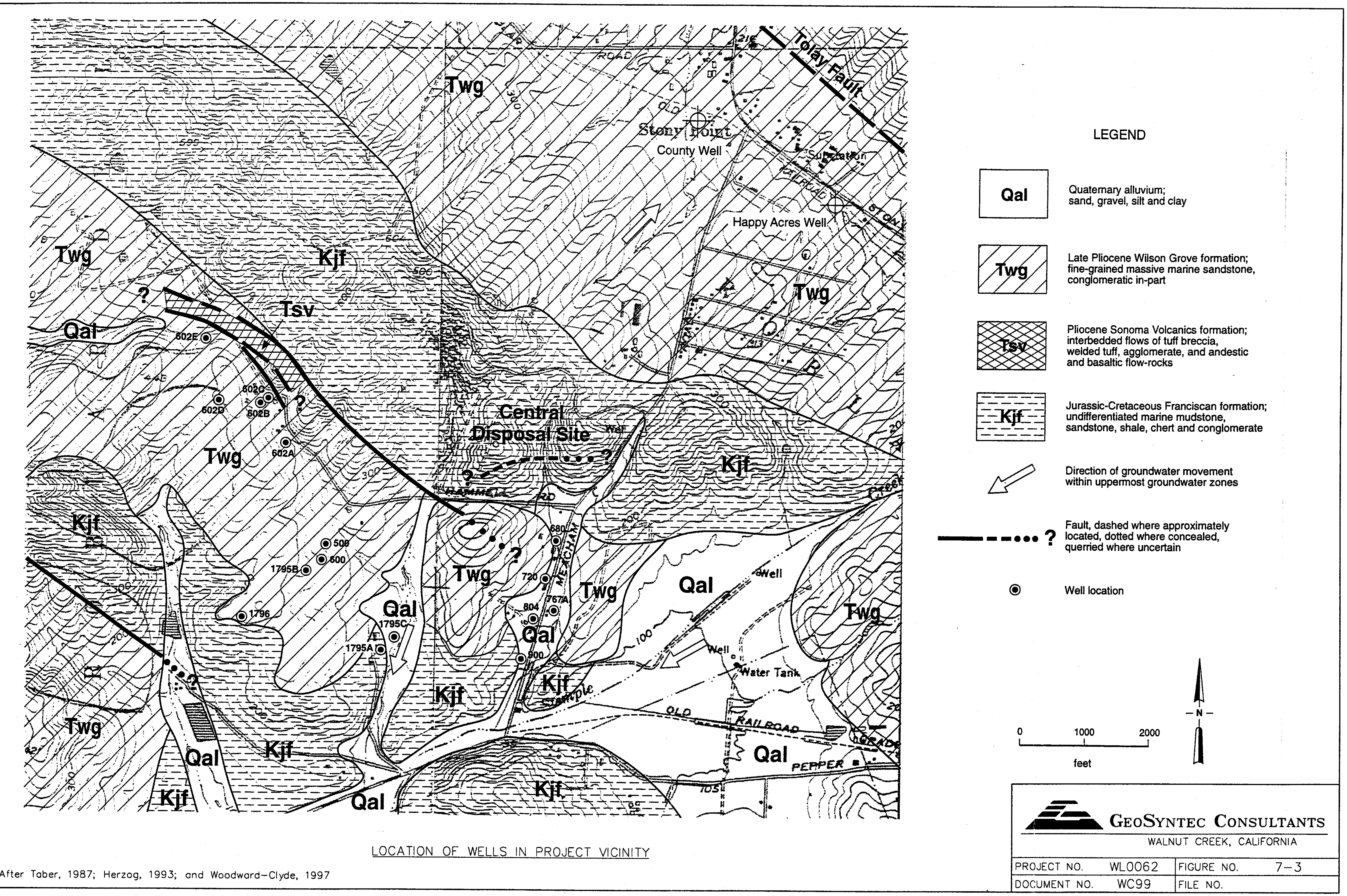
DESIGN	BY	ALEX SEBASTIAN
DRAWING	BY	ALEX SEBASTIAN

CONDENSATE PIPING			
BUDGET NUMBER	FISCAL YEAR	SHEET NUMBER	TOTAL SHEETS
6939	1996/97	1	

COUNTY OF SONOMA DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
EDWARD J. WALKER, DIRECTOR

PROJECT: LANDFILL GAS SYSTEM

DATE: October 1997 SCALE: 1" = 60'



LOCATION OF WELLS IN PROJECT VICINITY

After Taber, 1987; Herzog, 1993; and Woodward-Clyde, 1997

8. EAST CANYON AREA DESIGN

8.1 Introduction

The purpose of this section of the JTD is to describe the design and operations plan for the proposed East Canyon Area. The East Canyon Area is designed in accordance with the criteria and standards set forth in: Title 40, Code of Federal Regulations (CFR), Section 258 (Subtitle D); Title 27, California Code of Regulations (CCR), Division 2; and California Regional Water Quality Control Board (CRWQCB) Order No. 93-83, dated 22 September 1993. This section of the JTD is being submitted to comply with Section 21760 of Title 27 which states: *"Dischargers who own or operate classified waste management units(Units) shall submit, for each such Unit, detailed preliminary plans and (later, after completion) as-built plans, specifications, and descriptions for all liners, and other containment structures, leachate collection and removal system components, leak detection system components, precipitation and drainage control facilities, and interim covers installed, or to be installed or used.."*

The design has been developed to isolate waste from the surrounding environment, to allow for containment and collection of leachate and landfill gas, and to provide for diversion and management of surface-water run-on and run-off. The design of the East Canyon Area includes:

- grading and landfill construction phasing;
- a capillary break and underdrain system;
- a composite liner;
- a leachate collection and removal system (LCRS);
- a surface-water management system;
- interim and final cover systems;
- a separation between new waste overfilling existing waste;

- a landfill gas control system; and
- environmental site monitoring systems.

Design drawings entitled, *"Development Drawings, East Canyon Expansion, Central Landfill, Sonoma County, California"*, dated August 1998, accompany this section of the report, and are included in Appendix E-1. The drawings depict the planned development of the landfill and are referenced extensively in the following subsections.

In addition to the design given in this JTD, construction drawings, specifications, and construction quality assurance (CQA) documents will be developed for each phase of the landfill development. Construction documents for a particular phase will be submitted to the CRWQCB for approval prior to the start of construction of the phase.

8.2 Grading and Landfill Phasing Plan

8.2.1 Introduction

The East Canyon Area will be graded prior to landfill liner construction (i.e., foundation grading) and after waste has been placed to final grades (i.e., final grading). Foundation grading is designed to provide a firm foundation capable of supporting landfill structures, as required by Section 20240(d) of Title 27. Landfill foundation grading activities will include:

- clearing and grubbing;
- excavation to achieve design foundation grade elevations;
- subgrade preparation; and
- placement of engineered fill.

The foundation grading plan for all of the landfill phases is presented on Drawings 3 through 6.

Final grading will be performed as part of landfill closure activities, and will include the construction of the final cover and the final cover benches and access road.

The average final landfill slopes, as presently planned, will be 4H:1V (H = Horizontal:V = Vertical) with some sections at 3.2H:1V, and final bench slopes at approximately 2 percent. The final cover grading plan is presented on Drawing 12.

8.2.2 General Grading Activities

8.2.2.1 Clearing and Grubbing

Materials within the landfill footprint that are inappropriate for construction, and that would not provide suitable support, will be removed prior to the start of excavation or filling. Surficial vegetation, debris and structures, and organic or compressible materials will be cleared, grubbed, and removed from the construction areas.

8.2.2.2 Excavation

Once clearing and grubbing activities are completed, excavation will be performed to achieve the foundation grade elevations shown in Drawings 3 through 6. The materials to be excavated will range from loose soil to weathered and hard bedrock. Unsuitable materials encountered at foundation grade will be over-excavated, as necessary, and the over-excavated area will be backfilled with engineered fill. Hard rock will be blasted to bring the excavation to foundation grades.

8.2.2.3 Subgrade Preparation

The exposed subgrade (i.e., soil and bedrock materials exposed after clearing, grubbing, and excavation) will be prepared to provide a firm surface for the placement of engineered fill to achieve the design foundation grades in select areas, or for construction of the liner system. Soil materials exposed at subgrade level will be scarified, moisture conditioned, and compacted by sufficient passes of a heavy compactor. If compaction reveals soft or pumping conditions, the affected area will be excavated and backfilled with engineered fill. Backfill material will be compacted in accordance with the construction drawings and specifications.

8.2.2.4 Engineered Fill

Engineered fill is defined as earth material placed in a controlled manner during landfill construction. Engineered fill will be placed to: (i) achieve the design foundation grades; (ii) provide a smooth, stable surface for construction of the landfill liner system; and (iii) construct earth material components of the landfill liner system, and interim and final cover systems. Engineered fill will typically be placed in lifts of 6-in. to 12-in. (15 to 30-cm) thickness, moisture conditioned as necessary, and compacted as per the construction drawings and specifications.

On-site soil and rock materials that comply with the construction drawings and specifications will be used as engineered fill. On-site materials include alluvial deposits, colluvial deposits, and excavated bedrock. Sufficient quantities of these materials are available on site to meet the requirements of the project. Developing the East Canyon expansion will generate an estimated 1.7 million cubic yards of soil and rock material. Unusable material from clearing and grubbing will be stockpiled within the site for subsequent use for daily cover.

The landfill design includes components that will be constructed using on-site natural and processed soil and bedrock material (i.e., earth materials) placed in a controlled manner (i.e., engineered fill). Processing of on-site soil and rock materials will be undertaken, as necessary, to comply with the requirements for the various components contained in the construction drawings and specifications. Processing may include crushing, sieving, and mixing of soil and rock.

8.2.4 Foundation Grading

Final base grading plan is designed to comply with the following requirement contained in Section 20240 (d) of Title 27: "All containment structures at waste management units shall have a foundation or base capable of providing support for the structures and capable of withstanding hydraulic pressure gradients to prevent failure due to settlement, compression, or uplift as certified by a registered civil engineer or certified engineering geologist". The grades are also designed to provide a stable and firm foundation capable of supporting overlying landfill components and ancillary structures as required by Section 20240 (d) of Title 27. Loose or soft material found within excavated areas will be removed and replaced with compacted fill as necessary. Relatively weak colluvial material is present within the base of the East Canyon Area, and this material may require removal and replacement. However, since the colluvium varies in thickness from 5 to 40 ft (1.5 to 12 m), much of the material should be removed during base grading.

The grading for the East Canyon Area will involve excavation or filling to the design grades as shown on Drawings 3 through 6. A maximum depth of excavation of 50 to 60 ft (15 to 18 m) was used during design as this is the estimated maximum depth of rippability using standard earth moving equipment [Taber, 1993b]. Blasting of the harder rock at depth is expected.

The base grading plan primarily consists of minimum floor area grades of approximately 1.5% to the sump area, a maximum of 2.5H:1V slopes along the excavated side-slopes to a minimum of 10H:1V, approximately 2H:1V slopes along the toe berm embankment fill side-slopes. Interior benches are located every 50-ft (15-m) in vertical height and are 20-ft (6-m) wide. The perimeter access road is 30-ft (9-m) wide and is the limit of the containment system. Both floor and side-slope grades have been designed to accommodate the anticipated settlement of the underlying foundation material.

The base grading plan allows for gravity drainage of flow in the underdrain and LCRS layers to the sump area located at the expansion area low point as shown on Drawing 3. The layouts of the LCRS, including collection pipe and sump locations, are designed to achieve positive flow from all areas of the expansion. Benches at the limit of the phases are initially graded into the slope to divert surface water away from the slope prior to containment system construction. The LCRS layout shows the floor area graded at a minimum gradient of 1.5% within the blanket granular layer. The capillary break/underdrain system has similar grades, and includes collection pipes. The reason for this is that the primary purpose of this system is to separate the highest level of the underlying ground water, including capillary rise, from the liner.

8.2.5 Interim and Final Grading

8.2.5.1 Introduction

Interim and final grading will be performed as landfill operations progress. Interim grading will include: (i) construction of interim and permanent landfill access and haul roads; (ii) placement of daily and intermediate (i.e., interim) cover; and (iii) construction of interim surface-water management system features. Final grading will include: (i) construction of final cover benches and access road; (ii) construction of the final surface-water management system features; and (iii) construction of the final cover foundation layer.

8.2.5.2 Regulatory Requirements

State regulations for final grading are contained in Section 21090(b) of Title 27, which states: "*...the final cover of closed landfills shall be designed, graded and maintained to prevent ponding and to prevent soil erosion due to high run-off velocities. Except as provided, all portions of the final cover shall have a slope of at least three percent. ...Areas with slopes greater than ten percent, surface drainage courses, and areas subject to erosion by water and wind shall be protected or designed and constructed to prevent erosion*". Additional requirements for grading are contained in Sections 21090 and 21142 of Title 27. Section 21090 (a) states: "*Final Cover Slopes shall not be steeper than a horizontal to vertical ratio of one and three quarters to one with and shall have a minimum of one fifteen-foot wide bench for every fifty feet of vertical height*".

8.2.5.3 Interim Grading

Interim grading will be performed as the landfill is progressively developed. Landfill access roads will be constructed and extended as necessary to maintain access to the active areas of the landfill. On-site earth materials will be used to construct the landfill access roads. The roads will be graded to provide a minimum driveable width of 30 ft (9 m), and a maximum slope of 10%. Landfill access roads are described in detail in Subsection 8.11.

Interim cover will be placed over exposed waste during landfill operations. Interim cover provides control of odors, vectors, and litter, as well as infiltration from precipitation. On-site earth materials will be used for interim cover. Areas with interim cover will be sloped to promote surface-water run-off. Interim cover is discussed in detail in Subsection 8.5.3.

Interim surface-water management system features will be constructed as the landfill is progressively developed. These features include interim cover ditches at containment system terminations and downchutes. On-site earth materials will be used to construct these features. Interim and permanent surface-water drainage control features will be constructed with materials designed to resist erosion under anticipated flow conditions. Interim surface-water drainage control features are described in Subsection 8.4.3.2.

8.2.5.4 Final Grading

Final grading is shown on Drawing 12. In its final configuration, the landfill will have a crown sloped towards 4H:1V side slopes. The side-slopes will be constructed with benches every 50 ft (15 m) in vertical height, which will be approximately 15-ft (4.6 m) wide, and will be sloped at approximately 5% towards the side slope and 3 to 4% along the bench alignment.

Final surface-water management system features will be constructed during final grading. These features include: (i) final cover system drainage terraces; (ii) perimeter road drainage ditch; (iii) downchutes; and (iv) buried conduits. Final surface-water management system features are described in more detail in Subsection 8.4.3.3.

Final grading includes the construction of the foundation layer for the final cover, which will provide a stable base for the overlying final cover components.

8.2.6 Landfill Phasing

8.2.6.1 General

Phasing involves the staged development of the East Canyon Area containment system to efficiently utilize the disposal capacity with respect to operational, surface-water control, access, and construction cost considerations. A total of five (5) phases are proposed for the East Canyon Area. The approximate phase limits of the first four (4) phases are shown on Drawing 2. The fifth and final phase will include the fill over the existing 1971 Permitted Area, and is not shown on Drawing 2. The phase limits only indicate the containment system limits for each stage of development within the final base grading along with the layout of permanent design features. Detailed design completed as part of construction drawing preparation should evaluate the interim base grading and temporary layout of control features needed for the actual development of each phase.

In general, the maximum fill height for each phase will be controlled by slope stability considerations, the final cover grades and the containment system limit for each phase.

Within each daily landfill cell, waste will be spread in lifts of approximately 2 ft (1.5 m) thickness and then compacted. The working face of each daily landfill cell will be about 100 ft (30 m) in width. Daily cover soil will be placed over exposed waste in compacted lifts at least 6-in. (15-cm) thick prior to the end of operations each day.

The final cover will be constructed as areas of the active landfill are brought to the design grade. Construction of the final cover and the landfill gas collection system will be closely coordinated. Closure activities are described in Section 10 of this JTD.

Information regarding the lined area and the waste disposal capacity of each phase is presented in Table 8-1.

Table 8-1
CAPACITY AND AREA OF PHASES I THROUGH V
East Canyon Area

PHASE	PHASE AREA (plan acres)	WASTE FILL VOLUME (10^6 yd^3)
Phase I	14.0	1.1
Phase II	7.8	1.2
Phase III	7.7	0.75
Phase IV	10.3	2.3
Phase V (Tie-In To 1971 Permitted Area)	-	1.7
TOTAL	**39.8**	**7.0**

8.2.6.2 Phase I

Phase I is the initial phase and is sized to provide approximately 1,153,264 yd^3 (882,410 m^3) of air space (with waste elevation to maximum elevation of 346 ft (105 m) County Local Datum (CLD). In addition, most of the ancillary facilities needed for future phases will be installed during this initial phase such as access roads, temporary and permanent surface-water management system structures (including sedimentation ponds, drainage piping, and ditches), underdrain/leachate sumps and piping, and gas control system features.

The floor areas of Phase I have slopes of approximately 2 %. The slope of the side-slope areas in this phase vary from 3H:1V, along the western side to 2H:1V, along a relatively short southern side.

As shown on the Waste Fill Sequence Plan in Drawing 11, the waste face slopes at the end of Phase I are 4H:1V with approximately 50 ft (15 m) height, at the southern side, and 3.2H:1V, with 40 ft (12 m) height at the northern side. The waste slopes at the eastern and western side are 3.2H:1V. The top deck has a gradient of 5 % towards the east-west direction.

The existing sedimentation pond at the northwest corner of Phase I near the Administrative Building will remain in place during this phase of construction. The grading of Phases I and II will be modified in the construction documents to maintain the sedimentation pond in its current configuration.

8.2.6.3 Phase II

The second phase of waste placement will occur to the eastern and northeastern sides of Phase I. During this phase, waste will also be placed over the existing Phase I area. The maximum elevation within this phase will be approximately 400 ft (120 m) CLD. At the end of Phase II the slopes of the waste face will vary from 3.2H:1V along the western side to 4H:1V along the other sides as shown on the Waste Fill Sequence Plan in Drawing 11. The slope of the Phase II bottom side-slope area is approximately 2.5H:1V. Phase II will not include any floor area.

The estimated air space available in Phase II area is approximately 1,121,180 yd^3 (857,860 m^3).

8.2.6.4 Phase III

The third phase will include the northwestern portion of the site and over the existing adjacent waste faces of Phases I and II. The maximum waste elevation within this phase will be approximately 414 ft (126 m) CLD. At the end of this phase the slopes of the waste face will vary from 3.2H:1V along the southern and western sides and 4H:1V along the northern side sides as shown on the Waste Fill Sequence Plan in

Drawing 11. This phase will join Phases I and II along its eastern boundary. The slope in floor area of Phase III is approximately 10 %. The estimated air space available in Phase III is approximately 748,837 yd^3 (572,970 m^3).

8.2.6.5 Phase IV

The fourth phase of waste placement will occur in the southwestern portion of the site and over the adjacent waste faces of Phases I and III. The waste slopes will be 3.2H:1V along the western side and approximately 4H:1V on the northern, eastern and southern sides as shown on the Waste Fill Sequence Plan in Drawing 11. The maximum elevation of waste at this stage of development will be approximately 470 ft (143 m) CLD. The final cover will be placed over these slopes. Benches will be constructed at vertical intervals of 50 ft (15 m). The slope in the floor area of Phase IV is approximately 10%. The estimated airspace to reach this level of development is 2,299,469 yd^3 (1,759,420 m^3). The final outside slopes will not be steeper than 3 horizontal to 1 vertical.

8.2.6.6 Phase V

At the end of Phase IV, the western side of the East Canyon Area will be graded to tie-in with the final grades of the 1971 Permitted Area, as shown on the Final Cover Grading Plan on Drawing 12. This final development stage will consist of additional fill that will be placed above the Phase III and IV areas. The existing waste and new waste will be separated by a liner system placed over existing waste in the 1971 Permitted Area. The maximum height of the landfill slope will be 560 ft (170 m) CLD. The estimated air space to tie-in the East Canyon Area with the 1971 Permitted Area is approximately 1,713,000 yd^3 (1,310,000 m^3).

8.3 <u>Containment System</u>

8.3.1 General

In general, the proposed East Canyon Area containment system design consists of two different configurations depending on location within the expansion area. These configurations are referred to as the floor area and the side-slope area containment systems. These areas are discussed in summary below and in detail in Sections 8.3.2 through 8.3.5.

The design has been developed to isolate waste from the surrounding environment, and allows for containment, collection, and removal of leachate. The design of the landfill containment system for the expansion area includes the following elements:

- a prepared subgrade of excavated native materials or compacted general fill;
- a capillary break/underdrain system;
- a reinforcement layer for liner over existing waste.
- a composite liner system;
- a leachate collection and removal system (LCRS); and
- an operations layer.

The East Canyon Area containment system is designed in accordance with the state criteria and standards set forth in Title 27 of the CCR, and federal standards set forth in Subtitle D. Both floor and side-slope containment system configurations proposed involve the use of a non-prescriptive composite liner. However, the proposed containment system alternative designs meet or exceed the regulatory requirements, as demonstrated in the following paragraphs.

8.3.1.1 Floor Area

In floor areas of the East Canyon Area, the following components of the containment system are proposed from bottom to top (as shown in Figure 8-1):

- a prepared subgrade of excavated native materials or compacted general fill;
- a 1-ft (0.3-m) minimum thickness capillary break/underdrain system, consisting of granular material which provides a positive barrier to capillary rise and allows for removal of ground water below the composite liner and thus effectively separates ground water from the refuse;
- a 6 oz/yd^2 (200 g/m^2) geotextile separator layer;
- a 1-ft (0.3-m) minimum thickness compacted clay liner (CCL), with a hydraulic conductivity of 1 x 10^{-7} cm/s or less, which acts as a part of the secondary liner

in the composite liner system and thus reduces the potential for leakage or diffusion;

- a geosynthetic clay liner (GCL) which acts as the other part of secondary liner in the composite liner system and reduces the potential for leakage or diffusion;

- a 60-mil (1.5-mm) thick high density polyethylene (HDPE) geomembrane liner over the GCL, which acts as the primary liner in the composite liner system and further reduces the potential for leakage or diffusion;

- a geotextile cushion layer to protect the HDPE geomembrane from granular material in the LCRS;

- a 1-ft (0.3-m) minimum thickness LCRS consisting of a blanket layer of granular material with associated piping to efficiently collect leachate on top of the composite liner system and transmit it to the leachate sump for removal;

- a geotextile filter layer overlying the LCRS to prevent clogging of the drainage material by migration of fines from above; and

- a 24-in. (0.6-m) minimum thickness operations layer to protect the containment system during future waste placement.

8.3.1.2 Side-slope Area

In side-slope areas of the East Canyon Area, defined as areas with slopes from 2H:1V to 10H:1V, the following components are proposed from bottom to top (as shown on Figure 8-2):

- a prepared subgrade of excavated native materials or compacted general fill;

- a geocomposite (geotextile/geonet/geotextile) capillary break/underdrain layer, which provides a positive barrier to capillary rise and allows for removal of ground water below the composite liner and thus effectively separates ground water from the refuse;

- a GCL, with a minimum 30-mil (0.75-mm) thick HDPE geomembrane backing, which acts as the secondary liner in the composite liner system and reduces the potential for leakage or diffusion;

- a 60-mil (1.5-mm) thick HDPE geomembrane liner over the GCL, which acts as the primary liner in the composite liner system and further reduces the potential for leakage or diffusion;

- a LCRS consisting of a geocomposite (geotextile/geonet) to efficiently collect leachate on top of the composite liner system and transmit it to the leachate sump for removal;

- a 24-in. (0.6-m) thick operations layer to protect the containment system from exposure to the elements and during future waste placement.

The following sections describe, in detail, the components of the containment system for both floor and side-slope areas.

8.3.1.3 Side-slope Area Overlying 1971 Permitted Area Waste

In the Phase V area overlying existing waste, the following components are proposed from bottom to top (as shown on Sheet 10 of the Development Drawings in Appendix E-1.

- a prepared subgrade of existing intermediate cover;

- a reinforcement layer which provides mitigation against differential settlement over pre-existing waste fill areas composed of buffer soil or geogrid;

- a subbase layer of select fill material;

- a geocomposite (geotextile/geonet/geotextile) leachate collection layer which allows for removal of leachate from below the liner and thus, effectively separates leachate in existing refuse from new refuse;

- a 60-mil (1.5-mm) thick HDPE geomembrane liner over the GCL, which acts as the primary liner in the composite liner system and further reduces the potential for leakage or diffusion;

- a LCRS consisting of a geocomposite (geotextile/geonet) to efficiently collect leachate on top of the liner system and transmit it to the leachate transmission for removal; and

- a 24-in. (0.6-m) thick operations layer to protect the containment system from exposure to the elements and during future waste placement.

8.3.2 Capillary Break/Underdrain System

8.3.2.1 General

Immediately following establishment of foundation grades in the base and side-slope areas of the East Canyon Area, the capillary break/underdrain system will be constructed. This system will allow for the monitoring of the presence and quality of ground water, if any, immediately beneath the liner system, and for ground-water recovery. The underdrain system is designed to provide the best assurance of detection of a possible release from the landfill. The system will also enable Sonoma County to monitor the performance of the landfill liner system. The underdrain system will be constructed immediately beneath the liner system on the base of the landfill and on side-slope areas.

8.3.2.2 Regulatory Requirements

Section 20240 (c) of Title 27 requires that in order to protect ground-water quality all new landfills should be constructed with a minimum 5-ft (1.5-m) separation between the waste and ground water. The section states that:

"All new landfills, waste piles, and surface impoundments shall be sited, designed, constructed, and operated to ensure that wastes will be a minimum of 5 feet above the highest anticipated elevation of underlying ground water."

Section 20080(b) of Title 27 allows for approval of engineered alternatives.

"Unless otherwise specified, alternatives to construction or prescriptive standards contained in the SWRCB-promulgated regulations of this subdivision may be considered. Alternatives shall only be approved where the discharger demonstrates that:

1) *the construction or prescriptive standard is not feasible as provided in Subsection (c) of this section, and*

2) *there is a specific engineered alternative that (A) is consistent with the performance goal addressed by the particular construction or prescriptive standard, and (B) affords equivalent protection against water quality impairment."*

The proposed design of the East Canyon Area containment system incorporates an engineered alternative to the minimum 5-ft (1.5-m) separation between the highest anticipated ground water and the waste (i.e., the top of the composite liner). For the purposes of the expansion design, "*the highest anticipated ground water*" includes the height of capillary rise over the free ground-water table. Due to the fact that areas of the East Canyon contain shallow ground water including seasonal springs, it is anticipated that ground water may be present near the base grades in many locations. Thus, the proposed containment system design includes the placement of a 1-ft (0.3-m) thick granular blanket in floor areas or a geocomposite drainage layer on side-slope areas, which will serve as the capillary break/underdrain system. This engineered alternative design also includes a provision for ground-water collection and removal beneath the landfill liner by means of a capillary break/underdrain layer discharge pipe which will drain from the sump to an existing unimproved drainage channel south of the East Canyon Area.

The Statement of Reasons for Subchapter 15 indicates that the specific purpose of the 5 ft (1.5 m) separation from underlying ground water is *"primarily to ensure that leachate generation is minimized"* [SWRCB, 1984]. The same source states that *"Alternative equivalent protection methodologies... may be approved by regional boards... despite the potential contact between capillary water and wastes."* An engineered alternative in the East Canyon Area is more economical than the prescriptive 5 ft (1.5 m) separation. An engineered alternative is allowed when the prescriptive design is unreasonably and unnecessarily burdensome, and will cost substantially more than an alternative, which meets performance criteria in accordance with Section 20080(c)(1) of Title 27. In addition, the mere existence of a 5 ft (1.5 m) unsaturated zone does not provide a demonstrable protection to water quality, as recognized in the Statement of Reasons [SWRCB, 1984]. This is due to a potential error in estimating both the top elevation of the saturated zone and capillary rise. On the contrary, the proposed alternative design to the 5-ft (1.5-m) separation, with the capillary break/underdrain system, will ensure that *"the highest anticipated ground water"* will not compromise the integrity of the containment system and, therefore, ensure that leachate generation is minimized.

Waste containment systems have been constructed at several Class II and Class III landfill sites in California which also did not meet the required 5 ft (1.5 m) separation between waste and ground water. These were approved by the CRWQCB due to the fact that those waste containment systems met the performance criteria by implementing capillary break/underdrain systems. These facilities include the Keller Canyon Landfill in Pittsburg, the Vasco Road Sanitary Landfill in Livermore, the Altamont Landfill and Resource Recovery Facility in Alameda County, and the B&J Sanitary Landfill in Vacaville. Due to the controversial location of the Keller Canyon Landfill site, the landfill design, including the engineered alternative to the minimum 5 ft (1.5 m) separation between waste and ground water, was also reviewed by SWRCB and approved. Thus, the use of a capillary break/underdrain system in lieu of the required 5 ft (1.5 m) separation has been approved and successfully constructed on other projects.

In GeoSyntec's opinion, the design of the proposed engineered system affords equivalent or improved water quality protection as compared to the prescriptive standards by:

- providing a positive barrier to capillary rise, effectively separating ground water from the liner;
- providing a means of controlling, collecting, and monitoring ground water migrating beneath the landfill;
- providing a means of first detecting and then removing leachate in the extremely remote event that it penetrates the composite liner; and
- providing an alternative secondary component of the composite liner (geosynthetic clay liner [GCL]) with a hydraulic conductivity at least a hundred times less than the Title 27 and Subtitle D prescriptive standards.

The following sections describe the details involved with the proposed capillary break/underdrain system.

8.3.2.3 System Description

Floor Areas

After base grading and subgrade preparation for the phases of the expansion area, the capillary break/underdrain system will be constructed. The system will consist of a 1-ft (0.3-m) thick granular material placed as a blanket drain over the floor area. This system will prevent ground water from rising to the containment system due to capillary forces, and will allow for ground-water recovery and the monitoring of the presence and quality of ground water immediately beneath the liner system. Figure 8-3 shows the location of the capillary break/underdrain layer within the overall containment system.

The required drainage capacity of the capillary break/underdrain system will be evaluated in the design report prior to construction . This will involve evaluating peak ground-water inflow and specifying the required granular material hydraulic conductivity and checking that the proposed thickness is sufficient. This will assure that any ground water which rises to the capillary break/underdrain system will be intercepted and quickly flow through the drainage layer to the underdrain collection sump and discharge pipe for removal. In addition, specifying a granular material graded to be self-filtering, such as Caltrans Class II permeable, or a geotextile filter may be desirable to prevent potential clogging.

Side-Slope Areas

In general, a capillary break/underdrain system is needed over the entire expansion area since the separation between the containment system base grades (and thus waste) and the maximum anticipated ground water (including the capillary rise) is less than 5 ft (1.5 m) in most of the areas. Therefore, it is proposed to install the capillary break/underdrain system over both the floor and side-slope areas, but excluding the portion of the expansion that overlies the 1971 Permitted Area fill. The underdrain will terminate in the anchor trench between the existing and new waste areas.

The side-slope system will consist of a double-sided geocomposite (geotextile/geonet/geotextile). The required geonet transmissivity and filter geotextile properties will be evaluated in the design report prior to construction. Figure 8-2 shows a section through the side-slope containment system with the geocomposite layer shown.

As discussed in USEPA's *Background Document on the Liner and Leak Detection Rule* [USEPA, 1987a], the hydraulic transmissivity and hydraulic conductivity of geonet drainage layers are primarily a function of overburden compressive stress, boundary conditions (i.e., the materials above and below the geonet), and hydraulic gradient. The hydraulic transmissivity decreases as the hydraulic gradient decreases and the compressive stress increases. The maximum height of waste over the capillary break/underdrain system (i.e., geocomposite) in the landfill expansion will be approximately 230 ft (70m). This height corresponds to an overburden stress of approximately 11,500 psf (550 kPa) applied to the underdrain system, assuming an average unit weight of waste and cover materials of 50 pcf (7.8 kN/m^3). The geocomposite will be designed to provide sufficient capacity to handle the anticipated water flow at the maximum overburden stress.

The geonet will be bonded to a geotextile filter on its bottom and top sides. The proposed geotextiles will be made of polyethylene or polyester while the geonet will be constructed of HDPE.

Perforated Pipe

Perforated HDPE pipes will be located along the floor and will collect water from the underdrain. layer. These lateral pipes will discharge to the main collection pipe located along the centerline of the landfill base. This pipe will convey groundwater to the underdrain sump. The main drain pipe will also include cleanout pipes at either end.

Underdrain Sump

A capillary break/underdrain system sump is proposed for collection and removal of ground water. The sump is designed to be the lowest point in the expansion area and, therefore, is directly below the LCRS sump. An approximate location of the underdrain sump within the landfill expansion footprint is shown on Drawing 3. A detail of the sump is shown on Figure 8-3.

The sump will be approximately 20 x 20 ft (6 x 6 m) in plan dimensions and up to 2-ft (0.6-m) in depth. The sump will be filled with granular material having a hydraulic conductivity large enough to allow rapid removal of ground water.

An HDPE discharge pipe will begin at the low point of the sump. The pipe will be sloped away from the sump beneath the toe berm and extend to a termination point at the proposed sedimentation basin. The pipe will have a perforated section at its inlet within the sump and will be solid-walled pipe for the rest of its length.

New Waste/Existing Waste Interface

An effective barrier will be constructed at the interface between the East Canyon expansion and the existing waste. This barrier is to prevent landfill gases and leachate from the 1971 Permitted Area from migrating into and impacting the groundwater in the East Canyon Area. The interface area between the new and existing waste is detailed in Drawing 10 of 13 in Appendix E-1. The cutoff will consist of a trench excavated into native material backfilled with permeable gravel to act as a French drain. Two perforated HDPE pipes one on top of the other will be placed in the trench. The lower pipe will collect and transmit the leachate and the upper pipe will collect and transmit the landfill gases. The trench will be lined with an HDPE geomembrane to further prevent the migration of leachate and landfill gases toward the east canyon area. The leachate collection geocomposite beneath the liner over existing waste will come down the slope and terminate in the gravel filled cutoff trench. Leachate migrating from the existing waste will be collected by the geocomposite and transmitted to the cutoff trench and away from East Canyon. The liner system over the bench for the access road between the new and existing wastes will consist of the HDPE liner over compacted fill. With the cutoff trench and compacted fill the migration of leachate and landfill gases from the existing waste into East Canyon should be minimal.

8.3.2.4 Construction Considerations

Underdrain

The underdrain system drainage layer for the floor area will be constructed using coarse, granular material such as sand or gravely sand. Placement of this material will be controlled to avoid damaging the embedded HDPE pipes. A geocomposite underdrain will be installed on the sideslopes. The pressure applied by construction equipment will be minimized to the extent possible by using low ground pressure construction equipment. Construction drawings, specifications, and CQA plans developed for each phase of the landfill will contain detailed requirements for protection of the HDPE pipes during placement of the drainage layer.

The proposed design of the underdrain system has been dictated by the configuration of the landfill and by the hydrogeologic conditions of the site. However, the actual extent and configuration of the underdrain system will be defined, based on field observations, such as additional seeps, during excavation.

Containment System Terminations

Containment systems will be constructed for each phase of the landfill expansion. Drawings 9 and 10 show typical containment system terminations between the phases.

8.3.3 Composite Liner

8.3.3.1 Introduction

Based upon the present regulations, currently available geosynthetic materials, engineering analyses, and GeoSyntec's experience in liner design, an alternative to the prescriptive composite liner configuration is proposed for the East Canyon Area.

In general, two alternative secondary component composite liner systems are proposed for use in the floor and side-slope areas of the East Canyon Area. On the floor areas, the prescriptive configuration of a 2-ft (0.6-m) thick CCL secondary liner component is replaced with a 1-ft (0.3-m) thick CCL and an overlying GCL. On the side-slope areas, a 2-ft (0.6-m) thick CCL is replaced with a GCL only. The advantages of a GCL in these areas include the relative ease of construction versus compacting soil on side-slopes and the GCL's higher resistance to differential settlement than a CCL. The following sections describe the configurations in detail.

A non-woven geotextile cushion will be placed directly on the HDPE geomembrane component of the composite liner in the floor areas of the landfill. The purpose of the non-woven geotextile cushion is to protect the geomembrane during placement of the overlying granular LCRS.

8.3.3.2 Regulatory Requirements

Federal Requirements

Federal requirements for liner systems at non-hazardous solid waste landfills are contained in §258 of Subtitle D promulgated on 9 October 1991. Many of the provisions of Subtitle D, including the provisions for liner configuration, must be complied with as of 9 October 1993. The federal requirements allow the owner or operator of a facility to select a liner system design on the basis of a prescriptive minimum construction standard or a performance criterion.

The prescriptive minimum standards require that a non-hazardous solid waste landfill be constructed:

"(a)(2) With a composite liner, as defined in paragraph (b) of this section and a leachate collection system that is designed and constructed to maintain less than a 30-cm depth of leachate over the liner" (§258.40(a)(2)).

"(b) For purposes of this section, composite liner means a system consisting of two components; the upper component must consist of a minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1 x 10^{-7} cm/sec. FML components consisting of high density polyethylene (HDPE) shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component" (§258.40(b)).

The performance criterion in the federal requirements calls for new landfills to be constructed:

"(a)(1) In accordance with a design approved by the director of an approved State or as specified in §258.40(e) for unapproved States. The design must ensure that the concentration values listed in Table 1 of this section will not be exceeded in the uppermost aquifer at the relevant point of compliance, as specified by the Director of an approved State under paragraph (d) of this section" (§258.40(a)(1)).

State Requirements

State Water Resources Control Board (SWRCB) policy with respect to state implementation of Subtitle D requirements is contained in Resolution No. 93-62, dated 17 June 1993, and issued 7 July 1993, entitled *"Policy for Regulation of Discharges of Municipal Solid Waste".* Section III.A of the policy provides the following requirements for containment systems constructed after the 9 October 1993 effective date of the Subtitle D regulations:

"1. ***Post Federal Deadline Construction** - Except as provided in either III.A.3 (for steep side slopes) or III.A.2 (for new discharges to pre-existing liners), after the Federal Deadline, all containment systems shall include a composite liner that consists of an upper synthetic flexible membrane component (Synthetic Liner) and a lower component of soil, and that either:*

*a. **Prescriptive Design**:*

*i. **Upper Component** - Synthetic Liner at least 40-mils thick (or at least 60-mils thick if of high density polyethylene) that is installed in direct and uniform contact with the underlying compacted soil component described in paragraph III.A.1.a.ii; and*

*ii. **Lower Component** - Has a layer of compacted soil that is at least two feet thick and that has a hydraulic conductivity of no more than 1 x 10-7 cm/sec (0.1 feet/year); or*

*b. **Alternative Design** - Satisfies the performance criteria contained in 40 CFR § 258.40(a)(1) and (c), and satisfies the criteria for an engineered alternative to the above Prescriptive Design (as provided by Title 27 CCR Section 20080(b)), where the performance of the alternative composite liner's components, in combination, equal or exceed the waste containment capability of the Prescriptive Design."*

The CRWQCB outlines its liner requirements in Order No. 93-83, dated 22 September 1993. These regulations implement SWRCB regulations exactly as described earlier and thus are not discussed further herein.

8.3.3.3 Floor Area

General

The prescriptive design is the minimum construction standard described in the federal and state regulations discussed in the previous section. Specifically, the prescriptive liner design includes a composite liner system consisting of a lower component of compacted soil at least 2-ft (0.6-m) thick, with a hydraulic conductivity of 1 x 10^{-7} cm/s or less and an upper component of a geomembrane at least 40-mil (1-mm) thick (60-mil (1.5-mm) thick, if HDPE). However, the state and federal regulations allow for alternative design of the composite liner. Therefore, it is proposed to use a GCL as replacement for a 1 ft (0.3 m) thickness of the CCL in a floor liner system.

In the report titled "*Draft Preliminary Report, East Canyon Expansion, Central Landfill, Sonoma County, California*" by GeoSyntec Consultants [GeoSyntec, 1995] an equivalency comparison between a 2-ft (0.6-m) thick CCL and a GCL was performed. Using a GCL with geotextile backing as an alternative liner, the results of analyses showed that leakage rates will be about one-half of those of the prescriptive design under assumed identical conditions. In addition, for GCL with geomembrane backing which is planned for the sideslopes, and possibly the base as well, much lower leakage rates are anticipated since the geomembrane hydraulic conductivity is on the order of 1 x 10^{-12} cm/s [Haxo et al., 1982].

Furthermore, GCL has been approved in place of a 1-ft (0.3-m) thickness of a 2-ft (0.6-m) thick CCL on floor areas at other California sites, (e.g., B&J Drop Box Sanitary Landfill in Solano County). Therefore, the proposed liner configuration for the expansion floor areas consists of the following components:

- a 1-ft (0.3-m) minimum thickness of low-permeability CCL, with a maximum hydraulic conductivity of 1 x 10^{-7} cm/s;

- a GCL consisting of either a geotextile carrier type or with an HDPE geomembrane backing;

- a 60-mil (1.5-mm) thick HDPE geomembrane liner, textured on both sides; and

- a geotextile cushion layer (to protect the geomembrane from LCRS granular material).

Figure 8-1 illustrates the various components of the floor composite liner system. The components are described in detail below.

Low-Permeability Soil Liner

GeoSyntec understands that on-site low-permeability soils may be available which are potentially suitable for liner construction. However, previous work has indicated that the relatively high moisture contents needed may make the on-site material difficult to consistently obtain satisfactory results. A borrow evaluation of available soils should be performed during future design stages. As a minimum, the evaluation should include laboratory testing of the soil at varying moisture contents and relative densities. In general, clayey material for the CCL component of the containment system must meet the following criteria (Section 20320(d) of Title 27):

- minimum 30% by weight passing the U.S. #200 sieve; and
- fine grained soils classified as SC (clayey sand), CL (lean clays), and CH (fat clays) by the Unified Soil Classification System (USCS).

However, suitable material must also meet the compacted hydraulic conductivity requirement of no greater than 1×10^{-7} cm/s. Therefore, if suitable on-site soils are not available, on-site soils may require amendment or imported low-permeability soils will be employed.

Geosynthetic Clay Liner

A GCL is a manufactured product consisting of a geosynthetic material which has a relatively thin layer (0.25-in. (5-mm) thick, typically) of bentonite glued, stitch-bonded, or needle-punched to a geosynthetic material. A GCL is basically a layer of bentonite which is held on or between carrier geotextiles or may be glued to a geomembrane. Bentonite is a unique clay mineral which, when wetted, is the least permeable naturally occurring soil mineral.

There are four major manufactured products currently available and these are known as *Bentomat*, *Bentofix*, *Claymax*, and *Gundseal*. The four GCL products can be classified into two basic groups. The first group includes *Bentomat, Bentofix, and Claymax,* which consist of bentonite and geotextile carrier layers on top and bottom of the bentonite layer. The second group includes *Gundseal,* which consists of bentonite glued to a geomembrane. All four products were investigated for this report.

Either type of GCL is proposed in place of 1 ft (0.3 m) of the prescriptive 2-ft (0.6-m) thick CCL on the landfill expansion floor. The choice of which type should be employed should be evaluated during later design stages.

Geomembrane Component

A 60-mil (1.5-mm) thick HDPE geomembrane will be used as the upper component of the composite liner in the floor areas of the expansion. It will be installed directly on the GCL. HDPE geomembrane surfaces will be textured on both sides. Texturing is being used as a means of increasing slope stability by increasing interface friction. HDPE has been selected as the geomembrane material because of its resistance to attack by MSW leachate, its good ultraviolet light stability, its excellent durability and seaming characteristics, ability to be manufactured with a rough texture, its availability, and its wide use at landfill facilities in the United States and elsewhere. HDPE is commercially available from several qualified suppliers. HDPE geomembranes are manufactured in rolls of various widths and lengths.

The HDPE geomembrane will undergo contraction and expansion under the temperature variations anticipated at the site during construction. Specific measures to reduce these effects will be addressed in the later design stages. These measures may include nighttime construction during periods of high temperatures, restrictions on seaming operations, use of HDPE geomembranes with white surfaces, and placement of geotextiles, LCRS gravel and protective cover placement as soon as reasonably possible after HDPE geomembrane installation. Access over areas where HDPE geomembrane has been installed will be restricted until the overlying non-woven geotextile cushion and LCRS gravel are in place to reduce the potential for material damage.

Geotextile Cushion

An 8 oz/yd^2 geotextile cushion will be placed over the HDPE geomembrane in the floor areas of the expansion to protect the geomembrane from puncture due to the placement of the overlying LCRS gravel. The geotextile cushion will likely be non-woven, UV-stabilized polypropylene or polyester material. Geotextile cushion material will be delivered to the site in rolls and will be deployed in a manner similar to HDPE geomembrane. Deployment procedures will be specified in later design work and will cover overlaps and adjacent roll connection methods.

The puncture resistance of the cushion has been evaluated using the Geosynthetic Research Institute (GRI) design method. This empirical equation is applicable to non-woven needle punched geotextile cushion materials directly in contact with an HDPE geomembrane overlain by granular drainage stone [GRI, 1994]. For a site specific drainage material and overburden pressure, the design method evaluates the required mass per unit area of a non-woven needle punched geotextile cushion material. The method accounts for overburden pressure, angularity of drainage material, and duration of the applied pressure. Calculations are presented in Appendix F-1.

8.3.3.4 Side-Slope Areas

As shown on Drawing 3, the base grading will create side-slope area slopes varying in steepness from 2.5H:1V to as flat as 10H:1V. These areas have relatively steep slopes, which will convey leachate in the LCRS more rapidly than on the landfill floor areas. The composite liner configuration proposed thus involves a replacement of the CCL with a GCL. This is an acceptable alternative as the ability of the liner to prevent leakage through this component exceeds that of the prescriptive design. The composite liner over the side-slopes will consist of the following:

- a GCL with a 30-mil (0.75-mm) thick textured HDPE geomembrane carrier facing down; and

- a 60-mil (1.5-mm) thick HDPE geomembrane, textured on both sides.

Figure 8-2 illustrates details of the side-slope composite liner. The individual components are discussed below.

Geosynthetic Clay Liner

A *Gundseal* type GCL, overlying a capillary break/underdrain system, is proposed in place of the prescriptive 2-ft (0.6-m) thick CCL on the landfill side-slopes. The proposed GCL will consist of bentonite attached to a minimum thickness of 30-mil (0.75-mm) thick textured HDPE geomembrane. Although the potential for hydration of the bentonite is extremely low, a geomembrane backing material is proposed for side-slope areas to ensure that the containment system is stable.

Geomembrane Component

A 60-mil (1.5-mm) thick HDPE geomembrane will be used as the upper component of the composite liner in the side-slope areas of the expansion. It will be installed directly on the GCL. HDPE geomembrane surfaces will be textured on one side. Texturing is being used as a means of increasing slope stability by increasing interface friction.

8.3.3.5 Containment System Redundancy

The combination of the composite liner and the underdrain layer below the landfill will provide a significant level of containment system redundancy in these areas. In the sump area of the landfill, a total of four low-permeability layers will be installed (two geomembranes, GCL, and compacted soil liner). This level of containment significantly exceeds state and federal regulatory requirements.

8.3.3.6 Construction Considerations

General

Detailed procedures for construction of the composite liner will be presented in the construction drawings and specifications developed for each phase of landfill development. Likewise, a detailed description of the quality control and quality assurance procedures that will be employed at the East Canyon Area will be provided in the CQA plan developed for each phase. A general description of the construction procedures that will be detailed in these documents is provided below.

Geotextile Filter

Prior to placement of the compacted clay liner component of the composite liner, a geotextile filter will be placed over the granular underdrain layer. Adjacent rolls of geotextile filter material will be overlapped at least 6 in. (15 cm) and sewn together. Geotextile filters will likely be manufactured from UV light-stabilized polypropylene or polyester.

Compacted Clay Liner Component

As previously described, the clay liner will be placed on top of the geotextile filter in all areas of the landfill with an underdrain drainage layer. Soil will be placed in thin lifts, moisture conditioned to at least optimum moisture content, and compacted. Soil will be compacted to achieve a relative compaction of at least 90% of the maximum dry density obtained from the modified Proctor compaction test (ASTM D 1557). Actual target moisture contents and densities for clayey soil will be established in a pre-construction laboratory and field testing program, the results of which will be incorporated into the construction specifications. The surface of the soil liner will be rolled smooth and will be free of protrusions that could damage the overlying HDPE geomembrane.

During and after construction, the compacted clay liner will be protected from drying. Specific measures will be defined in the construction specifications. These measures may include periodically wetting the soil material and/or temporarily placing additional protective layers such as soil, plastic sheeting, or sealants on top of the compacted clay liner to prevent evaporation and to moderate temperatures. The project CQA plan will require that any observed significant drying and damage of the compacted clay liner be corrected prior to installing the overlying HDPE geomembrane. Other measures may include, if needed, night-time construction during periods of high temperatures, and placement of LCRS gravel and protective cover as soon as reasonably possible after HDPE geomembrane installation.

Geomembrane Component

HDPE geomembrane will be placed in all areas of the landfill that will underlie waste. The HDPE geomembrane will be installed directly on the compacted clay liner.

HDPE geomembrane will arrive at the site in rolls and will be deployed by unrolling the material from the top of the slope. The rolls are typically suspended from a loader or tractor using an A-frame assembly to facilitate the unrolling process. Adjacent HDPE geomembrane panels will be overlapped at least 2 in. (5 cm) and seamed. Fusion seams will be used wherever possible. Extrusion seams will be used wherever fusion seaming is not possible. Seams will be aligned in a down slope direction wherever possible. HDPE geomembrane panels on side slopes will be anchored at the top of each side slope level.

The HDPE geomembrane will undergo contraction and expansion under the temperature variations anticipated at the site during construction. Specific measures will be contained in the construction specifications to control temperature effects. These measures may include nighttime construction during periods of high temperatures, restrictions on seaming operations, using HDPE geomembranes with white surfaces, and placement of LCRS gravel and protective cover as soon as reasonably possible after HDPE geomembrane installation.

To minimize the potential for material damage, access over areas where HDPE geomembrane has been installed will be restricted until the overlying non-woven geotextile cushion and LCRS gravel are in place.

Geotextile Cushion

A geotextile will be placed over the uppermost HDPE geomembrane in all areas of the landfill to protect the geomembrane from puncture by overlying LCRS gravel. Geotextile cushions will likely be non-woven, UV-stabilized polypropylene or polyester materials. Geotextile cushion material will be delivered to the site in rolls and will be deployed in a manner similar to HDPE geomembrane. Adjacent rolls of geotextile cushion materials will be overlapped. Adjacent rolls will be sewn together unless otherwise indicated in the specifications.

8.3.4 Leachate Collection and Removal System (LCRS)

8.3.4.1 General

The expansion area containment system design incorporates an LCRS immediately above the composite liner as shown on Figures 8-1 and 8-2. The LCRS is designed to allow for the rapid conveyance of leachate to the LCRS sump. The blanket LCRS drainage layer will have a minimum bottom slope of 2% in floor areas so that leachate will flow by gravity through the granular material to the collection piping and/or LCRS sump. The main collection piping will also be sloped at a minimum of 1.5% to the sump. At the sump, the leachate will be removed from the landfill by pumping through an HDPE riser pipe. Leachate removed from the LCRS sump will be pumped to either leachate pond located to the southwest of the sump, in accordance with the current Leachate Management Plan, contained in the SWPPP (Appendix C-2).

As shown in Figure 8-3, the LCRS system will be composed of a blanket granular drainage layer (floor) or geotextile filter/geonet composite (side-slope), sump, HDPE collection piping and sump riser, and a submersible pump within the sump. The slope, thickness, and hydraulic conductivity of the LCRS drainage layers have been designed to prevent the buildup of hydraulic head on the liner of more than 1 ft (0.3 m) and to accommodate more than twice the anticipated daily peak flow volume as required by the regulations. The estimated maximum leachate generation was calculated using a water balance type analysis provided in USEPA's Hydrologic Evaluation of Landfill Performance (HELP) model. The program uses climatological, soil, and design data to produce daily estimates of water movement into, through, and out of the landfill. A detailed discussion of the analysis is in Section 9 of this JTD. Results of the analysis are in Appendix F-2.

The LCRS system has been designed to function without clogging and with clean-out and test pipes so that it can be tested annually. As demonstrated in the following subsections, the leachate collection sump is designed to reduce the hydraulic head required for pump operation, and a submersible pump will be capable of removing twice the maximum anticipated leachate volume. Other considerations which have been addressed in the design include the ability of the piping to resist collapse and the ability of the LCRS sump pump of efficiently removing twice the maximum anticipated flow volume and conveying it to the new leachate pond.

The following subsections of this JTD describe regulatory requirements, leachate generation design criteria, system components, and construction considerations relative to the LCRS.

8.3.4.2 Regulatory Requirements

Federal Requirements

Minimum federal requirements for the LCRS, presented in 40 CFR §258.40 (Subtitle D), are:

> *"New MSWLF units and lateral expansions shall be constructed: ...With a leachate collection system that is designed and constructed to maintain less than a 30-cm depth of leachate over the liner"* (§ 258.40(a)(2)).

It will be shown in this JTD that the LCRS for the East Canyon Area meets this applicable federal regulation.

State Requirements

Minimum state requirements for the LCRS are contained in Section 20340 of Title 27 and are presented below.

> *"Leachate collection and removal systems are required for Class III landfills which have a liner...."* (Section 20340[a]).

> *"...where an LCRS is used, it shall be installed immediately above the liner, and shall be designed, constructed, maintained, and operated to collect and remove twice the maximum anticipated daily volume of leachate from the Unit"* (Section 20340(b)).

> *"The RWQCB board shall specify design and operating conditions in WDRs to ensure that there is no buildup of hydraulic head on the liner. The depth of fluid in the collection sump shall be kept at the minimum needed to ensure efficient pump operation"* (Section 20340(c)).

> *"LCRSs shall be designed and operated to function without clogging through the scheduled closure of the Unit and during the post-closure maintenance period. The systems shall be tested annually to demonstrate proper operation..."* (Section 20340(d)).

> *"LCRSs shall consist of a permeable subdrain layer which covers the bottom of the Unit and extends as far up the side as possible, (i.e., blanket-type) ... The LCRS shall be of sufficient strength and thickness to prevent collapse under the pressures exerted by the overlying wastes, waste cover materials, and by any equipment used at the waste management Unit"* (Section 20340[e]).

The LCRS designed for the East Canyon Area meets these minimum state requirements.

8.3.4.3 Leachate Generation

In order to design the LCRS, potential leachate generation rates were evaluated. The estimation of potential leachate generation rates is based on computer simulations using the USEPA two-dimensional water balance model HELP, version 3.04a [Schroeder, 1994a & b], on information in the technical literature, and on site-specific observation in East Canyon Area.

In the leachate generation analyses, three cases were examined:

- during operation of a phase, with 30 ft (9 m) of waste and 6 in. (15 cm) of daily cover;
- at the end of a phase, with 100 ft (30 m) of waste and 12 in. (30 cm) of interim cover; and
- after closure, with 200 ft (61 m) of waste and final cover.

The East Canyon Area consists of both floor areas and side-slope areas. The floor area is present only in Phase I and side-slope areas are present in all five phases. Accordingly, separate HELP model analyses were performed for each of the Phase I through IV areas, to evaluate the leachate generation during each of the above-mentioned cases. Because the Phase V area is within the 1971 Permitted Area and leachate collected in this area will be collected and transmitted to the existing leachate system prior to reaching the East Canyon Area, no HELP analyses were completed for this area. The approximate sizes of the different areas and the slopes at their bases and tops were obtained on the basis of the phase development plans and are shown in Table 8-2.

The floor area of Phase I will have a base area with an average slope of 2%. The slope at the top of this area (following waste placement) will be approximately 5%, according to the Phase Development Plans. The slopes at both the base and the top for the side-slope areas of Phase I will be between 3H:1V and 4H:1V. Accordingly, an average slope of 30% was used for this area during HELP model analyses. The remaining phases will not include any floor areas. The slopes of the side-slope areas of the different phases at the base level and at the top were also obtained on the basis of the phase development plan. The information presented in Table 8-2 was used as input for the HELP model analyses.

Table 8-2
FLOOR AND SIDE-SLOPE AREAS FOR PHASES I THROUGH IV
EAST CANYON AREA, SONOMA LANDFILL

	Phase I			Phase II			Phase III			Phase IV		
	Area	Slope (%)		Area	Slope (%)		Area	Slope (%)		Area	Slope (%)	
	(acres)	base	top	(acres)	base	top	(acres)	base	top	(acres)	base	top
Floor Area	3	2	5	-			-			-		
Side-slope Area	11	30	30	7.8	40	30	7.7	10	30	10.3	10	25
Total Area	14			7.8			7.7			10.3		

The analyses were performed using climatological data synthesized to suit the conditions at the Sonoma landfill site. For this purpose records of monthly maximum and minimum temperature and normal precipitation for Sonoma obtained from the National Oceanic and Atmospheric Administration [NOAA, 1992] were entered into the HELP model. The values for remaining climatological data (e.g. the evapotranspiration and solar radiation) were taken from the HELP model's default settings for San Francisco, California.

The leachate generation analyses are presented in Appendix F-2 of the Engineering Analyses section of this report. The period during operation (with 30 ft [9 m] of waste and 6-in. [15-cm] thick daily cover) was found to be the most critical in terms of the volume of peak daily flow in the LCRS. The floor area LCRS has been designed to collect and remove twice the total anticipated peak daily volume of leachate generated in the entire Phase I area (floor and side-slope). This has been done to ensure that the floor area LCRS has sufficient capacity to carry not only the leachate generated within the floor area itself, but any additional leachate generated in the side-slope area of Phase I. The side-slope area of Phase II was found to generate the largest anticipated peak daily volume of leachate, among all the side-slope areas. Therefore, two times this volume was used in the design of the side-slope LCRS geocomposite for all side-slope areas.

The leachate generation rates estimated using the HELP model are expected to be higher than the actual leachate generation rates at the East Canyon Area, since experience indicates that the HELP model typically overestimates leachate generation rates by a significant amount [Lane et al, 1992]

8.3.4.4 Floor Areas

Leachate that percolates through the waste to the floor will be intercepted by the LCRS drainage layer. This layer will be located immediately above the composite liner over the entire floor area (Figure 8-1). Leachate collected in the drainage layer will flow by gravity to the drainage pipes and the sump. The sump will be equipped with an HDPE riser pipe containing a submersible pump capable of pumping leachate to the new leachate pond.

Potential for clogging of the LCRS drainage, which could potentially impair performance, will be limited by the fact that the system has been designed conservatively. In addition, several positive features have been incorporated into the design to control the potential for clogging. These include: (i) a minimum 2% floor slope in the LCRS and a LCRS granular material with a minimum hydraulic conductivity of 1 cm/s, which will result in relatively high leachate flow velocities in the LCRS; (ii) a geotextile filter above the LCRS gravel; (iii) HDPE leachate collection pipes along the floor areas sloped at a minimum of 1.5% to collect and rapidly convey leachate to the LCRS sumps; and (iv) a 24-in. (0.6-m) thick operations layer, which will also serve as a filter layer.

The LCRS and associated piping have been conservatively designed. HDPE piping has been chosen because of: (i) the material's compatibility with a wide variety of chemical constituents that could be in leachate; and (ii) its availability in various diameters and wall thickness. The HDPE pipes specified will have sufficient thickness and structural capacity to support the anticipated overburden loads. Pipe capacity has been evaluated assuming that each pipe is installed in an untrenched condition (i.e., positive projecting pipe conditions).

Collection Pipes

It is proposed that perforated HDPE pipe with 6-in. (15-cm) diameter and a standard dimension ratio (SDR) of 17 be used for the collection pipe. Adjacent sections of the pipe can be butt fusion welded together. The collection pipes will have a minimum slope of 1.5% and be located along the floor area centerline. The details regarding the design of the collection pipe are provided in Appendix F-2. The capacity of the collection pipe has been designed to handle twice the anticipated peak daily volume of leachate collected over the entire area of the landfill (Phases I, II, III and IV combined). The estimate for the volume of leachate was obtained from the HELP model analyses following procedures outlined in the previous section. The structural stability of the pipe has been found to withstand the loads generated during initial operation, interim operation and post-closure periods. In all of the above cases adequate factors of safety were obtained through analyses.

Granular Material

The drainage layer on the floor area of the landfill expansion will be composed of a relatively coarse, granular drainage material. The grain size distribution of the material shall be equivalent to the gradation indicated in Table 8-3. The blanket drainage layer will have a minimum slope of 2% to the LCRS collection pipes and sump. These slopes are typical of values used at MSW landfills. The flow capacity of the floor drainage layer is a function of the slope, hydraulic conductivity, and thickness of the granular material. The required capacity has been conservatively selected to exceed the minimum needed to accommodate the design leachate generation rate while limiting the hydraulic head on the liner to less than 12 in. (0.3 m).

Table 8-3
LCRS DRAINAGE AGGREGATE GRADATION REQUIREMENTS
East Canyon Area, Sonoma Landfill

SIEVE SIZE	PERCENT PASSING
3/4" (19 mm)	50 - 100
1/2" (12 mm)	20 - 60
No. 4 (4.75 mm)	0 - 20
No. 200 (0.075 mm)	0 - 5

Geotextile Filter

A geotextile filter is required between the operations layer and the granular material on the floor area to prevent migration of fine-grained soil particles from the operations layer into the LCRS. The location of the filter is shown on Figure 8-1. The geotextile filter located between the operations layer and the LCRS gravel must satisfy three requirements regarding the size of its openings.

- The geotextile filter must have openings which are small enough to retain fine-grained soil particles and prevent them from entering the geonet or gravel, which could result in clogging or flow capacity reduction of the geonet or gravel.

- The geotextile filter must have openings which are large enough to allow leachate to pass through the soil/geotextile interface without significant flow impedance.

- The geotextile filter must have a sufficient number of openings so that the flow across the soil/geotextile interface is not significantly impeded when a relatively small number of openings in the geotextile are blocked.

At the time of this design, information about the gradation of the operations layer soil was not available. However, based on GeoSyntec's experience with geotextile filters, the retention, permeability and clogging criteria for the geotextile filter were evaluated and a non-woven polypropylene geotextile with unit weight of 7 oz/yd^2 (198 g/m^2) was found suitable for use in the floor area. Considerations for survivability of the geotextile were based on criteria accepted for moderate installation condition and high contact stresses [GeoSyntec, 1991b].

8.3.4.5 Side-Slope Areas

Leachate that percolates through the waste to the side-slope areas, including the Phase V area, will be intercepted by the LCRS drainage layer consisting of geosynthetic materials. The LCRS will be located immediately above the composite liner and leachate collected in the drainage layer will flow by gravity to the floor area and the sump. In the side-slope areas, which will have inclinations of between 10H:1V to 2.5H:1V, the LCRS will consist of:

- an HDPE geonet; and

- two geotextile filter layers (which are typically combined with the geonet in a geocomposite material).

The geocomposite will be placed directly on the HDPE geomembrane. The LCRS section for side-slopes is shown on Figure 8-2. The maximum leachate head on the side-slope liner has been designed to be less than the thickness of the geonet and thus less than maximum allowable head criterion set forth by the prescriptive requirements of Subtitle D and Title 27.

The geocomposite will consist of a geonet with a transmissivity sufficient to carry twice the anticipated leachate to be generated. The filter geotextile components of the geocomposite will protect the geonet from the overlying operations soil. These components are discussed below.

Geonet

The geonet will consist of an HDPE material similar to that described for the capillary break/underdrain geonet described in Section 8.3.2.3. The capacity of the geonet is specified by its hydraulic transmissivity, which is primarily a function of overburden compressive stress, boundary conditions (i.e., the materials above and below the geonet), and hydraulic gradient. The geocomposite shall have a minimum flow rate equivalent to 4 gal/min (1×10^{-3} $m^3/m/sec$) measured under a hydraulic gradient of 1.0 following ASTM D 4716. This geocomposite will possess sufficient capacity to handle twice the anticipated peak daily leachate flow (as per the Title 27 requirement). Detailed design of the LCRS geocomposite placed directly over the geomembrane liner is presented in Appendix F-2.

Geotextile Filter

On the side-slope LCRS geocomposite, the geotextiles will be heat bonded to the geonet. The specified geotextile filter will be non-woven, polypropylene or polyester material. The geotextile overlying the LCRS geonet must perform in a manner similar to the geotextile overlying the LCRS gravel as was discussed in Section 8.3.4.2.

8.3.4.6 LCRS Sump and Piping

One sump will be constructed for collection and removal of leachate generated within the East Canyon Area. The sump is designed to be the lowest point in the landfill, as shown on Drawing 3. Details of the LCRS sump are shown on Figure 8-3. The sump will be approximately 20 x 20 ft (6 x 6 m) in plan dimensions and up to 2-ft (0.6-m) in depth. The sump will be filled with coarse granular material with little to no fines having a hydraulic conductivity large enough to allow rapid removal of leachate, approximately 1 cm/sec or greater.

An HDPE side-slope riser, with a nominal diameter of 24 in. (600 mm) will terminate at the low point of the sump. The riser will extend from the sump, up the side slope of the expansion toe berm to a termination point located at the perimeter access road. The riser will have a perforated section at its bottom to allow for the inflow of leachate and will be equipped with a dedicated submersible pump. The pump will operate when sufficient leachate is available for proper pump operation. The LCRS system has been designed to operate with a maximum head of 12 in. (30 cm). Leachate generated will be pumped to the new leachate pond located to the southwest of the expansion area, or in accordance with the current Leachate Management Plan.

One 6-in. (150-mm) diameter solid-wall HDPE riser pipe will be installed adjacent to the LCRS riser pipe to provide access to the LCRS collection pipe. This access is provided as a means to clean-out the leachate collection pipes in the event that they become blocked or clogged, and to allow monitoring of the LCRS. As required by Title 27, the LCRS collection pipes are to be tested annually.

8.3.4.7 Construction Considerations

General

Detailed procedures for construction of the LCRS will be given in the construction drawings and specifications developed for each phase of the landfill. Likewise, a detailed description of the quality control and quality assurance procedures that will be employed at the East Canyon Area will be provided in the CQA plan developed for each phase. A general description of the construction procedures that will be detailed in these documents is provided below.

Floor Area

As described in Subsection 8.5, the LCRS drainage layer on the floor area will consist of LCRS gravel. Construction considerations for the drainage layer material are presented below.

LCRS gravel, with a minimum hydraulic conductivity of 1 cm/s, will be placed on the relatively flat landfill base above the geotextile cushion that will immediately overlie the composite liner. The 12-in. (60-cm) thick layer will be constructed in two lifts. The initial lift will be at least 8 in. (45-cm) thick to protect the underlying composite liner from construction-related damage. To further protect the underlying composite liner, only relatively lightweight construction equipment will be allowed to place the first lift of the material. A geotextile filter will be placed on top of the drainage layer, if necessary, prior to the placement of the operations layer material.

Side-slope Area

As discussed in Section 8.3.4.5, the LCRS layer on the side-slope areas will consist of a geocomposite composed of a HDPE geonet and two geotextile layers. These elements will probably be combined in a manufactured geocomposite, which can be deployed as one layer. The geocomposite will be secured in an anchor trench prior to deployment downslope.

The deployment of the geocomposite on the side-slopes will be monitored by CQA personnel and shall be downslope with minimum overlaps. In general, installation will conform to the manufacturer's recommendations unless otherwise more stringent requirements are indicated in the specifications. Details of deployment will be described in the construction specifications (which will be prepared at a later date) and the CQA plan.

Leachate Collection Sump

One sump will be constructed in the East Canyon Area. The sump will consist of sump gravel, a side-slope riser pipe that is perforated within the sump, a submersible pump, a side-slope leachate collection clean-out riser pipe, and a pipe completion located at the top of the side-slope just beyond the limit of the landfill containment system.

After Phase I liner system construction, the side-slope riser will be installed into the sump. A LCRS leachate collection clean-out riser pipe will also be installed at this time and will be located next to the riser in the sump. An HDPE "rub sheet" will be installed beneath the bottom of the side-slope riser and clean-out pipes. The rub sheet acts as a protective buffer between the riser and the underlying composite liner in case the riser pipe moves during waste filling.

Drainage material will be placed around the perforated portion of the riser and will consist of sump gravel, with a minimum hydraulic conductivity of 10 cm/s. A geotextile filter will be placed between this layer and the overlying operations layer to prevent the migration of fines.

8.4 Operations Layer

An operations layer composed of suitable on-site soil will be placed over the filter geotextile overlying the LCRS layer which will protect the containment system components from degradation due to exposure to the elements. The operations layer will serve as a protective layer prior to refuse placement. Thus, the operations layer will be composed of a minimum of 24-in. (60-cm) thick layer of native soil or rock material, free from deleterious material such as wood, debris or large rock, which could damage the liner system components. It will be placed on the floor area, as well as the side-slope areas.

8.5 Surface-Water Management System

8.5.1 Introduction

The purpose of the surface-water management system developed for the East Canyon Area is to:

- control flows on the landfill surface after the intermediate or final cover has been placed;
- isolate the landfill by diverting surface-water run-off from adjacent areas around the landfill footprint;
- isolate the daily landfill cell, i.e., the active area with exposed waste, by diverting surface-water run-off from landfill areas with intermediate or final cover, and from the adjacent side slopes, away from the active area;
- limit infiltration, inundation, and ponding within the daily landfill cell;

- limit erosion, slope failure, washout, and over-topping of the surface-water conveyance and sedimentation structures; and
- limit erosion of interim (daily and intermediate) and final cover.

The following subsections present: the federal, state and local regulations which pertain to the design; a description of the overall surface-water management system; the methodology which was adopted in the design of the drainage, erosion and sediment control features; and the design configurations for these control features.

8.5.2 Regulatory Requirements

8.5.2.1 Introduction

The design of the surface-water management system for the East Canyon Area complies with the applicable federal, state and county requirements. Federal regulatory requirements pertaining to surface-water drainage contained in Subpart C, Part 258, Title 40 (40 CFR § 258) of the Code of Federal Regulations (CFR) present operating criteria for municipal solid waste landfills. The State of California regulatory requirements for precipitation and drainage controls are contained in Section 20365 of Title 27 of the California Code of Regulations (CCR). County requirements are contained in the Sonoma County Water Agency (SCWA) publication entitled *"Flood Control Design Criteria* " [SCWA, 1983].

8.5.2.2 Federal Requirements

Federal requirements for surface-water drainage controls are contained in 40 CFR §258.26 and §258.27. Applicable federal requirements are presented below.

"*Owners or operators of all MSWLF units must design, construct, and maintain:*

(1) *A run-on control system to prevent flow onto the active portion of the landfill during peak discharge from a 25-year storm;*

(2) *A run-on control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24 hour, 25-year storm*" (§ 258.25).

"*MSWLF units shall not*:

(*a*) *cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirements of the Clean Water Act, including but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to Section 402.*

(*b*) *cause the discharge of a nonpoint source of pollution to waters of the United States, including wetlands, that violates any requirement of an area-wide or State-wide water quality management plan that has been approved under Section 208 or 319 of the Clean Water Act, as amended*" (§ 258.27).

8.5.2.3 State Requirements

Title 27 regulations for precipitation and drainage controls are contained in Sections 20365, 21090, 21150, 21710, and 21750. The regulations for applicable requirements are given below.

"*Units and their respective containment structures shall be designed and constructed to limit, to the greatest extent possible, ponding, infiltration, inundation, erosion, slope failure, washout, and overtopping under the precipitation conditions specified in Table 4.1 (of this article) for each class of waste management unit*" (Section 20365 (a)).

"*Precipitation on landfills or waste piles which is not diverted by covers or drainage control systems shall be collected and managed through the leachate collection and removal system which shall be designed and constructed to accommodate precipitation conditions specified in Table 4.1 of this article for each class of waste management unit*" (Section 20365(b)).

"*Diversion and drainage facilities shall be designed, constructed and maintained: (1) to accommodate the anticipated volume of precipitation and peak flows from surface run-off under the precipitation conditions specified in Table 4.1 of this article for each class of Unit; (2) to effectively divert sheet flow run-off laterally, or via the shortest distance, into the drainage and collection facilities; (3) to prevent surface erosion through the judicious use of: (A) energy dissipaters..; and (B) slope protection and other erosion control measures; (4) to control and intercept* *run-on.; (5) to take into account: (A)..the expected final contours of the closed Unit, including its planned drainage pattern; (B) for operating portions of Units other than surface impoundments, the Unit's drainage pattern at any given time; (C) the possible effects of the Unit's drainage pattern on and by the regional watershed; and (D) the design capacity of drainage systems downstream and adjacent properties by providing for the gradual release of retained water downstream in a manner which does not exceed the expected peak flow rate at the point of discharge if there were no waste management facility; and (6) to preserve the system's function therefore the discharger shall periodically remove accumulated sediment from the sedimentation or detention basins as needed to preserve the design capacity of the system.*" (Section 20365(c)(1-6)).

"*Collection and holding facilities associated with precipitation and drainage control systems shall be emptied immediately following each storm or otherwise managed to maintain the design capacity of the system*" (Section 20365(d)).

"*Surface and subsurface drainage from outside of a waste management unit shall be diverted from the Unit*" (Section 20365(e)).

"*Cover materials shall be graded to divert precipitation from the Unit, to prevent ponding of surface water over wastes, and to resist erosion as a result of precipitation with the return frequency specified in Table 4.1 of this article for each class of Unit... Any drainage layer in the final cover shall be designed and constructed to intersect with the final drainage for the Unit in a manner promoting free drainage from all portions of the drainage layer.*" (Section 20365(f)).

"(1)*(A) closed landfills shall be designed, graded and maintained to prevent ponding and to prevent soil erosion due to high run-off velocities, all portions of the final cover shall have a slope of at least three percent. (1)(B) the RWQCB can allow portions of the final cover to be built with slopes of less than three percent if the discharger proposes an effective system for diverting surface drainage, and preventing ponding in the allowed flatter portion. (2) Areas with slopes greater than ten percent having surface drainage courses and areas subject to erosion by water and wind shall be protected from erosion or shall be designed and constructed to prevent erosion.*" (Section 21090 [b]) "(a) *The drainage and erosion control system shall be designed and maintained to ensure integrity of postclosure land uses, roads, structures: to prevent public contact with waste and leachate; to ensure integrity of gas monitoring and control systems; to prevent safety hazards; and to prevent exposure of waste; and (c) Slopes not underlain by waste shall be stabilized to prevent soil erosion...*" (Section 21150) and

In accordance with Section 21750, the discharger shall provide data for the "*maximum expected 24-hour precipitation for the Unit's design storm (i.e. for storm conditions specified as design criteria for the particular class of Unit as prescribed in Table 4.1 of Article 4, Subchapter 2, Chapter 3, Subdivision 1 of this division)*". (Section 21750[e][3]).

The above-referenced Table 4.1 states that Class III landfills should be designed for a 100-year, 24-hour storm event.

8.5.2.4 County Requirements

Sonoma County requirements for flood control defined by the Sonoma County Water Agency (SCWA) are contained in the publication entitled "*Flood Control Design Criteria*" [SCWA, 1983]. Criteria for the design of open channels and closed conduits in the East Canyon Area are under the category for minor waterways.

Minor waterways which have a drainage area of one square mile of less are required to be designed for an average recurrence interval of 10 years. However, if a secondary or major waterway is placed in a closed conduit, sufficient additional surface routes must be made available to carry the added flow increment up to the 100 year design discharge. When surface routes cannot be made available, the secondary waterway must be designed to carry the 100 year design discharge. Open channels are required to carry design flows, and to have 1.5 ft of freeboard. The freeboard may be less for small natural swales, and creeks through open space such as parks and golf courses, however, the freeboard must be adequate to provide for the reduced capacity due to weed growth and the 100 year design flows within the right-of-way. Minor waterways which are placed into closed conduits shall have entrance conditions such that the 10 year discharge will meet freeboard requirements in the upstream channel, and the 100 year design discharge will also be containable within the banks of the upstream channel. Closed conduits shall also be designed have minimum velocities of 2.5 ft/s to provide self-cleaning action which will prevent siltation.

Requirements for the design of the sedimentation basins were taken from the Association of Bay Area Governments (ABAG) publication *entitled "Manual of Standards for Erosion and Sediment Control Measures"* [ABAG, 1995]. The manual gives requirements for the design of temporary sedimentation basins. More stringent requirements were adopted to allow the basins to be located permanently at the site. The permanent sedimentation basins were designed to accommodate the runoff volume from the 100-yr, 24 hour storm while temporary basins are typically designed to accommodate the 10-year, 6-hour storm. Emergency spillways for the permanent sedimentation basins will be concrete lined, while emergency spillways for temporary basins may be earth-lined. The sedimentation basins for the East Canyon Area are designed to allow sedimentation of silt-sized and larger particles.

8.5.3 Description of the Surface-Water Management System

8.5.3.1 General

The drainage basin of the East Canyon Area is approximately 175 acres in plan. Approximately 120 acres (49 ha) of the drainage basin lie to the north of the expansion area. The expansion area including adjacent drainage area as shown on Drawing No. 2, the site development plan, is approximately 55 acres (22 ha) in plan. Runoff from the drainage area, just north of the site, will be routed into a buried conduit, which will carry the water under the proposed landfill perimeter road into one of the sedimentation basins south of the expansion area. Runoff from the northern slopes of the Central Disposal Site, which lie to the west of the East Canyon Area, will be routed onto the expansion area slopes during the final phase of landfill development. Prior to this phase, all of the surface water from the Central Disposal Site will be accommodated by the existing facilities.

The sequence of landfill development is presented in four phases of development as shown on the waste fill sequence plan on Drawing No. 11. The last development phase is shown on the final cover grading plan on Drawing No. 12.

The construction of Phase I will begin in the eastern half of the canyon. The majority of the floor of the eastern half will be covered during this phase. Runoff from the interim landfill slopes and the remaining undeveloped floor will be captured by ditches lined with erosion control matting at the base of the Phase I development on the west, north, and eastern sides. The exception to this will be along the southeast portion of the perimeter road, which has a slope of approximately 22%. GeoSyntec recommends the use of asphalt, or an equivalent erosion resistant material to counteract the effects of the high tractive forces in this area. As mentioned earlier, runoff from the slopes lying to the north of the expansion area will be routed into the perimeter road and buried conduits which will carry the water to sedimentation basins.

During Phase II, the eastern and northeastern portion of the expansion area will be developed. The ditch which carried runoff from the northern and eastern floor slopes during Phase I will be covered. Runoff from the developed slopes in this area will flow directly into the perimeter road. The remaining water will flow into the ditch on the western side of Phase II.

The northwestern portion of the landfill will be developed during Phase III. The primary modification to the surface water management plan is that approximately half of the ditch along the western side of base of Phase II will be covered. A west to east flowing ditch will be constructed along the base of the southern edge of the Phase III development. The ditch will join with the existing ditch along the western edge of Phase II. Runoff which does not flow into this ditch will flow into the perimeter road.

In Phase IV, the southwestern portion of the landfill will be developed, resulting in complete coverage of the floor of the expansion area. Phase IV runoff will be routed to the perimeter road in the north, south and east. Runoff from the western slopes of the expansion area will flow into the existing road, which lies between the Central Disposal Site and the East Canyon Area. At the end of this phase, the road between the Central Disposal Site and the East Canyon Area will be filled in with waste to tie the two areas together, as shown on the Final Cover Grading Plan on Sheet 12 of the Development Plans. A portion of the runoff from the upper slopes of the Central Disposal Site will be routed through benches into the East Canyon Area and eventually to the perimeter road whose flows will be routed to the sedimentation basins.

For all of the interim phases, benches will be constructed as needed for the control of surface water flows, as well as for landfill access. Runoff from the benches will be routed to ditches at the base of the landfill as needed during each phase.

To the extent possible, the operator will minimize the quantity of runoff, which cannot be routed to the proposed ditches and perimeter road. The current surface water management plan has been designed to assist the operator in achieving this objective. Containment system terminations along the perimeter berm and between phase boundaries were designed so that run-on flows away from the active cell. However, any surface water which comes in contact with exposed waste is considered contact water and will be directed, along with leachate, into the LCRS.

A critical component of the surface-water management system developed for the East Canyon Area is the erosion and sediment control plan. The rationale behind the development of this plan is that by adequately addressing erosion concerns, the magnitude of the sediment problem will be significantly reduced. Even with measures to control erosion, runoff from development areas will inevitably contain elevated levels of sediment; therefore, all runoff from the expansion area will be routed through two sedimentation ponds (hereafter referred to as Sedimentation Ponds 5 and 6) to trap sediments prior to off-site discharge.

The following sections briefly describe the interim and final surface-water drainage controls and erosion and sediment controls comprising the surface-water management system for the East Canyon Area. The design methodology and criteria used for sizing the drainage and sediment control features are described in Section 9 of this JTD.

8.5.3.2 Interim Drainage Control Features

The surface water drainage system for the East Canyon Area will be modified to accommodate the operational needs of the facility during each phase of development. Surface water drainage appurtenances which are not included in the final phase drainage system are referred to as interim drainage control features. As landfilling progresses, final drainage control features will be installed to the extent possible as per the waste fill sequence plan in Drawing 11. Designs for the interim and final drainage controls constituting the drainage system for each construction phase will be included in the construction drawings and specifications.

The following are interim drainage controls for the East Canyon Area surface-water management system:

- interim-cover ditches;
- containment system terminations along the various phases; and
- downchutes.

A brief description of the interim drainage control features follows.

Interim Cover Ditches

The interim cover ditches will be constructed every 50 ft (15.2 m) of vertical height on the 3.2H:1V (H=Horizontal, V=Vertical) interim side slopes in order to reduce the erosion potential along slopes and to control surface water. Water from the ditches will be conveyed by downchute, as necessary, to containment system terminations or to the proposed perimeter road, which is a final phase drainage feature discussed in the next section. Detailed design of the ditches for the interim phases will be completed in the design report prior to construction, however, it is anticipated that the ditches will have minimum slopes of 2% and will be lined erosion control matting such as Curlex II (American Excelsior), to prevent unacceptable levels of erosion.

Containment System Terminations

The containment system terminations will be constructed between Phases I and II, I and III, I and IV, and III and IV. Their purpose will be to intercept runoff, which would otherwise flow into the active landfill. The typical containment system termination will consist of a temporary access road and a drainage ditch sloped at 2%, although there will be steeper portions for small sections to facilitate tie-in with the existing ground. The terminations between all of the phases except along the boundary between Phases I and II will consist of a 12-ft (3.6-m) wide road and a 2-ft (0.61-m) deep, erosion matting lined v-ditch with 2H:1V sideslopes. The containment system termination along the boundary between Phases I and II will consist of a 10-ft (3-m) wide road and a 2-ft (0.61-m) deep, erosion matting lined v-ditch with 2H:1V sideslopes. For each phase, runoff from the waste slopes and the undeveloped floor will be routed to the containment system termination ditches. The water in these ditches will then be routed to the perimeter road, or into the existing road along the western side of the expansion area (for Phase IV only, as shown on Drawing 12). Some areas of the containment system termination ditches will contain erosion resistant material, at the outlets for downchute pipes carrying flow from the interim cover ditches.

Downchutes

Temporary downchutes will be installed as necessary to convey water from the interim cover ditches to the containment system terminations. Erosion resistant material will be placed at the pipe outlets.

8.5.3.3 Final Drainage Control Features

The final cover drainage control system will be completed when the landfill reaches the ultimate configuration as shown in Drawing 12 in the Development Plans. Final drainage control features will be installed to the greatest extent possible during development of the landfill.

The following are final drainage control features for the East Canyon Area surface water management system:

- final cover system drainage terraces;
- perimeter road drainage ditch;
- downchutes; and
- buried conduits.

In the final landfill configuration, surface water on the final cover will flow to the final cover benches. Infiltration of the flow into the landfill will be significantly reduced by the proposed geomembrane and low-permeability barrier layer of the final cover, system shown in Drawing 13. The perimeter road ditch will capture runoff from some of the lower final cover benches, and from the lower slopes of the landfill. The remaining runoff, primarily from the upper slopes, will be routed from the final cover benches into downchutes, which will discharge into conduits flowing directly to Sedimentation Ponds 5 and 6. The perimeter road will have three drop inlet points. The first point will be located at the top of the road and will capture runoff from the upper slopes and the perimeter road. Flows into this drop inlet will be routed into a 48-in. (1.2-m) diameter buried conduit, which will also carry runoff from the slopes to the north of the East Canyon Area. This conduit will discharge to Sedimentation Pond No. 5. The second drop inlet will be located in the southeastern section of the perimeter road just above Sedimentation Pond No. 5. This inlet will capture runoff coming from the road and the slopes along the eastern portion of the landfill, and will be routed to the 48-in. (1.2-m) diameter conduit carrying flows to Sedimentation Pond No. 5. The final drop inlet will be located in the southern portion of the perimeter road just above Sedimentation Pond No. 6. This drop inlet will capture flows from the lower slopes in the southern portion of the landfill, and will be routed to a 36-in. (0.9-m) diameter buried conduit which will also be carrying flows from the upper slopes of the landfill to Sedimentation Pond No. 6. Each sedimentation pond will have a principal and an emergency spillway. Detained surface water from each pond will ultimately be discharged to a natural drainage way, which will carry the flows offsite. A brief description of the final cover drainage controls follows.

Final Cover System Surface Water Drainage Terrace

The final cover system surface water drainage terraces will be constructed on the final side slopes and will intercept and convey runoff on the final cover to the perimeter road or downchutes. The drainage terraces will be constructed by sloping the bench at approximately 5% towards the side slope, as shown in Drawing 13, and creating a slope of approximately 2% along the alignment (some of the terraces will have steeper slopes at 3 to 4%, along boundaries where they are being integrated with the existing surface water drainage system for the Central Disposal site.) Drainage terraces will be lined with erosion control matting such as Greenstreak Pec-Mat, or equivalent, to prevent unacceptable levels of erosion.

Perimeter Road Drainage Ditch

The perimeter road drainage ditch will be located along the outside edge of the East Canyon Area perimeter road and will convey flows from an approximate elevation of 380 ft (116 m) CLD in the north to 250 ft (76 m) in the south at a slope of approximately 2%. By routing the majority of the runoff from the slopes of the East Canyon Area into downchutes, the size of the perimeter road drainage ditch was able to be minimized, while still allowing the ditch to have adequate capacity to carry flows for the final and interim phases. Drawing 8, containment system details, shows a cross-section of the perimeter road with the drainage channel. The channel will be appropriately lined to prevent the flow from causing unacceptable levels of erosion.

Downchutes

Downchutes will be corrugated metal pipes (or equivalent) which will convey flows from the surface water drainage terraces to the final cover slopes. Downchutes will be at two locations on the final cover slopes. An approximate 155 ft (47 m) length of downchute pipe will be located on one of the northeastern slopes. The flow from the downchute will be routed into the 48-in. (1.2-m) diameter buried conduit, as was discussed earlier. The second downchute on the final cover slope will be approximately 840 ft (256 m) in length and will be located on the southeastern slope of the landfill. The flows from this downchute pipe will be routed into the 36-in. (0.9-m) diameter buried conduit, which will flow to Sedimentation Pond No. 6. A 12-in. (0.3-m) diameter downchute will be used to route flows from the eastern slopes (where the slopes will be graded, but where no waste will be placed) into the perimeter road drainage ditch. Additional erosion resistant material will be placed at this location as necessary.

Buried Conduits

Buried conduits will be used to convey flows to the sedimentation ponds. A 48-in. (1.2-m) diameter conduit will be installed underneath the perimeter road and will run from the northern part of the landfill due south to Sedimentation Pond No. 5. A 36-in. (0.9-m) diameter conduit will capture flows from the downchute on the southeastern face of the landfill and route them to Sedimentation Pond No. 6.

8.5.3.4 Erosion and Sediment Control Features

Runoff from the landfill floor, side and waste-fill slopes will contain elevated levels of sediment, which will need to be intercepted prior to the water being discharged from the site. The most efficient method for decreasing the sediment load is to intercept the sediment at the source (i.e., by implementing adequate erosion control measures). However, the greatest potential for erosion exists prior to the establishment of vegetation.

The following are erosion control measures, which will be implemented and maintained during construction, and operation, closure and post-closure at the East Canyon Area.

Vegetation on Newly Graded Slopes

Temporary and permanent vegetative cover will be established as soon as possible on sideslopes and waste-fill slopes. The functions of the vegetative cover include:

- reduction of rainfall impact;
- reduction of surface water velocity;
- promotion of infiltration;
- trapping of sediment; and
- retention of soil.

In order to protect the slopes prior to vegetation establishment, a mulch, consisting of straw or wood fiber, will be applied at the time of seeding.

Benches on slopes to intercept sheet flow. Benches will be installed on landfill sideslopes and on the waste fill slopes to shorten drainage paths and to intercept flow in order to minimize the potential for the attainment of erosive velocities.

Protective lining on interim and final drainageways to protect against erosive velocities. Possible lining materials include: riprap, concrete, grass, and temporary erosion control mats. Most of the interim drainageways will be erosion control matting, and have gentle slopes of approximately 2% to help minimize erosive velocities from developing. Suitable protective lining will be added as needed to prevent erosion. The perimeter drainage channel will be lined with reinforced concrete.

Energy dissipaters to reduce flow velocity. Energy dissipaters for the end of conduits will be constructed at the Sedimentation Pond Nos. 5 and 6 inlets for the 48 and 36 in. (1.2 or 0.9 m) diameter conduits, respectively. In addition, energy dissipaters will be constructed at the outlets for both ponds. Possible types of energy dissipaters are riprap aprons and concrete spillways.

Following are sediment control measures which will be implemented and maintained during construction, operation, closure and post-closure at the East Canyon Area.

Sedimentation Ponds. Two sedimentation ponds, as previously described, will be constructed south of the landfill footprint. The ponds have been designed to handle the volume of runoff from the 100-year, 24-hour storm, and to settle out silt-sized and larger soil particles.

The peak storage of Sedimentation Pond No. 5 will be 6.4 acre-ft (7876 m^3), assuming a minimum clean-out frequency of 1 year for accumulated sediments. The base and crest elevations of the pond will be 212 ft and 220 ft CLD, respectively. The side slopes of the sedimentation pond will be 3H:1V, and the surface area at its crest will be approximately 1.7 acres (0.69 ha). There will a maintenance road approximately 20 ft (6 m) in width around the perimeter of the pond. Primary discharge from the pond will be through a single 54-in. (1.4-m) diameter riser made of corrugated metal pipe (CMP), with a 78-in. (2-m) diameter concentric trash rack and anti-vortex device. The pipe conduit at the base of the riser will be 36-in. (0.9-m) in diameter and will discharge to an existing natural channel. This primary discharge will be capable of accommodating the peak 118 cfs (3.3 m^3/s) flow from the 100 year, 24 hour storm, assuming a minimum freeboard of 2 ft (0.6 m). Secondary discharge will be through a concrete lined emergency spillway with a peak outflow rate of 139 cfs. The crest of the riser will be located at an elevation of 215.5 ft (65.7 m) CLD, 1 ft (0.305 m) above the elevation of the optional dewatering opening.

The peak storage of Sedimentation Pond No. 6 will be 2 acre-ft (2722 m^3) assuming a minimum clean out frequency of 1 year for accumulated sediments. The base and crest elevations of the pond will be 212 ft and 220 ft CLD, respectively. The side slopes of the sedimentation pond will be 3H:1V, and the surface area at its crest will be approximately 0.63 acres (0.26 ha). There will a 20-ft (6-m) wide maintenance road around the perimeter of the pond. Primary discharge from the pond will be through a single 42-in. (1.1-m) diameter riser made of corrugated metal pipe (CMP), with a 60-in. (1.5-m) diameter concentric trash rack and anti-vortex device. The pipe conduit at the base of the riser will be 24-in. (0.6-m) in diameter and will discharge to an existing natural channel. The primary discharge will be capable of accommodating the peak 51 cfs (1.4 m^3/s) flow from the 100 year, 24 hour storm, assuming a minimum freeboard of 2 ft (0.6 m). Secondary discharge will be through a concrete lined emergency spillway with a peak outflow rate of 90 cfs (2.6 m^3/s). The crest of the riser will be located at an elevation of 216.5 ft (66 m) CLD, 2 ft (0.6 m) above the elevation of the optional dewatering opening.

Table 8-4 summarizes the design criteria and configurations for the sedimentation ponds.

8.5.4 Design Criteria and Methodology for Drainage Control Features

Chapter 9, Engineering Analyses, includes additional detail about the surface water analyses which were performed in accordance with federal, state and local regulations. Appendix F-8 includes the analyses performed.

Table 8-4
DESIGN CRITERIA AND CONFIGURATIONS FOR FINAL DRAINAGE CONTROL FEATURES
East Canyon Area

DESIGN CRITERIA		DESIGN STORM 100-YR, 24-HR		DESIGN CONFIGURATIONS SEDIMENTATION PONDS
Storage Volume and Release Discharge Federal (Subtitle D): 25-yr, 24-hr[(1)] State (Title 27): 100-yr, 24-hr[(2)] Local (Sonoma County): 100-yr flood[(3)] Freeboard Local (ABAG): 1 ft between pond crest and design high-water elevation in the emergency spillway.	Peak Inflow (cfs)	Pond 5 118 cfs	Pond 6 51 cfs	Riser and Discharge Pipe 54 in. CMP riser with 36 in. conduit discharge 42 in. CMP riser with 24 in. conduit discharge Emergency Spillways Pond 5 Capacity: 139 cfs Pond 6 Capacity: 90 cfs Additional Features 2-ft depth settling zone silt sized and larger particles settle out optional dewatering outlet for risers (4 inϕ max.)
	Peak Outflow from Riser(cfs)	87.9	45.5	
	High Water Elevation @ Riser (ft CLD)[(4)]	216.8	217.5	
	Maximum Storage (acre-ft)	6.4	2	

Notes:

(1) §258.25(2)
(2) Section 20365(f)
(3) Sonoma County Water Agency, Flood Control Design Criteria
(4) Crests of pond embankments are both at elevation 220 ft CLD.

8.6 Interim and Final Cover Systems

8.6.1 General

The design of the East Canyon Area incorporates interim and final landfill cover systems. The interim and final cover systems for the East Canyon Area are intended to:

- control odors, vectors, and litter;
- minimize infiltration into the landfill;
- control erosion and convey run-off to the surface-water management system at manageable, non-scouring flow rates; and
- control and contain landfill gas.

Interim cover will be placed as part of landfill operations, as described in Subsection 8.5.3. The final cover system will be placed in accordance with the closure plan once final waste grades have been achieved, as described in Section 10 of this JTD.

The design of the final cover system for the East Canyon Area consists of, from bottom to top:

- a 2-ft (0.6 m) thick foundation for final cover layer;
- a geosynthetic clay liner (GCL) barrier layer;
- a 40-mil HDPE geomembrane liner;
- a geocomposite drainage layer; and
- a 1-ft (30 cm) thick erosion (vegetative) layer separated from the drainage layer by a geotextile filter;

A cross-section of the final cover is shown on Drawing 13. The following subsections of this JTD describe the regulatory requirements for the design of the interim and final cover systems for the East Canyon Area.

8.6.2 Regulatory Requirements

8.6.2.1 Introduction

Regulatory requirements for interim and final cover systems for Class III landfills are contained in state and federal regulations. State of California requirements are contained in Title 27. Federal requirements for interim and final cover systems are contained in 40 CFR § 258.21 and § 258.60. Applicable state and federal regulations are described below.

8.6.2.2 State Requirements

Applicable state requirements for interim and final cover systems are contained in Sections 20680, 20700, 20705, 21090 and 21140 of Title 27 and are presented below.

> *"Interim cover over wastes discharged to a landfill shall be designed and constructed to minimize percolation of precipitation through wastes"* (Section 20705(b)).

> *"Closed landfills shall be provided with not less than two feet of appropriate materials as a foundation layer for the final cover. These materials may be soil, contaminated soil, incinerator ash, or other waste materials provided that such materials have appropriate engineering properties...."* (Section 21090(a)(1)).

> *"Closed landfills shall be provided with a low-hydraulic conductivity layer consisting of not less than one foot of soil containing no waste or leachate, that is placed on top of the foundation layer and compacted to attain a permeability of either 1×10^{-6} cm/s or less, or equal to the hydraulic conductivity of any bottom liner system or underlying natural geologic materials, whichever is less permeable...."* (Section 21090(a)(2)).

> *"Closed landfills shall be provided with an uppermost cover layer consisting of not less than one foot of soil which: a) contains no waste; b) is placed on top of all portions of the low-hydraulic conductivity layer described in subsection (a)(2) of this section; c) is capable of sustaining native, or other suitable, plant growth; d) is initially planted - and is later replanted as needed to provide effective erosion resistance - with native or other suitable vegetation having a rooting depth not exceeding the depth to the top of the low-hydraulic-conductivity layer described in*

subsection (a)(2) of this section; e) will be resistant to foreseeable erosion effects by wind-scour, raindrop impact, and runoff " (Section 21090(a)(3)).

"The final cover shall be designed and constructed to function with the minimum maintenance possible" (Section 21090(a)(4)).

"Closed landfills shall be designed, graded and maintained to prevent ponding and to prevent soil erosion due to high run-off velocities. Except as provided in subsection (b)(1)(B) of this section, all portions of the final cover shall have a slope of at least three percent" (Section 21090(b)(1)).

"Areas with slopes greater than ten percent, areas having surface drainage courses, and areas subject to erosion by water or wind shall be protected from erosion or shall be designed and constructed to prevent erosion" (Section 21090(b)(2)).

"(a) the owners and operators of MSWLF units shall cover disposed solid waste with six inches of compacted earthen material at the end of each operating day, or at more frequent intervals if necessary; (d) Earthen or alternative cover materials shall be placed over all surfaces of disposed solid waste for other than MSWLF units..to control vectors, fires, odors, blowing litter, and scavenging" (Section 20680(a) and (d)).

"Compacted earthen material of at least twelve (12) inches shall be placed on all surfaces of the fill where no additional solid waste will be deposited within 180 days to control vectors, fires, odors, blowing litter, and scavenging." (Section 20700).

"The final grading design shall be designed and approved by a registered civil engineer or certified engineering geologist" (Section 21090(b)(C)).

"(a) The final cover shall function with minimum maintenance and provide waste containment to protect public health and safety..(b) In proposing a final cover design, meeting the requirements under Section 21090, the owner or operator shall assure that the proposal meets the requirements of this section...(c) the EA may require additional thickness, quality, and type of final cover depending on, but not limited to the following (1) a need to control landfill gas emissions and fires (2) the

future reuse of the site; and (3) provide access to all areas of the site as needed for inspection of monitoring and control facilities etc. " (Section 21140).

Title 27 contains regulations that allow for engineered alternatives to the minimum standards.

As previously described, the proposed final cover design includes a geomembrane cap in combination with a GCL. These two components form the barrier layer. The geomembrane cap will overlie the GCL. The geomembrane cap in itself is an effective barrier layer. In addition, due to its very low water vapor permeability, it will limit moisture loss from the bentonite in the GCL to the environment.

The proposed erosion layer is considerably thicker than required by regulation, will be resistant to erosion, will not require irrigation, and will blend with the surrounding environment. For these reasons, the proposed erosion layer is a superior engineered alternative to applicable minimum construction standards.

The proposed final cover system fully complies with the regulations contained in Section 20080(b)(2) in that the design meets the performance goals contained in Section 21090(a) and provides superior protection against water quality impairment in comparison to a soil final cover alone meeting the requirements of Section 21090(a)(2).

8.6.2.3 Federal Requirements

Minimum federal requirements for the interim and final cover design are contained in 40 CFR § 258.21 and § 258.60 and are presented below.

"*(a) Except as provided in paragraph (b) of this section, the owners or operators of all MSWLF units must cover disposed solid waste with six inches of earthen material at the end of each operating day, or at more frequent intervals if necessary, to control disease vectors, fires, odors, blowing litter, and scavenging without presenting a threat to human health and the environment*" (§ 258.21(a)).

"*(b) Alternative materials of an alternative thickness (other than at least six inches of earthen material) may be approved by the Director of an approved State if the owner or operator demonstrates that the alternative material and thickness control disease vectors, odors, blowing litter, and scavenging* *without presenting a threat to human health and the environment"* (§ 258.21(b)).

"*(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" (§ 258.60(a)).

The interim and final cover systems for the East Canyon Area landfill are designed to fully comply with applicable federal regulatory requirements. The proposed geomembrane cap and underlying GCL liner will essentially eliminate the potential for surface-water infiltration. The geomembrane cap will have about the same hydraulic conductivity as the geomembrane component of the liner system. The final cover will also contain a geocomposite drainage material. The erosion layer for the East Canyon Area will be 12-in. (30-cm) thick, which is much more than the 6 in. (15 cm) requirement of the federal regulations. Native plant growth in the vicinity of the project site will be developed. The erosion layer will be constructed with on-site soil, if possible.

The design of the interim and final cover systems for the East Canyon Area are presented in the following subsections.

8.6.3 Interim Cover

Interim cover at the East Canyon Area will consist of:

- daily cover, which will be composed of a minimum of 6 in. (15 cm) of compacted soil, placed over the waste at the end of each working day; and
- intermediate cover, which will be composed of a minimum of 12 in. (30 cm) of compacted soil, or equivalent, placed over waste areas which will be inactive for periods greater than 180 days; existing daily cover may be used as a part of the intermediate cover.

It is anticipated that on-site soils will be used for interim cover. Alternative materials may be used in lieu of soil for daily cover, but only if they meet the requirements of Section 20685 of Title 27, and only after approval by the CRWQCB, CIWMB and LEA. Additional information on construction procedures and material sources for interim cover were presented in Section 3.4 of this JTD.

8.6.4 Final Cover

8.6.4.1 Introduction

The final cover system for the East Canyon Area will consist of a foundation layer, a low-permeability barrier layer, a drainage layer, and an erosion layer. Construction of the final cover will take place as part of the progressive closure of the landfill. The design of the final cover system is presented in the following subsections.

8.6.4.2 Foundation For Final Cover

The foundation for final cover layer is the bottom component of the final cover system and will consist of a 2-ft (0.6-m) thick layer of compacted soil or alternative material such as select waste. Intermediate cover previously placed over waste may be incorporated into the foundation for final cover layer.

8.6.4.3 Low-Permeability Barrier Layer

A geosynthetic clay liner (GCL) low-permeability barrier layer overlain by a geomembrane will be constructed on top of the foundation of the final cover system.

The low-permeability barrier layer will virtually eliminate the potential for significant surface-water infiltration into the landfill, and it will control and contain landfill gas. This layer will be protected by the placement of a non-woven geotextile cushion on top of the layer. The GCL and geomembrane barrier layer has a number of advantages over a single compacted soil barrier layers including:

- *Liquid Permeability*. Polyethylene geomembrane has a hydraulic conductivity of less than 1×10^{-12} cm/s which is significantly lower than the minimum regulatory design requirement of 1×10^{-7} cm/s for a compacted soil barrier layer.

- *Gas* Permeability. Polyethylene also has a very low gas transmissivity when compared to a compacted soil barrier layer.

- *Desiccation Cracking*. The performance of the geomembrane barrier layer will not be affected by the arid climate at the site that could cause desiccation cracking of fine-grained soils. Desiccation would have an adverse affect on a compacted soil barrier layer but the GCL is self healing when wetted and dryed.

- *Settlement* and *Subsidence*. Geomembrane is flexible and is capable of withstanding stresses induced by differential settlement and subsidence better than a compacted soil barrier layer. For example, compacted soil barriers may undergo cracking at tensile strains as low as one percent, whereas the tensile strain at yield of a polyethylene geomembrane ranges from 15% to 30%.

8.6.4.4 Drainage Layer

A drainage layer will be used to remove surface water infiltrating through the erosion layer, protect the low-permeability barrier layer from damage due to equipment traffic and the overlying erosion layer. The drainage layer will consist of a geocomposite that will be placed on top of the geomembrane layer. The geocomposite will prevent migration of fines from the erosion layer. The material and placement conditions for this layer will be specified to avoid damage to the barrier layer.

8.6.4.5 Erosion Layer

The erosion layer will be used to control erosion caused by surface-water run-off, and to visually blend with the surrounding environment. The erosion layer will consist of a minimum 1-ft (30-cm) thickness of soil material that will be placed on top of the drainage layer. The erosion layer will be composed of on-site soils. The cover will be planted with vegetation whose rooting depth does not exceed the depth of this final cover layer.

Along final cover benches and final cover access roads, the top 6 in. (15 cm) of this layer will be replaced with a 6-in. (15-cm) thick layer of coarse road base material to provide support for maintenance vehicles.

8.6.5 Construction Considerations

8.6.5.1 General

Placement procedures for the interim cover are described in the operations plan, presented in Section 3.4 of this JTD. Detailed procedures for construction of the final cover will be given in the construction drawings and specifications developed for each phase area of the East Canyon Area. Likewise, a detailed description of the quality control and quality assurance procedures that will be employed during final cover construction will be provided in the CQA plans developed for progressive closure. A Preliminary CQA Plan is in Chapter 12. A general description of the requirements of these documents for each component of the final cover is provided below.

8.6.5.2 Foundation for Final Cover

The foundation for final cover layer will be constructed using on site soil or rock. Intermediate cover previously placed over waste may be incorporated into the foundation for final cover. Foundation for final cover materials will be placed in lifts, moisture-conditioned, and compacted.

8.6.5.3 Low-Permeability Barrier Layer

The low-permeability barrier layer for the East Canyon Area will consist of a GCL component and a polyethylene geomembrane cap.

GCL

A GCL is a manufactured product consisting of a geosynthetic material which has a relatively thin layer (0.25-in. (5-mm) thick, typically) of bentonite glued, stitch-bonded, or needle-punched to a geosynthetic material. A GCL is basically a layer of bentonite which, is held on or between carrier geotextiles or may be glued to a geomembrane. Bentonite is a unique clay mineral which, when wetted, is the least permeable naturally occurring soil mineral.

There are four major manufactured products currently available and these are known as *Bentomat*, *Bentofix*, *Claymax*, and *Gundseal*. The four GCL products can be classified into two basic groups. The first group includes *Bentomat, Bentofix, and Claymax,* which consist of bentonite and geotextile carrier layers on top and bottom of the bentonite layer. The second group includes *Gundseal,* which consists of bentonite glued to a geomembrane. All four products were investigated for this report.

Either type of GCL is proposed on the landfill final cover system. The choice of which, type should be employed should be evaluated during later design stages.

Polyethylene Geomembrane

The geomembrane cap will arrive at the site in rolls and will be deployed by unrolling it in a downslope direction directly on the GCL liner. Geomembrane rolls are typically suspended from a loader or tractor using a spreader-bar assembly to facilitate the unrolling process. Adjacent geomembrane cap panels will be overlapped and seamed. Fusion seams will be used wherever possible. Extrusion seams will be used wherever fusion seaming is not possible. Seams will be aligned in a downslope direction wherever possible. Geomembrane cap panels will be anchored at the perimeter of the landfill.

The geomembrane cap will undergo contraction and expansion under the temperature variations anticipated at the site during construction. Specific measures will be contained in the construction measures to control these temperature effects during construction. Potential measures are the same as for the HDPE geomembrane component of the composite liner, and are discussed in the Preliminary Construction Quality Assurance Report in Section 12. These measures may include nighttime construction during periods of high temperatures, restrictions on seaming operations, using geomembrane caps with white surfaces, or other appropriate measures.

To minimize the potential for material damage, access over areas where geomembrane cap has been installed will be restricted until the overlying drainage geotextile and vegetative layers are in place.

8.6.5.5 Drainage Layer

A geocomposite drainage layer will be placed over the geomembrane liner, prior to placement of the erosion layer and granular drainage layer. Adjacent rolls of geocomposite material will be overlapped at least 6 in. (15 cm). The geocomposite geotextile filters will likely be manufactured from ultra-violet light (UV) stabilized polypropylene or polyester. Adjacent rolls will be sewn together unless otherwise indicated on the construction drawings and specifications.

8.6.5.7 Vegetative Layer

A vegetative layer will be placed over the geotextile filter layer. The vegetative layer will be constructed using on-site materials.

Vegetative layer material will be placed using a combination of equipment that is capable of handling the vegetative layer materials and manual labor. Heavy construction equipment placing the vegetative layer materials will be restricted to final cover access roads, and final cover benches, while lighter construction equipment will be allowed to operate on the final cover slopes. The vegetative layer will be constructed starting at the bottom of each slope.

8.7 Landfill Gas (LFG) Collection System

8.7.1 General

The purpose of the LFG collection system expansion into the East Canyon is to maintain conformance with BAAQMD Regulation 8, Rule 34, which requires the control of surface emissions from landfills.

This system is not specifically designed to prevent the migration of LFG pursuant to Title 27 CCR Section 20921. The installation of a low-permeability liner at the base of the East Canyon minimizes the potential for LFG migration through the surrounding soils. However, the LFG collectors will reduce the pressure of LFG within the waste fill, thereby further reducing the potential for LFG migration.

The LFG facilities installed for the East Canyon Area will be connected to the existing LFG collection system. LFG collected in this expansion will be treated by using the existing treatment systems, which appear to have sufficient capacity. The text in this section refers to drawings *entitled "Landfill Gas Master Plan, Central Landfill, Sonoma County*", (hereafter referred to as LFG Master Plan), prepared by Landfill Systems Engineering, October 1997.

8.7.2 LFG Production Rate

The production of LFG in the East Canyon Area is expected to begin within the first year of waste placement, although at a very slow rate initially.

Peak LFG production from the expansion area is expected to be approximately 900 ft^3/m (25.5 m^3/m), occurring two to three years after the last waste is placed in this area. This production rate includes LFG from all waste placement made possible by the East Canyon Area: both from waste placed directly in the Canyon and from new waste placed on adjacent existing landfill slopes.

8.7.3 LFG System Description

The LFG facilities installed to serve the East Canyon will include a header, laterals, and horizontal collectors.

The LFG header will be installed on native soil in the access road. It will meet the following criteria:

Size	12-inch (minimum), SDR 17
Material	High density polyethylene (HDPE)
Minimum slope	1% to condensate collection points
Condensate collection points	Two to drain condensate from the header piping.

Condensate drained from the header will be directed to the LCRS installed in the canyon base. Three isolation valves will be provided to facilitate LFG system maintenance.

A connection between the LFG collection system and the LCRS piping will prevent the pressurization of the LCRS piping with LFG.

Lateral piping (connecting the LFG header to the horizontal collectors) will be 4-in. (10-cm) diameter HDPE, SDR 17. Laterals will be installed on the surface of the landfill liner concurrent with the installation of the horizontal collectors, which they serve. Each lateral will include an adjustment valve and sampling ports. The ability to measure the flow rate through each lateral will also be provided.

Horizontal collectors are proposed because they can be installed and operated without impeding subsequent waste placement. Horizontal collectors are installed on the top of a waste lift, and consist of long trenches filled with a perforated pipe and porous material through which LFG is collected.

The location of the horizontal collectors will be chosen, in accordance with the LFG Master Plan, to allow maximum collection of LFG with minimal intrusion of air. Horizontal spacing between collectors will be approximately 200 ft (61 m), with locations adjusted to accommodate the waste contours. Vertical spacing will vary depending on location and proximity to the base or top of the landfill.

Although horizontal collectors are very effective when covered by at least one waste lift, they are of minimal effectiveness immediately after installation because they are installed on the surface of the waste fill. This is not a significant aspect because refuse produces little of any LFG at the time of placement.

8.7.4 Construction Phasing

The LFG collection system will be installed in four stages (beginning with Stage 0), coinciding with the construction and fill phases of the East Canyon Area, and a fifth stage corresponding to the final cover grading shown on Drawing 13 of the Draft Development Drawings.

The zero LFG system construction stage will occur as part of the construction of the Canyon liner and other preparation for the placement of waste, as shown of Sheet 2 of the LFG Master Plan. During this stage, the East Canyon LFG header will be installed, and will be provided with stub-outs for all future LFG collectors. The East Canyon header will be connected to the existing LFG header, although LFG will not be collected during this stage.

During Stages I through IV, Sonoma County personnel will install horizontal collectors and laterals in the East Canyon. The first collectors will be installed after approximately 20 ft (6.1 m) of waste has been placed in the base of the canyon, and remaining collectors will be installed as the refuse fill reaches appropriate elevations. Sheets 2 through 4 show the LFG system layout for these stages.

In Stage V, LFG collectors will be installed in the "notch" between the existing Central Landfill, and the East Canyon Area, as shown on Sheet 9 of the LFG Master Plan. Collectors will be installed as the appropriate elevations are reached. The collectors under the liner in the overfill area will prevent migration of LFG into the East Canyon Area, as shown in Drawing 10 of Development Drawings in Appendix E-1. This Stage will complete the Central Landfill and the LFG collection system according to present permit applications.

8.7.5 Operation

A time period of 6-12 months is required for waste materials to begin producing any significant methane. LFG will be collected as it is produced; slowly at first and gradually increasing as the waste ages and as more waste is placed the gas system operates under a permit condition that no waste will no uncontrolled for LFG collection in excess of 12 months. Valves at individual collectors will be adjusted to optimize LFG collection to meet dual operating criteria: (1) control migration; and (2) quality fuel for power production.

At this time, it is anticipated that the operation of the East Canyon LFG collectors will be under contract with the operator of the cogeneration facility.

Condensate produced within the LFG header will be drained to the LCRS at the base of the Canyon. From there, it will be pumped with leachate to the leachate facilities.

8.8 Ancillary Facilities

8.8.1 General

State regulations contained in Section 21760(a)(1) of Title 27 require that "*The ROWD, including any such report integrated into a Joint Technical Document shall contain a description of, and location for, ancillary facilities including roads, waste handling areas, buildings, and equipment cleaning facilities*". The ancillary facilities associated with the landfill are to provide support for landfilling operations. These facilities are primarily used for access, waste transportation and handling, equipment cleaning, maintenance, storage, construction, utility service, and office space for landfill administrative and operational personnel.

The only new ancillary facilities associated with the East Canyon Area anticipated to be constructed are the main haul road into the expansion area for waste disposal operations, the landfill perimeter road, and final cover maintenance roads for maintenance of the intermediate and final covers over waste. The existing landfill access road, operation/maintenance facilities, and water supply and distribution facilities will be utilized during landfilling operations for the East Canyon Area. The ancillary facilities to be constructed as part of the East Canyon Area are described below.

8.8.2 Waste Disposal Haul Road

Access to the East Canyon Area from the Central Disposal Site will be through the existing main haul road as shown on Drawing 3. The haul road is located south of the existing main access road and will provide primary access to the active portions of the expansion. This road will be:

- suitable for travel by waste trucks, emergency vehicles, and landfill construction and operation vehicles;
- constructed with a minimum graveled width of 32 ft (9.7 m) and a maximum grade of approximately 5%;
- paved using durable road material (e.g., asphalt concrete, chip seal, or gravel);

- mechanically swept or watered to control dust and to maintain trafficability; and;

- maintained throughout the disposal operations period.

8.8.3 Landfill Perimeter Road

The landfill perimeter road surrounds the East Canyon Area. The road will be used primarily by maintenance vehicles. Construction of the perimeter road will occur during Phase I construction. The landfill perimeter road has a cross slope at a grade of 4%. Drawing 3 shows the perimeter road plan and details on Drawing 8 shows typical cross sections which include the perimeter road profile.

The perimeter road will be:

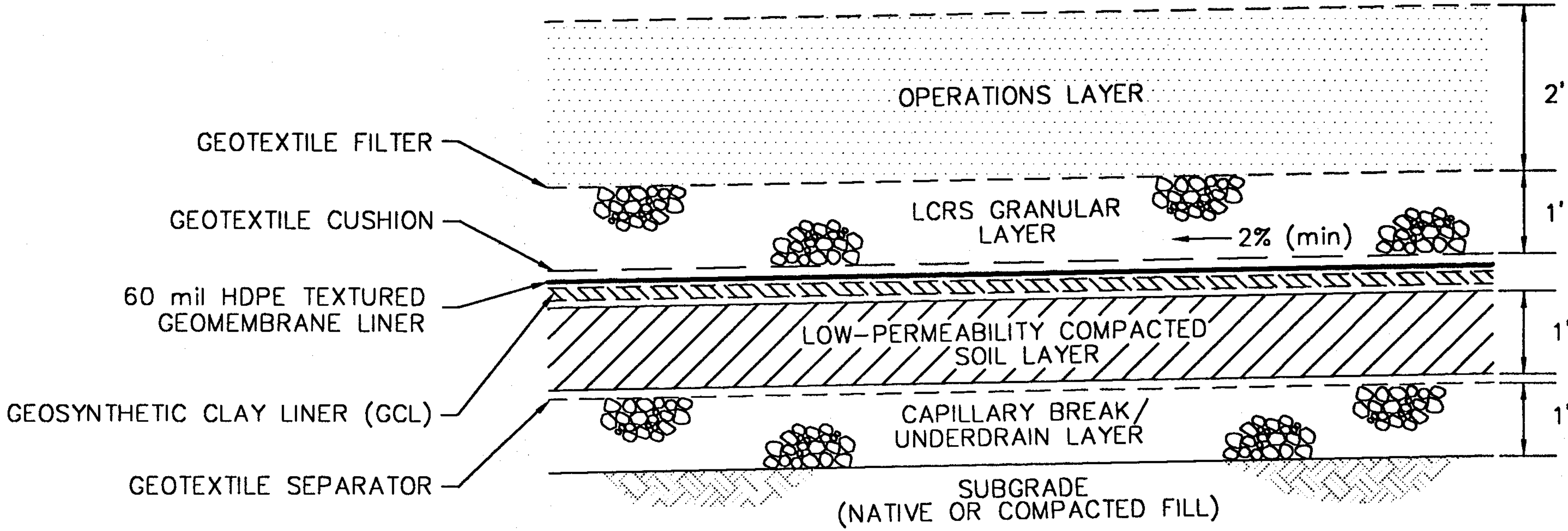
- constructed with a minimum driveable width of 16 ft (4.9 m) and a maximum grade of approximately 22%, with the majority of the road at a grade of approximately 2%;

- paved with appropriate surfacing materials to prevent erosion, control dust, and provide all-weather usability; and

- maintained throughout the post-closure maintenance period.

8.8.4 Interim and Final Cover Access Roads

Interim and final cover access roads will be constructed at various locations within the landfill as waste filling progresses. Interim cover access roads constructed during landfilling operations will provide access primarily for waste hauling vehicles from the waste disposal haul roads to the landfill working face. During interim and final closure activities, roads will be constructed to provide access for maintenance vehicles to the final cover benches on the landfill working face and to site monitoring locations on the landfill. Final landfill access roads will be maintained throughout the post-closure maintenance period. The roads will also serve as surface-water control structures.

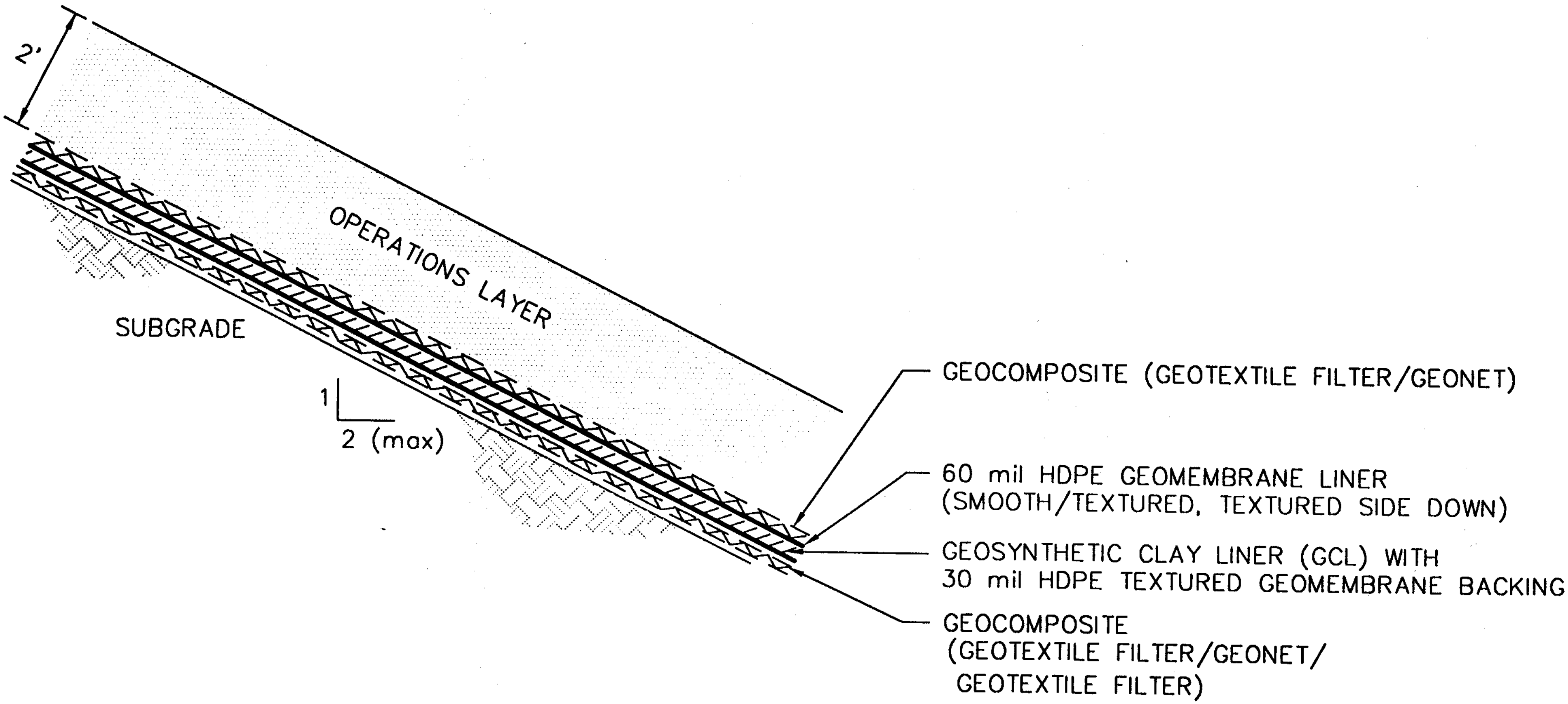


FLOOR AREA CONTAINMENT SYSTEM
EAST CANYON EXPANSION
SONOMA COUNTY, CALIFORNIA

NOT TO SCALE

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

FIGURE NO.	8-1
PROJECT NO.	WL0062
DOCUMENT NO.	WC97552
FILE NO.	0062_FG8.DWG

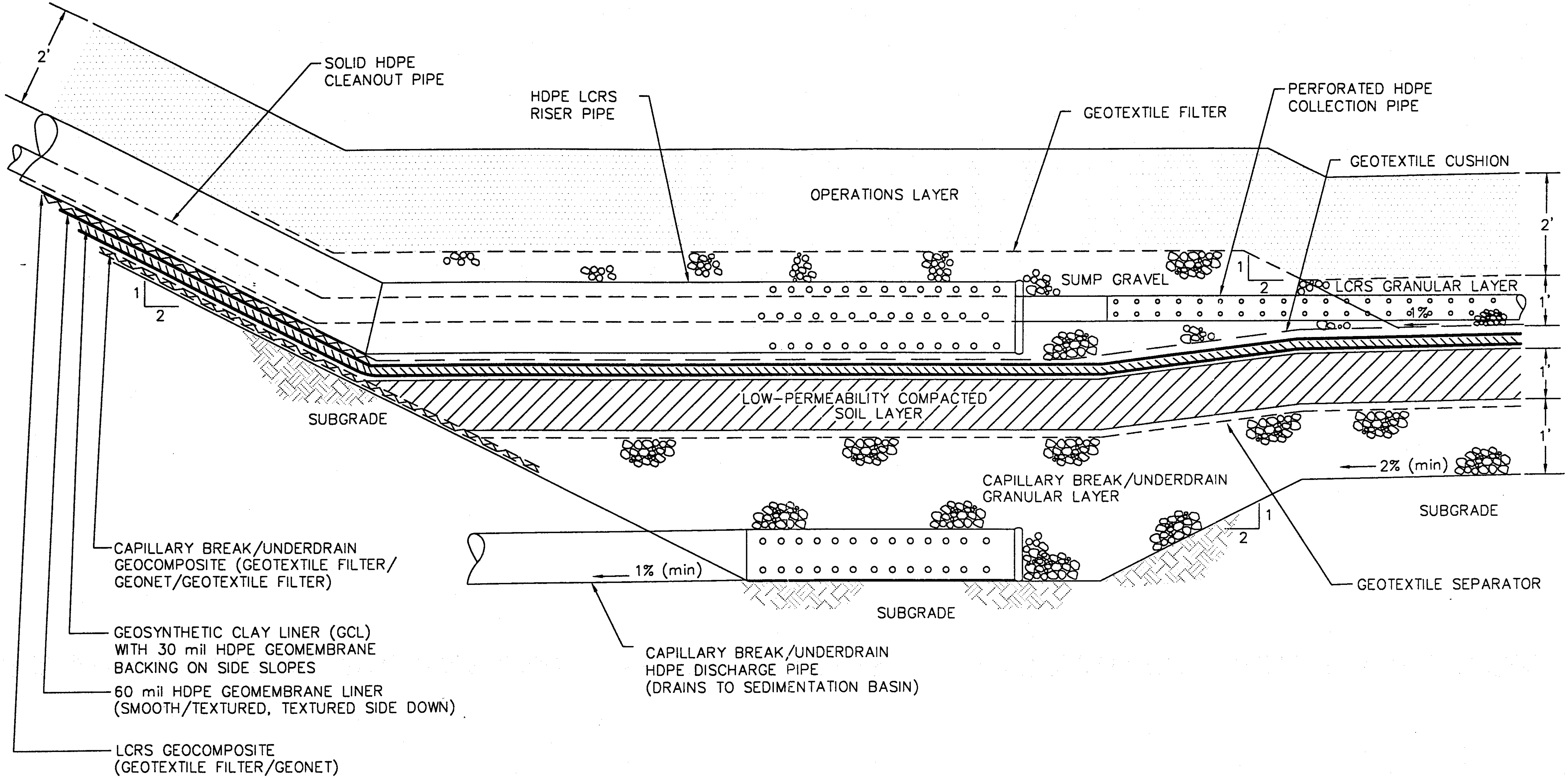


SIDE-SLOPE CONTAINMENT SYSTEM
EAST CANYON EXPANSION
SONOMA COUNTY, CALIFORNIA

NOT TO SCALE

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

FIGURE NO.	8-2
PROJECT NO.	WL0062
DOCUMENT NO.	WC97552
FILE NO.	0062_FG8.DWG

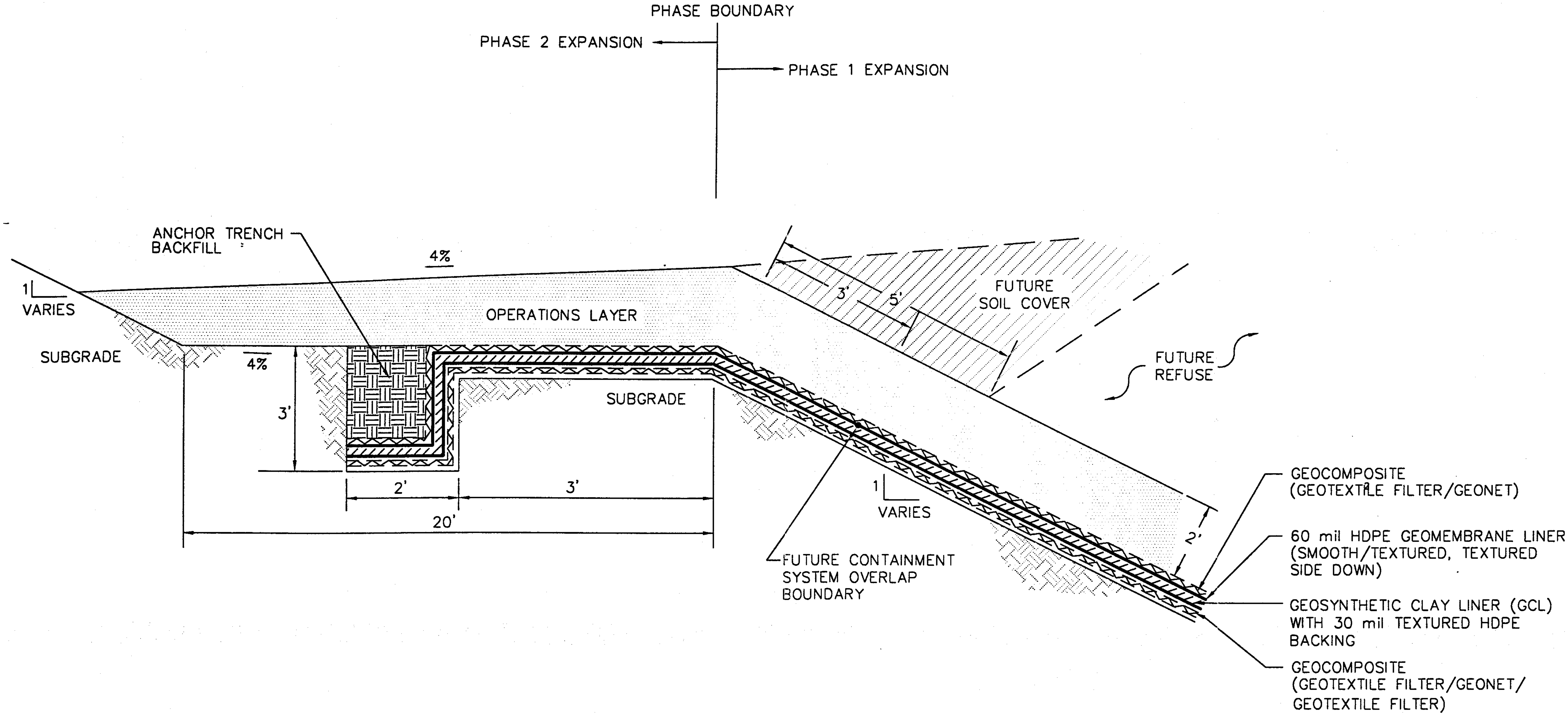


NOT TO SCALE

CAPILLARY BREAK/UNDERDRAIN AND LCRS SUMPS
EAST CANYON EXPANSION
SONOMA COUNTY, CALIFORNIA

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

PROJECT NO.	WL0062	FIGURE NO.	8-3
DOCUMENT NO.	WC97552	FILE NO.	0062_FG8.DWG



CONTAINMENT SYSTEM TERMINATION ALONG PHASE BOUNDARIES
EAST CANYON EXPANSION
SONOMA COUNTY, CALIFORNIA

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

PROJECT NO.	WL0062	FIGURE NO.	8-4
DOCUMENT NO.	WC97552	FILE NO.	0062_FG8.DWG

9. EAST CANYON AREA ENGINEERING ANALYSES

9.1 Slope Stability

9.1.1 Slope Conditions

9.1.1.1 General

The purpose of this section of the JTD is to describe engineering slope stability analyses performed as part of the design of the East Canyon Expansion. Several different categories of analyses were performed to evaluate whether the shear strength properties of the natural and engineered materials included in the landfill design, coupled with the proposed geometry of the landfill, result in adequate slope stability factors of safety. The analyses were also performed to demonstrate that the landfill design satisfies the slope stability requirements of Title 27 of the California Code of Regulations (CCR); and Title 40, Part 258 (i.e., Subtitle D), of the Code of Federal Regulations (CFR).

The analyses described in this section were performed for conditions that will be present during each major stage of landfill development, as well as conditions after landfill closure. The methods and details used in performing the analyses are described in Subsection 9.1.2. The categories of slope stability analyses that have been performed are discussed briefly in the following paragraphs and are described in more detail in Subsections 9.1.3 to 9.1.4. The results of analyses are presented in Appendix F.

9.1.1.2 Natural Slopes

Existing natural slopes at the site have, in the geologic past, experienced all of the destabilizing natural phenomena that are likely to occur over the life of the landfill. These phenomena include earthquakes and extremes of rainfall. As shown on Drawing 3 of the Development Plans in Appendix E-1, construction of the Phase I portion of East Canyon includes excavation of the natural slopes to the east and north. Therefore, natural slope stability is not a critical issue.

9.1.1.3 Construction Cut Slopes

Cut slopes (side walls) within the landfill area will be excavated in bedrock with inclinations of 2H:1V to 3H:1V (H = horizontal:V = vertical). The slopes include a benches 10 ft (3.1 m) to 30 ft (9 m) wide which are designed at 40 ft (12 m) to 50 ft (15 m) vertical height increments, as shown on Drawing 3. Overall slope heights range up to about 200 ft (61 m). The stability of the cut slopes will be controlled by the shear strength of the rock mass and the configuration of cut slopes. Analyses that consider these factors have been performed to evaluate the stability of the cut slopes after construction. Results of these analyses are presented in Subsection 9.1.3.

Additionally, an engineering geologist/rock mechanics specialist observed the proposed cut slopes for East Canyon. As recommended, an aditional boring was drilled and sampled through the alluvium near the stream bed down the center of East Canyon to evaluate the thickness and strength of the alluvial deposit. Upon further evaluation, it was concluded that the average strength of the overall slope material, which has an average slope of 23 degrees and total height of 190 feet, is sufficient to provide stability. Therefore, the cut slopes proposed are satisfactory. Appendix F-5-2 includes the additional boring log, test data, and evaluations of the cut slopes by the engineering geologist/rock mechanics specialist.

9.1.1.4 Interim and Final Landfill Slopes

Landfill construction and waste placement in the East Canyon Expansion area will take place in five phases. The stability of the liner systems designed for the different phases has been evaluated through slope stability analyses. Separate analyses were performed for each of the phases, considering various critical sections for each phase. Critical failure surfaces, passing through the waste material, the liner system and the subgrade material were studied, to model slope stability. The details regarding these analyses, as well as the results, are presented in Section 9.1.4.

Phase I

The first phase of waste placement will take place in the canyon, which will include both floor area and side-slope liner systems. The floor areas of Phase I have slopes of approximately 2%. The slopes of the side-slope areas vary from 3H:1V, along the western side to 2.5H:1V on the eastern side and 2H:1V, along a relatively short southern side adjacent to the toe buttress.

The waste face slopes at the end of Phase I are 4H:1V with 60 ft (18 m) height, at the southern side, and 3H:1V, with 40 ft (12 m) height at the northern side. The waste slopes at the eastern and western side are 3H:1V.

Phase II

The second phase of waste placement will occur to the eastern and northeastern sides of Phase I. During this phase, waste will also be placed over the existing Phase I area. The maximum elevation within this phase will be approximately 390 ft (119 m) MSL. At the end of Phase II the slopes of the waste face will vary from 3H:1V along the western side to 4H:1V along the other sides. The Phase II side-slope area is approximately 2.5H:1V. Phase II will not include any floor area.

Phase III

The third phase will include the northwestern portion of the site with additional waste filling over the existing adjacent waste faces of Phases I and II. The maximum waste elevation within this phase will be approximately 410 ft (125 m) MSL. At the end of this phase the slopes of the waste face will vary from 3H:1V along the southern and western sides and 4H:1V along the northern side. This phase will join Phases I and II along its eastern boundary. The slope at the base of Phase III is approximately 10%. Phase III will not include any floor area.

Phase IV

The fourth phase of waste placement will occur in the southwestern portion of the site and over the adjacent waste faces of Phases I and III. The maximum elevation of waste within this phase will be approximately 470 ft (143 m) MSL. The waste slopes will be 3.2H:1V along the western side and 4H:1V along the other sides.

Phase V

The fifth and final phase of waste placement will connect the upper slopes of the East Canyon Expansion area and the existing Central Landfill. Waste placement within the East Canyon Expansion area during this phase will take place in the western portion of the landfill. The maximum elevation of waste at the end of this phase within the East Canyon footprint will be 520 ft (158 m) MSL. At the end of this phase the all waste slopes will have reached their final grades, and remaining areas of final cover will be placed. The slopes of the waste face will be approximately 4H:1V on all sides. Benches will be provided at vertical intervals of 50 ft (15 m). On the western side the landfill will be graded to tie into the final grades of the existing landfill.

9.1.1.5 Final Cover System

The final cover for the landfill will be constructed at an inclination of approximately 4H:1V, except for in a small area where the cover will slope at 5% to tie in with the final cover of the existing landfill. It is possible that additional slope stability studies performed for the final design may result in final exterior slopes as steep as 3 horizontal to 1 vertical. Benches approximately 15-ft (4.6-m) wide, sloped at 2%, will be constructed every 40 to 50 ft (12 to 15 m) of vertical height.

9.1.2 Methods and Details of Analysis

9.1.2.1 Methods of Analysis

Conventional limit equilibrium methods of analysis by Bishop [1955] and Janbu [1957] were employed for static slope stability evaluation of cut slopes and the landfill. These analysis methodologies were implemented using the computer software, XSTABL, Version 5 [Sharma, 1994], a modified version of the STABL software originally developed by Purdue University [Carpenter, 1986]. Through the program, the Bishop and Janbu methods were used to automatically search for the critical circular and noncircular slip surfaces, respectively. The noncircular slip surfaces were investigated to model failure through the bottom liner system.

The static stability of the landfill cover system for the East Canyon expansion, was analyzed using the infinite slope method. The method presented in Matasovic [1991] was utilized for this purpose. Potential failure surfaces along the geosynthetic interfaces present in the final cover were considered in the analyses. Since specific information regarding the critical interface properties are not available at the present time, the infinite slope stability analyses were performed over a range of cohesion and friction angle values representative of the interfaces included in the final cover. Results of the cover stability analyses are presented in Section 9.1.5.

9.1.2.2 Allowable Factors of Safety and Deformations

The measure of the stability of a slope used by engineers is the factor of safety. Minimum acceptable static factors of safety were selected for this project to meet the requirements of state and federal regulations as well as the standards of general engineering practice. The minimum acceptable static factors of safety selected were 1.3 for the interim waste slopes and short-term conditions on cut slopes, and 1.5 for the final waste slopes in each phase and long-term conditions on cut slopes.

Seismic site response and deformation analyses were performed separately and are included in Appendix F-4. One-dimensional seismic site response analyses were performed using SHAKE 91 program [Idriss and Sun, 1992] for two columns, 75-ft and 150-ft high. These columns were selected on the basis of the location of the most critical failure surfaces obtained in slope stability analyses.

The results of this analysis were used as input in a Newmark-type deformation analyses to evaluate the permanent seismic deformation potential of the landfill. From the results of this deformation analysis plots of seismically-induced displacement versus yield acceleration for the two columns and the cover system were developed. As per current practice in solid waste design [Seed and Bonaparte, 1991] maximum seismically-induced deformations ranging from 6 to 12 in. (15 to 30 cm) were considered acceptable.

9.1.2.3 Material Shear Strength Characteristics

Slope stability analysis requires knowledge of material shear strength characteristics. Materials involved in the stability of the proposed landfill were categorized into five major groups, i.e., waste material, liner system, cover system, engineered fill, and bedrock.

Selection of representative shear strength characteristics for each material group requires consideration of different factors, including material composition, compaction conditions, environmental factors, pre-existing stress-strain states, expected loading conditions, etc.

Waste Material

The shear strength properties associated with municipal solid waste were used on the basis of values presented in recent technical literature. Specifically, shear strength parameters consisting of a cohesion intercept, $c = 900$ psf and an angle of internal friction, $\phi = 31°$ were used in the analyses. These parameters were obtained from results of large-scale direct shear tests on specimens of waste material from a large southern California landfill and presented by GeoSyntec [1996].

Liner System

The interface shear strength properties for the liner materials used in the slope stability analyses have been obtained on the basis of previous GeoSyntec projects and results published in literature. The most critical interfaces with regard to interface shear strength properties were identified to be those between textured geomembrane and low permeability soil in the case of the base and textured geomembrane and bentonite element of geosynthetic clay liner in the case of the side-slope liner. The strength parameters of these were used in slope stability analysis programs where non-circular slip surfaces passing through the liner system were generated. Project specifications will require that actual materials used to construct the East Canyon to meet these minimum shear strengths. Compliance will be verified by conformance testing by the Construction Quality Assurance (CQA) firm of the actual construction materials. Testing will be completed over the range of anticipated stresses (up to approximately 14,000 psf) that the liner will be exposed to as the site is filled.

The shear strength properties of the critical landfill liner interface materials used in these analyses are shown in Table 9-1.

Table 9-1
LINER CRITICAL INTERFACE SHEAR STRENGTH
East Canyon Expansion, Sonoma Central Landfill

MATERIAL	SHEAR STRENGTH PARAMETERS			
	Floor Area		Side-slope Area	
	c (psf)	ϕ	c (psf)	ϕ
Liner	0	10°	0	15°

Final Cover System

The interfacial shear strength of the geosynthetic components of the final cover system were estimated over a range for the purpose of analyses. The range was selected based on GeoSyntec's experience from projects where similar cover material interfaces have been utilized. The range of shear strength selected for analyses is represented by cohesions varying from 10 to 100 psf and friction angle varying from 14 to 20 degrees.

Engineered Fill

Engineered fill derived from grading of Phase I will be used to construct the berms at the southern end of the East Canyon, and at other localized areas to develop grades within the East Canyon Expansion area. Fill will be compacted to a minimum relative compaction of 90% (ASTM D 1557) or higher to meet these strength requirements. Strength will be verified by conformance testing completed by the CQA firm during construction. The shear strength properties for the engineered fill material from on-site borrow that will comprise the berms were assumed as follows: cohesion intercept, c = 400 psf and angle of internal friction, ϕ = 33° [United States Navy, 1986].

Bedrock

The bedrock at the site is comprised of Franciscan Assemblage [Huntingdon Herzog, 1993]. The strength properties of this material have been discussed in the previous reports that dealt with this site. EBA Wastechnologies, Inc. [EBA, 1992] assumed a native bedrock design strength as follows: cohesion, c = 2,000 psf and angle of internal friction, ϕ = 20°. Huntingdon Herzog used the following values in their analyses: c = 300 psf, and ϕ = 18° (undrained) and c'=300 and ϕ'=24°(drained).

The EBA report did not provide any information regarding the source of the strength parameters used in the analyses. The report from Huntingdon Herzog provided details of a field investigation program that included collection of samples from three shallow test pits. Two of the test pits were located within the East Canyon Expansion area and one within the West Canyon area. Consolidated undrained (C-U) triaxial compression tests were performed on the samples collected from the pits and the results from these tests are provided in the Huntingdon Herzog report. The report indicates that the test pits were excavated in shallow weathered material.

The Planned excavation in East Canyon will include significant excavation of rock material to a depth of approximately 50 ft (15 m). Seismic refraction surveys completed at the site in 1992, included in the EBA report, and further surveys completed in 1998 [Spectrum, 1998] indicate that excavation will reach depths of competent unweathered rock. This rock which exhibits high shear wave velocities much higher than for near-surface materials such as tested by Huntingdon Herzog. Accordingly, it was concluded that data from Huntingdon Herzog's testing was likely conservative and unrepresentative of the rock slope strengths after excavation.

Since suitable shear strength data was not available, initially calculations were completed on ranges of bedrock strengths necessary to achieve suitable minimum factors of safety of 1.3 for short-term conditions and 1.5 for rock cut slopes.

The following shear strength properties were used to represent the bedrock material in the slope stability analyses for the waste mass and the liner system: cohesion, c = 400 psf, angle of internal friction, $\phi = 38°$. While the actual rock strength values require evaluation by more testing, it is GeoSyntec's conclusion that the rock strengths are much higher than the waste or liner system shear strengths.

The most critical failure surfaces for the stability of the waste mass and the liner system did not pass through the bedrock material. Therefore, the factors of safety for the global stability of the landfill were independent of the strength of the bedrock material. Consequently, the analyses performed represent both long-term and short-term conditions for the stability of the landfill mass/ liner system. In the case of long term analyses of the natural and cut slopes, the groundwater was assumed to be near the surface. This assumption is thought to be conservative.

9.1.3 Construction Cut Slope Stability

9.1.3.1 Conditions

Two sections were identified, on the basis of the development plans, as representing the critical construction cut slopes in the East Canyon Expansion area. The sections are A_cA_c' and B_cB_c'. The subscript "c" refers to the fact that these sections represent the construction cut slopes.

The locations of the sections which have been analyzed are shown in Figure 9-1. Section A_cA_c' is located in a east-west direction along the slopes to be prepared for the Phase I construction. Section B_cB_c' is located at the southeastern portion of the landfill area and runs in a northeast-southwest direction. Both were analyzed using circular slip surfaces.

Each of the slopes was analyzed for two phases in terms of fill sequencing: the first, prior to any landfilling activity and the second, following the placement of waste up to the final grade. For each of these conditions, stability analyses were performed for both long-term and short-term conditions. In the short-term condition, no groundwater surface was included in the analyses. A phreatic groundwater surface was included in the long-term analyses. However, little information is currently available regarding the location of the groundwater surface along the eastern slopes of the proposed East Canyon expansion area. Therefore, two conditions of groundwater elevation were modeled in the analyses. The first assumed the groundwater surface to be at the ground surface, all the way up the slope, which is thought to be very conservative. The second assumed the groundwater surface to be along the ground surface from the base of the cut slope up to the first bench, and then to continue at a slope of 10% toward the east. It is believed that, while neither of these two cases may be representative of the actual field condition, they conservatively represent two conditions in which groundwater could occur in the field.

As discussed in Section 9.1.2.3, site-specific strength parameters felt to represent cut slope rock strengths are not currently available for rocks underlying the eastern side of the landfill. Accordingly, reasonable ranges of potential shear strengths were assumed to evaluate the minimum shear strength necessary to provide required minimum factors of safety on the cut slopes.

9.1.3.2 Results

Results of initial analyses of the construction cut slopes for circular slip surfaces are summarized in Tables 9-2 to 9-5. The analyses are presented in Appendix F-5.

Table 9-2
Results of Cut Slope Stability Analyses
East Canyon Area
Section A_cA_c' Prior to Waste Placement

Static Factor of Safety Under Short-term Condition

c		Factor of Safety			
(psf)	φ =	17.5	18	19	20
300		1.19		1.28	1.34
350		1.21	1.24		
400		1.24	1.27		
450		1.27			
500			1.22		

Static Factor of Safety Under Long-term Condition
[Groundwater Level Assumed to be at the Ground Surface]

c		Factor of Safety				
(psf)	φ =	24	30	35	36	38
300		0.95	1.17	1.37		
350						
400		0.99		1.43		
450				1.46	1.5	1.59
500				1.48		

Static Factor of Safety Under Long-term Condition
[Groundwater Level Assumed to be at Ground Surface up to the First Bench and at 10% Gradient Thereafter]

c (psf)	ϕ =	Factor of Safety			
		24	30	32	35
300		1.19	1.45	1.52	1.65

Table 9-3
Results of Cut Slope Stability Analyses
East Canyon Area
Section A_cA_c' After Waste Placement

Static Factor of Safety Under Short-term Condition

c (psf)	ϕ =	Factor of Safety			
		17.5	18	19	21
300		1.26	1.29	1.35	1.47

Static Factor of Safety Under Long-term Condition
[Groundwater Level Assumed to be at the Ground Surface]

C (psf)	ϕ =	Factor of Safety				
		24	28	33	36	37
300		1.02	1.16		1.49	1.51
500			1.32	1.52		

Static Factor of Safety Under Long-term Condition
[Groundwater Level Assumed to be at Ground Surface up to the First Bench and at 10% Gradient Thereafter]

c (psf)	ϕ =	Factor of Safety
		24
300		1.67

Table 9-4
Results of Cut Slope Stability Analyses
East Canyon Area
Section B_cB_c' Prior to Waste Placement

Static Factor of Safety Under Short-term Condition

c (psf)	φ =	Factor of Safety 17.5
300		1.12
450		1.28
500		1.33
550		1.39

Static Factor of Safety Under Long-term Condition [Groundwater Level Assumed to be at the Ground Surface]

C		Factor of Safety				
(psf)	φ =	24	30	35	36	38
300		0.93	1.11		1.31	1.38
500				1.5		1.61

Static Factor of Safety Under Long-term Condition [Groundwater Level Assumed to be at Ground Surface up to the First Bench and at 10% Gradient Thereafter]

c		Factor of Safety	
(psf)	φ =	24	28
300		1.31	1.53
800		1.53	

Table 9-5
Results of Cut Slope Stability Analyses
East Canyon Area
Section B_cB_c' After Waste Placement

C (psf)	φ =	Factor of Safety 17.5	20	22	25	30
300		1.13		1.35	1.51	1.78
500		1.34	1.46			

Static Factor of Safety
Under Long-term Condition
[Groundwater Level Assumed to be at the Ground Surface]

C (psf)	φ =	Factor of Safety 24	30	33	35	38
300		0.94				
400						1.52
500			1.33	1.43	1.51	

Static Factor of Safety Under Long-term Condition
[Groundwater Level Assumed to be at Ground Surface up to the First Bench and at 10% Gradient Thereafter]

c (psf)	φ =	Factor of Safety 24	26
300		1.46	1.57
400		1.57	
500		1.67	

9.1.3.3 Supplemental Evaluations

Owing to uncertainties regarding strength of the rock materials in the cut slopes and the applicability of slope stability analyses using circular slip surfaces to the complex character and structure of the Franciscan materials underlying the east cut slope, it was decided that additional evaluations were warranted. Accordingly Dr. Richard E. Goodman, Professor Emeritus at University of California at Berkeley was retained to provide additional analysis of proposed cut slope stability. Dr. Goodman is a noted engineering geologist and specialist in rock mechanics, with extensive experience involving Franciscan rocks like those underlying the east slope. He was retained to provide supplemental evaluation related to three specific issues:

- the need for and suitability of possible field investigations to further evaluate strength of the rocks in the proposed cut slope;
- potential to steepen a limited slope area, located at the top of the east cut slope in the northeast portion of East Canyon from 2H:1V to 1.5H:1V, which would allow elimination of a retaining wall at the toe of the slope segment; and
- overall stability of the proposed east cut slope.

Dr. Goodman reviewed available background information on the geology and material properties of the East Canyon area and performed a field reconnaissance of the slopes with GeoSyntec staff on 15 February 1999. Based upon this information he concluded that only a limited field investigation program consisting of a single boring to evaluate the thickness and properties of the colluvium material in the bottom of the East Canyon. Additional drilling and sampling in the east slope to evaluate shear strength of the rock would be of limited value at best due to the irregular nature of the Franciscan materials with range blocks in a matrix of Franciscan melange.

One boring, B-1, was drilled and sampled in the central area of the East Canyon just to the west of the stream. Samples were collected and strength and index tests were completed on the samples. The boring log and laboratory test results are included in Appendix F-5-2. This information was provided to Dr. Goodman.

Dr. Goodman provided a series of three letter reports (Appendix F-5-2) which concluded the following.

- The northeast portion of the top of the East cut slope can be steepened to 1.5H:1V, from the currently proposed slope of 2 H:1V, and the retaining wall can then be eliminated. (Note the 2H:1V slope and retaining wall are shown in the Development Drawings in Appendix E-1. The slope will be changed as part of the preparation of the Phase I and II construction plans.)

- The designed cut slopes are satisfactory.

The condition of the rock slope will be evaluated by an engineering geologist during site grading to confirm actual slope conditions. The California Department of Water Resources (WR) is providing review of slope stability evaluations for the East Canyon expansion DWR issued a letter dated 6 March 2000 that requested additional information on several items. Among these was the preparation of cross-sections of the east cut slope including boring log information and geographical shear ware relocity testing. These cross sections are included in our response package to DWR's letter that is presented in Appendix F-6-2.

9.1.4 Interim and Final Landfill Slope Stability

9.1.4.1 Conditions

Stability analyses of the interim and final landfill configuration include the evaluation of critical failure surfaces passing through the waste mass, the liner system and the subgrade bedrock material. In order to investigate these modes of failure, failure surfaces having both circular and non-circular (block) shapes were studied. The circular failure surfaces were found to be applicable for failures within the waste mass, or for deep seated failures that passed through the subgrade material. Of these, the failure surfaces passing through the waste mass were found to be more critical. The block shaped failure surfaces were critical for failures planes that passed along the liner system. Accordingly, for each cross-section under investigation, separate analyses were performed for circular (i.e., for waste mass/subgrade) and block (for liner system) for filling in Phase I through III areas. Results of previous analyses indicated the circular surfaces were not critical, so analyses were limited to block surfaces in Phase IV in several cross-sections.

The shear strength properties of the waste material were obtained from results of large-scale direct shear tests, as mentioned in Section 9.1.2.3. The shear strength properties of the subgrade material were assumed on the basis of data used in previous analyses, also described in Section 9.1.2.3. The liner system in the East Canyon Expansion area will have different configurations in the floor and the side-slope areas. Accordingly, the critical liner interfaces with respect to slope stability were identified and suitable shear strength property values were assigned for use in the analyses.

The slope stability analyses were performed using shear strength parameters presented in Section 9.1.2.3. In the case of most of the materials included in the landfill mass/liner stability (i.e., waste material, liner, and engineering fill), the shear strength values were obtained from literature or from other projects and the drained (long term) and the undrained (short term) shear strengths were assumed to be within the same range. Therefore, the stability analyses were performed only for one condition and the minimum acceptable factor of safety was set at 1.5, i.e., same as for the long-term condition. Because of the underdrain layer, the groundwater level is expected to remain below the liner level and, therefore, will not affect the stability analyses.

The undrained and the drained strengths of the subgrade material likely differ. However, since these strengths were obtained from reports by previous consultants which did not include explanations behind the strength selections or the strengths were from weathered near surface material, it was not considered appropriate to adopt these values without further field investigation and strength testing. As rock shear strengths are thought be well above for waste or liner shear strengths, all of the critical failure surfaces considered for the landfill mass/liner stability were found to be completely within the waste mass and the liner system and did not penetrate into the subgrade. Therefore, it was inferred that the change in strength of the subgrade from long-term to short-term will not influence the results of stability analyses. Hence the stability analyses for the landfill mass/ liner system were performed with a minimum acceptable factor of safety of 1.5 using a single set of strength parameters for all the elements.

Brief accounts of the different conditions that were analyzed are presented in the following sections. The sections for which analyses have been performed were selected carefully on the basis of the subgrade orientation and maximum height and slope of the waste mass. The locations of the sections are shown in Figure 9-2. The details of the analyses are provided in Appendix F-6. A summary of the results of the analyses are provided in Section 9.1.4.2.

Phase I

In Phase I, four critical sections were identified for slope stability analyses.

Section AA′

Section AA' of Phase I is located along a north-south direction through the canyon area of the landfill. The slope stability was evaluated through analyses in which circular failure surface passing through the waste mass and/or subgrade and block-shaped critical failure surfaces passing along the liner. The block analyses were performed only for the southern slope of the section, since on the northern part the bottom liner slopes into the landfill, eliminating the potential for movement to occur in an outward direction. The circular analyses were conducted on both slopes.

Section BB′

Section BB' of Phase I is located along an east-west direction through the canyon area of the landfill. The eastern and the western slopes of this section are geometrically similar. Both circular and block shaped failure surfaces were analyzed for the east and west slopes.

Section 101

Section 101 is located along a east-west direction, passing immediately to the north of the canyon "base" area. Both the eastern and the western slopes have similar slopes of 3.3(H):1(V). However, the eastern slope is higher than the western slope. Therefore, both circular and block shaped failure surfaces were analyzed on the eastern slope of this section.

Section 102

Section 102 is located in a north-south direction passing by the western side of the canyon area. The southern point of this section is located in the proposed west sedimentation pond. The southern slope of this section was analyzed for both circular and block shaped failure surfaces. The northern slope is relatively flat (approximately 10% slope) and the liner system on this side slopes inward into the landfill mass. Therefore, no analyses were performed for the stability of this slope.

Phase II

In Phase II, two critical sections B-B' and 101 were identified for slope stability analyses. Other cross-sections have essentially the same profile as in Phase I.

Sections BB' and 101

The locations of both sections for Phase II is the same as described for Phase I. The western slope for these cross-sections in Phase II is steeper and higher than the eastern slope. Also, the liner system beneath the eastern face slopes inward into the waste mass. Therefore, both circular and block shaped failure surfaces were analyzed for the western slope.

Phase III

In Phase III two critical sections were identified for slope stability analyses. Analysis was not performed on Section 101 for Phase III because the eastern slope of this section has the same height and slope as Phase II and the western slope has the same height as Phase II and a flatter slope. Both the eastern and the western slopes of Section 101 for Phase II have already been analyzed and found to have adequate factors of safety.

Section 102

The location of Section 102 is described in Section 9.1.4.1.1. The southern slope was analyzed for both circular and block shaped failure surfaces. The northern slope of this section has a flatter slope, a shorter slope height and a base liner that slopes inwards, into the landfill. Therefore, slope failure of this section was not considered critical.

Section 103

Section 103 is located in a north-south direction, passing to the west of the canyon base area. The southern limit of this section passes through the existing leachate pond. The southern slope of this section was analyzed for both circular and block shaped failure surfaces. In the northern portion of this section, the base liner is placed over a side-slope area that slopes inwards, into the landfill. Therefore, stability of the northern slope was not analyzed for this section.

Phase IV

Block and circular failure surfaces were analyzed for the western slope of this section. In Phase IV six critical sections were identified for slope stability analyses.

Section AA'

Block failure surfaces were analyzed for the southern slope of this section.

Section BB'

Block and circular failure surfaces were analyzed for the western slope of this section.

Section CC'

Section CC' is located along a northwest-southeast direction. Due to the geometry of this section, it is believed that the potential for sliding exists only on the southern slope, and both circular and block type slope stability analyses were performed for this slope.

Section 101

Block failure surfaces were analyzed for both the eastern and western slopes of this section. The eastern slope a lower factor of safety for block analyses than the western and was subsequently analyzed for circular failure surfaces. Factors of safety in the eastern slope were high enough the circular analyses of the Section 101 western slope were not necessary.

Section 102

The southern slope of this section was analyzed for block shaped failure surfaces. The northern slope has an base liner sloped into the landfill (as mentioned in connection with Phases I and III). Therefore, the northern slope was not analyzed for this section.

Section 103

Block failure surfaces were analyzed for both the southern and northern slopes of this section. The northern slope was found to provide a lower factor of safety than the southern and therefore, was also analyzed for circular failure surfaces.

Phase V (Final Phase)

Waste placement operations in Phase V will bring the East Canyon expansion area and the existing Central Landfill to the final grades. Waste placement will be limited to the western portion of the East Canyon landfill. Phase V operations will alter only three of the cross-sections, Sections BB', 101 and 103, from their configurations in Phase IV.

Sections BB' and 101

The eastern slope was analyzed for both circular and block shaped failure surfaces. The western slope of this section has a similar slope, a significantly shorter slope height and a base liner that slopes inwards, into the landfill. Therefore, slope failure of this section was not considered critical.

Section 103

Both the northern and the southern slopes of this cross-section were analyzed for circular and block failure surfaces.

Section DD'

The fill over the existing waste was analyzed for circular and block failure surfaces.

9.1.4.2 Results

Results of slope stability analyses for landfill configurations during the different phases of operation are summarized in Table 9-6. Detailed calculation results are attached in Appendix F-5. The results indicate that the waste mass and the liner system in the different phases of landfill construction will have appropriate calculated factors of safety against sliding.

Seismic site response and deformation analyses were performed separately and are included in Appendix F-4. These analyses were completed for the Healdsburg-Rogers

Creek Fault. The potential for the San Andreas Fault to generate larger deformations was also evaluated. The evaluation, also included in Appendix F-4 concluded that deformations associated with the Healdsburg-Rogers Creek Fault would be larger. The seismically-induced deformations were calculated using a Newmark-type deformation model, YSLIP_PM [Yan, et al., 1996] for two columns, 75-ft and 150-ft high. The appropriate column height was selected, depending on the location of the most critical failure surface. The results of these analyses are presented in Appendix F-4 (Figures 8 and 9) in the form of plots of seismically-induced displacements versus yield accelerations. The calculated yield accelerations for the most critical cases are shown in Table 9-6. The deformations in the landfill mass/liner system and final cover associated with the calculated yield accelerations were evaluated using the plots. All were found to be less than 6 in. (15 cm).

9.1.4.3 Supplemental Evaluations

As noted previously. DWR is reviewing slope stability analyses for the East Canyon expansion. In the course of their review they have issued correspondence to the RWQCB dated 8 March 1999, which requested additional information on a variety of issues. A response letter dated 20 January 2000, which includes the comments was issued to the DWR. This letter is included in Appendix F-6-2. (Note that Attachment 1 to this letter is included in this JTD as appendix F-5-2 and Attachment 2 has been superceeded).

Subsequently, a meeting was held with DWR staff to discuss remaining slope stability issues. These issues were formalized as a letter dated 6 March 2000 also, included in Appendix F-6-2, which dealt with three issues: 1) excavation slopes, 2) lines system critical interface strengths and 3) earthquake – induced displacements.

Additional interface testing was completed to evaluate the strength of the critical interface between the GCL and geomembrane under hydrated and unhydrated conditions. These test results are presented in the response package to DWR dated 6 April 2000 (Appendix F-6-2).

Additional slope stability analyses were completed using the interface test results and modified waste shear strength. These analyses included the most critical cross-section C-C' and additional non-linear sections through the length of the floor footprint and parallel sections on either side of the floor.

The analyses are included in the response package. Another earthquake motion was also used to evaluate earthquake generated deformations.

The results of the analyses indicate that all factors of safety are larger than 1.5 and seismically induced defermations are less than 6 inches.

Table 9-6
Results of Landfill Slope Stability Analyses
East Canyon Expansion, Sonoma Central Landfill

Phase	Section	Failure Surface	Results Short Term			
			Filename	FS	Filename	k_y
I	AA′ (north slope)	Circular	S1ANC01	6.98		
	AA′ (south slope)	Circular	S1ASC01	2.74	S1ASCQ1	0.53
		Block	S1ASB03	2.56	S1ASBQ1	0.51
	BB′ (east slope)	Circular	S1BNEC01	4.38		
		Block	S1BNEB02	2.94	S1BNEBQ3	0.22
	BB′ (west slope)	Circular	S1BNWC02	2.4		
		Block	S1BNWB01	1.93	S1BNWBQ1	0.42
	101 (east slope)	Circular	S101EC02	3.68		
		Block	S101EB01	3.26	S101EBQ1	0.43
	102 (south slope)	Circular	S102SC02	2.14	S102SCQ1	0.30
		Block	S102SB03	3.66	S102SBQ2	0.37
II	BB′ (west slope)	Circular	S2BNWC02	3.54		
		Block	S2BNWB0M	2.90	S2BNWBQM	0.19
	101 (west slope)	Circular	S201WC01	3.24		
		Block	S201WB02	2.62	S201WBQ1	0.29
III	102 (south slope)	Circular	S302SC02	3.40		
		Block	S302SB02	1.98	S302SBQ1	0.20
	103 (south slope)	Circular	S303SC01	3.80		
		Block	S303SB02	2.47	S303SBQ1	0.28
IV	AA′ (south slope)	Block	S4ASB01	2.05	S4ASBQ1	0.12
	BB′ (west slope)	Circular	S4BNWC02	3.3	S4BNWCQ1	0.5
		Block	S4BNWB02	3.79		
	CC′	Circular	S4CUC01	3.10	S4CUCQ1	0.41
		Block	S4CUB01	1.65	S4CUBQ1	0.12
	101 (east slope)	Circular	S401UC01	4.97		
		Block	S401UB02	3.96	S401UBQ1	0.33
	101 (west slope)	Block	S401WUC1	4.24		
	102 (south slope)	Block	S402EUBC	1.97	S402EBQ	0.18
	103 (south slope)	Block	S403SB01	3.06	S403SBQ1	0.32
	103 (north slope)	Circular	S403NC02	3.51		
		Block	S403NB02	2.90	S403NBQ2	0.29
V (Final)	BB′ (east slope)	Circular	S5BNWC01	3.75		
		Block	S5BNWB0M	2.06	S5BNWBQM	0.18
	101 (east slope)	Circular	S401EC02	4.66		
		Block	S501EB01	3.58	S501EBQ3	0.26
	103 (south slope)	Circular	S503SC02	3.66		
		Block	S503SB02	3.13	S503SBQ1	0.32
	103 (north slope)	Circular	S503NC02	3.69		
		Block	S503NB02	2.86	S503NBQ1	0.31
	DD' (West Slope) Overfill	Circular	S5DNWB01	3.90	S5DNWBQ1	0.32
		Block	S5DNWC01	6.88		

9.1.5 Final Cover Slope Stability

9.1.5.1 Conditions

The stability of the final cover system was analyzed using an infinite slope approach [Matasovic, 1991]. Sliding failures were assumed along planes defined by the interfaces between the geosynthetic components of the final cover system. While the interface most critical for the purpose of analyses cannot be identified with any certainty, ranges of shear strength properties characteristic of the geosynthetic components included in the final cover design were utilized.

Analyses were performed for both long-term and short-term conditions. The short-term condition was considered to be one where a seepage head equal to the thickness of the vegetative layer develops in the cover system. This assumption is considered to be extremely conservative, since the final cover system will be provided with a drainage geocomposite layer, which will exit at benches provided at 50 ft (15 m) vertical intervals. Pseudo-static analyses were performed to estimate the yield acceleration. Seepage was not considered to act at the same time as horizontal seismic acceleration.

9.1.5.2 Results

The results of infinite slope analyses are summarized in Table 9-7. Details of the analyses are presented in Appendix F-7. The results indicate the range of strength properties over which the final cover system will have adequate factor of safety under long and short-term conditions. The ranges of acceptable static factors of safety are shaded in gray in the tables.

As mentioned previously, the results of seismically-induced deformation analyses are presented in Appendix F-4 in the form of plots of seismically-induced displacements versus yield accelerations. The results of the stability analyses, performed over a range of cover strength, are shown in Table 9-7. On the basis of the results of the seismic analyses, the yield accelerations for which the displacements are below 12 in (30 cm) are identified in gray shading. The minimum shear strength of the cover material that correspond to displacements below 12 in. (30 cm) is represented by cohesion, $c = 40$ psf and friction angle, $\phi = 14°$, or $c = 20$ psf, and $\phi = 18°$.

Table 9-7
Results of Final Cover Stability Analyses
East Canyon Area
Static Factor of Safety Under Long-term Condition

c		Factor of Safety			
(psf)	ϕ =	14	16	18	20
10		1.37	1.52	1.67	1.83
20		1.75	1.90	2.05	2.21
40		2.50	2.65	2.80	2.96
60		3.25	3.40	3.55	3.70
80		4.00	4.15	4.30	4.45
100		4.75	4.90	5.05	5.20

Static Factor of Safety Under Short-term Condition

c		Factor of Safety			
(psf)	ϕ =	14	16	18	20
10		0.81	0.87	0.94	1.00
20		1.18	1.25	1.31	1.38
40		1.93	2.00	2.06	2.13
60		2.68	2.75	2.81	2.88
80		3.43	3.49	3.56	3.63
100		4.18	4.24	4.31	4.38

Pseudo-static Yield Acceleration

c		Yield Acceleration k_y (g)			
(psf)	ϕ =	14	16	18	20
10		0.09	0.12	0.16	0.19
20		0.18	0.21	0.24	0.28
40		0.35	0.38	0.42	0.45
60		0.53	0.56	0.59	0.62
80		0.71	0.74	0.76	0.79
100		0.88	0.91	0.94	0.97

9.2 Settlement

An evaluation of the anticipated settlement of the landfill during the post-closure maintenance period is required by Title 27. Settlement of the landfill is due to two components. The first component is the settlement of the natural soil/compacted fill/bedrock foundation materials due to stresses imposed by the landfill. The second component is the settlement due to the consolidation and decomposition of the wastes. The references, assumptions, approaches and calculations involved in the settlement analyses are included in Appendix F-3.

9.2.1 Foundation Settlement

Settlement of the landfill due to compression of the bedrock foundation materials is limited due to the high density and thus relative incompressibility. Bedrock materials are assumed to behave elastically. Maximum natural soil thickness beneath the proposed expansion area is estimated to be on the order of 25 ft (8 m). If not removed during grading, this material will be replaced with compacted fill and thus will not contribute to foundation settlements. Foundation fill at the site will be compacted at least 90% relative compaction, measured according to the modified Proctor compaction test (ASTM D 1557). Fill compacted to this density is relatively stiff and will be present in relatively small thickness. The estimated maximum settlement calculated for the landfill foundation for these conditions was conservatively estimated to be less than about 0.5 ft (0.2 m). This amount will not significantly affect the performance of the containment system with regard to base grades.

In addition, foundation settlement occurs when the load is applied (i.e., as the waste is placed), and therefore, should be essentially complete prior to placement of final cover. Hence, the settlement profiles acting on the final cover resulting from foundation settlement are likely to be less than this estimate. Due to its limited magnitude and the timing of its occurrence, settlement of the landfill foundation is not considered significant.

9.2.2 Waste Settlement

Landfill settlement due to compression of waste will occur as a result of two distinct mechanisms: mechanical compression due to the weight of the overlying waste and cover soils (primary settlement); and compression caused by the decomposition of organic matter contained within the waste (secondary settlement).

Primary Settlement

Total primary settlement is estimated to be on the order of 10 to 20 percent of the waste thickness. Therefore, for a waste fill height of 100 to 230 ft (30 to 70 m), total primary settlement is estimated to be on the order of 10 to 46 ft (3 to 14 m). However, primary settlement will occur progressively as the landfill is filled and will be largely complete at the time of final cover placement. Therefore, the impact of primary settlement of the waste on the final cover will be small.

Secondary Settlement

The rate and magnitude of secondary settlement primarily depend on the rate of waste decomposition and the waste thickness. The dry climate, and the relatively dry nature of the waste accepted at the site, limit the rate and magnitude of waste decomposition. If waste decomposition is limited, secondary settlement is also limited. Total secondary settlement after closure is estimated to be on the order of 5 to 10 percent of the waste thickness. Therefore, for a waste fill height of 100 to 230 ft (30 to 70 m), total secondary settlement is estimated to be on the order of 5 to 23 ft (1.5 to 7 m). Secondary settlement will occur over a period of 10 to 30 years, or more, depending on waste decomposition rates. The rate of secondary settlement will, however, decrease with time after closure.

9.2.3 Combined Effect of Estimated Settlement

As stated in the previous section, the primary source of the anticipated settlement occurring during the post-closure period is secondary compression of the waste. Thus, the detailed design of the final cover system should take into account the anticipated secondary settlement in the design of drainage structures, gas extraction well details, and in the design of the final landfill grading. Postclosure land uses and postclosure maintenance activities also take into account the potential for secondary settlement. Specifically, post-closure land uses are to be limited to those not adversely affected by secondary settlement. In addition, the postclosure maintenance plan should include specific activities to correct adverse impacts resulting from the secondary settlements including repairing surface-water drainage structures, roads, or gas extraction wells adversely affected by the settlement.

9.2.4 Existing Waste Overfill

Phase 5 of the East Canyon expansion will place new waste above the existing waste of the current cell. This overfill expansion area is approximately 15 acres (6.2 ha). The County has proposed to place a geomembrane liner above the existing waste before any new waste is placed. Liner settlement due to the expansion over existing waste will occur in response to the weight of the new waste and to ongoing decomposition and/or time-dependent mechanical compression of the existing waste.

The settlement evaluation involved first calculating total settlements at discrete points over the landfill area. Potential impacts of the calculated settlements on the liner system performance are considered below. The settlement of the liner system is primarily due to two modes of waste settlement, namely: (i) liner settlement due to overall waste compression; and (ii) localized liner settlement due to possible local-scale waste heterogeneity.

The ability of the HDPE geomembrane component of the landfill liner system to continue to function as a hydraulic barrier when subjected to the anticipated foundation settlements was assessed. The assessment considers the magnitude of extensional strains that will develop in the liner system due to the calculated settlements as discussed.

9.2.5 Overall Compressibility

The term "overall compressibility" of existing waste as used herein refers to the potential for area-wide settlement when the waste is subjected to an increase in vertical stress and/or an increment of elapsed time. Settlement resulting from overall compressibility is assumed to be characterized by two components, a rapid primary settlement, and a longer-term, time-dependent secondary settlement, as previously discussed.

Once the new waste is placed the existing waste will be subjected to a new load causing the existing waste to go into primary consolidation. The new waste will not all be placed simultaneously, thus it was conservatively assumed that the primary settlement will occur in the first three months of new waste placement. Secondary settlement was assumed to occur over 30 years from the time that primary settlement was completed. Due to the variability of MSW a broad range of settlement parameters was assumed to evaluate minimum and maximum possible settlements caused from placing the new waste over the existing waste.

The liner settlements due to overall compressibility will range from 1.5 to 57 feet (0.5 to 18 m), depending upon existing waste thickness and amount of new waste placed. Total settlement calculations of the landfill liner system were performed at discrete points at which the thickness of the waste is approximately known [after EBA, 1997]. All other factors remaining equal, the largest differential settlements will occur where there is the greatest gradient of the depth of the waste. The spacing between settlement calculation points was approximately 200 ft (61 m). It should be noted that at the point where the existing waste is a thin layer with a thick layer of new waste, the maximum total settlement was calculated to be approximately 61 percent of the original height. Typically wastes have been observed to settle only 10 to 20 percent of their original height. Therefore, these calculations are considered quite conservative.

Extensional strains may be induced into the geomembrane from differential settlements caused by overall waste compressibility. The maximum potential differential settlements from this analysis would be 57 ft over a horizontal distance of 200 ft (61 m). However, this is well above the level observed in landfills, so this is considered quite conservative. Even differential settlements of this excessive magnitude will produce extensional strains in the geomembrane. Generally, the analyses indicated that a combined tensile strain of less than 9% may be experienced by the geomembrane. Due to the fact that the specifications will require a minimum yield strain of 12%, tensile strength of the proposed geomembrane is sufficient. For this project, the overall waste compressibility is not a concern for the design of the geomembrane. Larger extensional strains than those calculated may develop due to differential settlement resulting from waste variability within the intervals between settlement points. Differential settlements will be most noticeable at the landfill edges. However, this settlement is expected to induce compressional strains into the geomembrane, which are not generally a design concern.

9.2.6 Local Heterogeneity

The term "local heterogeneity" of existing waste as used herein refers to the potential for differential waste settlement due to localized differences in waste stiffness or compressibility. Localized waste heterogeneity may result from: (i) buried appliances, or other hollow objects, which are initially very stiff, but which have the potential to collapse due to either increases in vertical stress or loss of strength due to rust or corrosion; and (ii) localized differences in waste compressibility resulting from differences in waste composition, field compaction, or cover soil placement procedures.

The potential for the collapse of an appliance has previously been considered in the design of several cover systems and vertical landfill expansions in the United States [Koerner and Hwu, 1991; Giroud et al., 1990; and Berg and Collin, 1993]. The collapse of a major appliance may induce significant differential settlements in the overlying liner system if the collapse occurs in close proximity (i.e., within approximately 10 ft [3 m]) of the geomembrane. However, since appliances are recovered from the waste at the Central Disposal Site this is not considered likely.

Localized differences in settlement of waste may result from differences in compressibility of adjacent hard and soft waste materials, for example, construction debris adjacent to yard waste. Differences in the decomposition rate of adjacent wastes can also lead to localized differences in settlement. The settlement evaluation in this report includes analyses of local settlement resulting from potential differences in waste compressibility that are conservative with respect to these landfill operational practices. The analysis also accounts for attenuation of the settlement through the foundation layer.

The calculations indicate that strains at the geomembrane resulting from local waste heterogeneity are compressive within a vertical height to the geomembrane approximately 2.3 ft (0.7 m) of the compressible zone and extensional farther away. Maximum extensional strains were below 5%. The results show that the induced strains are significantly increased as the depth of the compressible zone reduces. Thus, it is important that the proof-rolling of the foundation be completed to identify compressible zones near the surface, which can then be recompacted.

9.2.7 Extensional Strain in Liner System

Allowable extensional strains for HDPE geomembranes was addressed by Giroud et al, [1993]. Their work indicated that the allowable value depends on several factors, including: (i) geomembrane yield strain in uniaxial tension tests; (ii) geomembrane service temperature; (iii) depth of scratches in the geomembrane surface; (iv) quality of geomembrane seams; (v) freedom of seams to rotate when extended in service; and (vi) nature of the state of stress in service (i.e., uniaxial or biaxial). GeoSyntec used the guidelines provided by Giroud et al, to establish an allowable extensional strain for the geomembrane in the landfill.

In establishing the allowable extensional strain, GeoSyntec considered project-specific factors. These factors are based on typical requirements used by GeoSyntec for specifications that are intended to ensure high-quality geomembrane installation and seaming. These specifications also require a minimum HDPE geomembrane yield strain of 10 percent, and experience indicates that a minimum value of approximately 12 percent is typically obtained. These values are consistent with values used by GeoSyntec for textured HDPE geomembranes on other recent landfill design. Calculated strains due to settlement in for very conservative cases are below 10 percent.

9.3 Liquefaction

A review of the subsurface data available indicates that liquefiable soils are not present within the East Canyon expansion area. Therefore, liquefaction will not be a factor for the East Canyon expansion area.

9.4 Leachate Generation

In general, the rate of leachate generation at a landfill is highest early in the operating life of the facility, approaches a steady-state condition during the latter stages of filling, and decreases after placement of the final cover system. The long-term reduction in leachate generation rate due to final cover placement is dependent on the degree of impermeability of the cover. If the cover essentially prevents infiltration, leachate will eventually cease to be generated.

Typically, leachate generation rates for the design of landfills are estimated using the USEPA model "*Hydrologic Evaluation of Landfill Performance*," or "*HELP*" model [Schroeder, 1994 a & b]). The HELP model is a quasi-two-dimensional water balance method for evaluating daily run-off, evapotranspiration, percolation (i.e., infiltration), and LCRS flow at landfills. Input parameters to the model include cover, waste, and liner system properties, landfill geometry information, and climatological data. HELP model analyses of three conditions at the East Canyon Expansion were performed as part of preparation of this JTD. Precipitation and temperature data for Sonoma, California were used in the input for the program. The other climatological data (e.g., evapotranspiration and solar radiation) used for the analyses were those for San Francisco, California. The three conditions analyzed using the HELP model were:

- during operation of a phase, with 30 ft (9 m) of waste and 6 in. (15 cm) of daily cover;
- at the end of a phase, with 100 ft (30 m) of waste and 12 in. (30 cm) of interim cover; and
- after closure, with 200 ft (61 m) of waste and final cover.

The results of the analyses indicate that the maximum peak daily flow of leachate will occur under a condition when all three phases will be under operation simultaneously. Under this condition the peak daily flow in the LCRS, as obtained from the HELP model analyses, is 26,080 ft^3 (739 m^3). Additionally, analyses indicate that peak daily leachate generation final configurations (after closure of all three phases) will be approximately 2.1 ft^3 (0.06 m^3).

Regulations contained in Section 20340(b) of Title 27 require that the LCRS be "*...designed, constructed, maintained, and operated to collect twice the maximum anticipated daily volume of leachate from the Unit*". The individual components of the LCRS (such as the gravel drainage layer, the geocomposite drainage layer and the perforated pipes) were designed on the basis of the leachate generation expected in each phase of the landfill. In each case, the components have been designed to handle twice the peak daily leachate flow (as predicted by the HELP model) for the corresponding phase.

Additionally, experience at other landfills, and the conservative nature of the HELP model assumptions, suggest that the actual leachate flow will be less than these values. Actual leachate production from lined landfills is frequently 20% to 50% less than predicted by the HELP model [Lane, et al., 1992]. The results of HELP model analyses are in Appendix F-2.

9.5 Surface-Water

The purpose of the surface-water control systems for the East Canyon Expansion area is to:

- control flows on the landfill surface after the intermediate or final cover has been placed;
- isolate the landfill by diverting surface-water run-off from adjacent areas around the landfill footprint;
- isolate the daily landfill cell, i.e., the active area with exposed waste, by diverting surface-water run-off from landfill areas with intermediate or final cover, and from the adjacent side slopes, away from the active area;
- limit infiltration, inundation, and ponding within the daily landfill cell;
- limit erosion, slope failure, washout, and over-topping of the surface-water conveyance and sedimentation structures; and
- limit erosion of interim (daily and intermediate) and final cover.

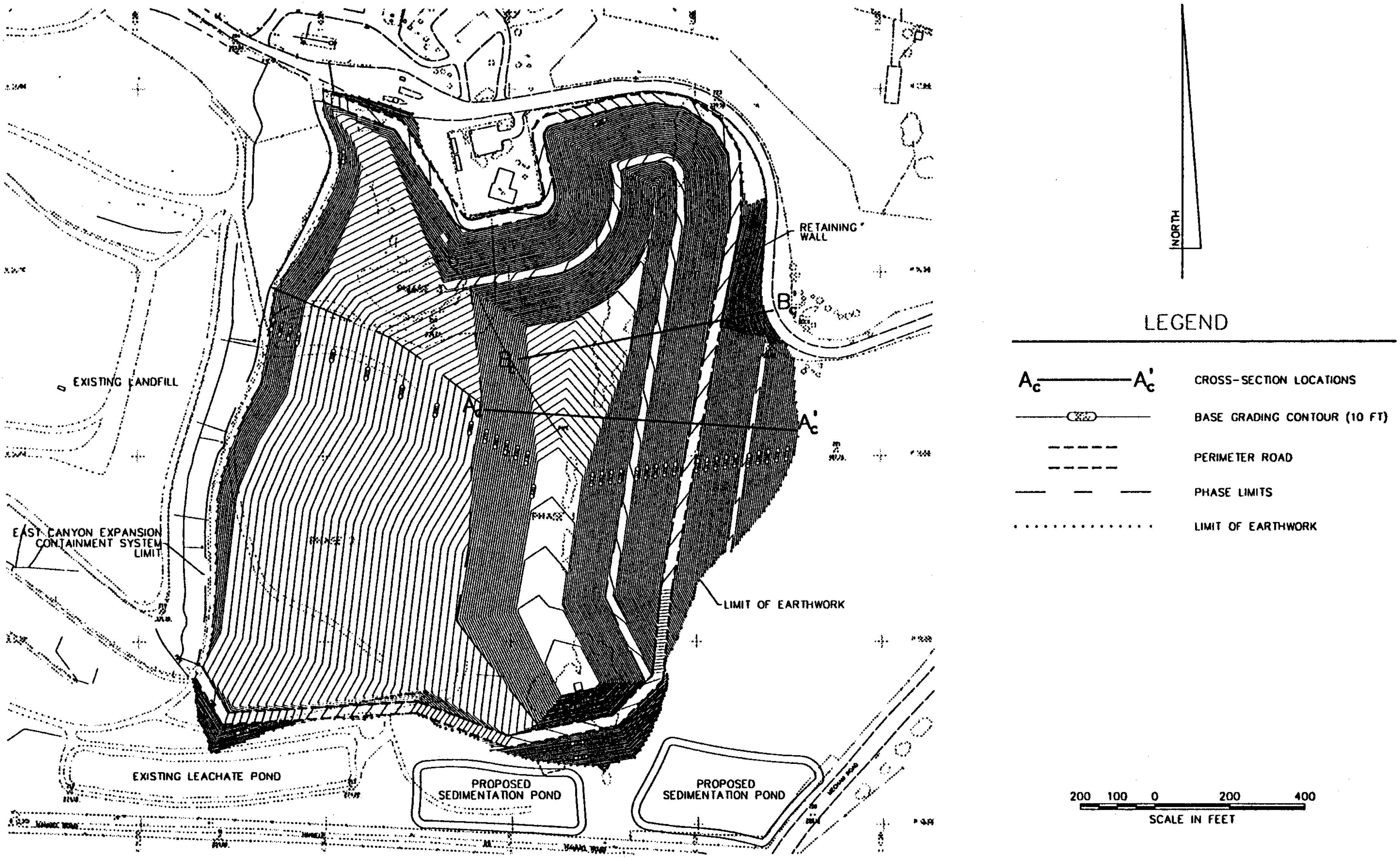
The objective of these analyses was to calculate the expected quantities of flow for the East Canyon expansion area resulting from a 100-yr, 24 hr-storm event, and to design surface water drainage appurtenances as necessary to accommodate the flows. This area includes the tributary areas of the existing landfill west of the expansion and other areas, which contribute flows to the expansion area. The drainage appurtenances which were designed included ditches for the perimeter access road, final closure benches, downchutes, culverts and sedimentation ponds.

The Rational Method was used to calculate flow quantities for the subcatchments at the site. Manning's equation was used to calculate the required sizes of ditches and pipes. Sedimentation basins were designed using the procedures outlined in the Manual of Standards for Erosion and Sediment Control [ABAG, 1995].

The surface-water management plan was prepared utilizing data for the site provided from literature and site topography provided in Autocadd, Version 13 drawing format by the County, dated October 1996. This topography is based on photogrammetric surveys of the site conducted in October 1996

The details for the analyses which were performed are included in Appendix F-8. The results of the surface water analyses include v-ditch depths, culverts/downchutes required sizes, and sedimentation basin sizes.

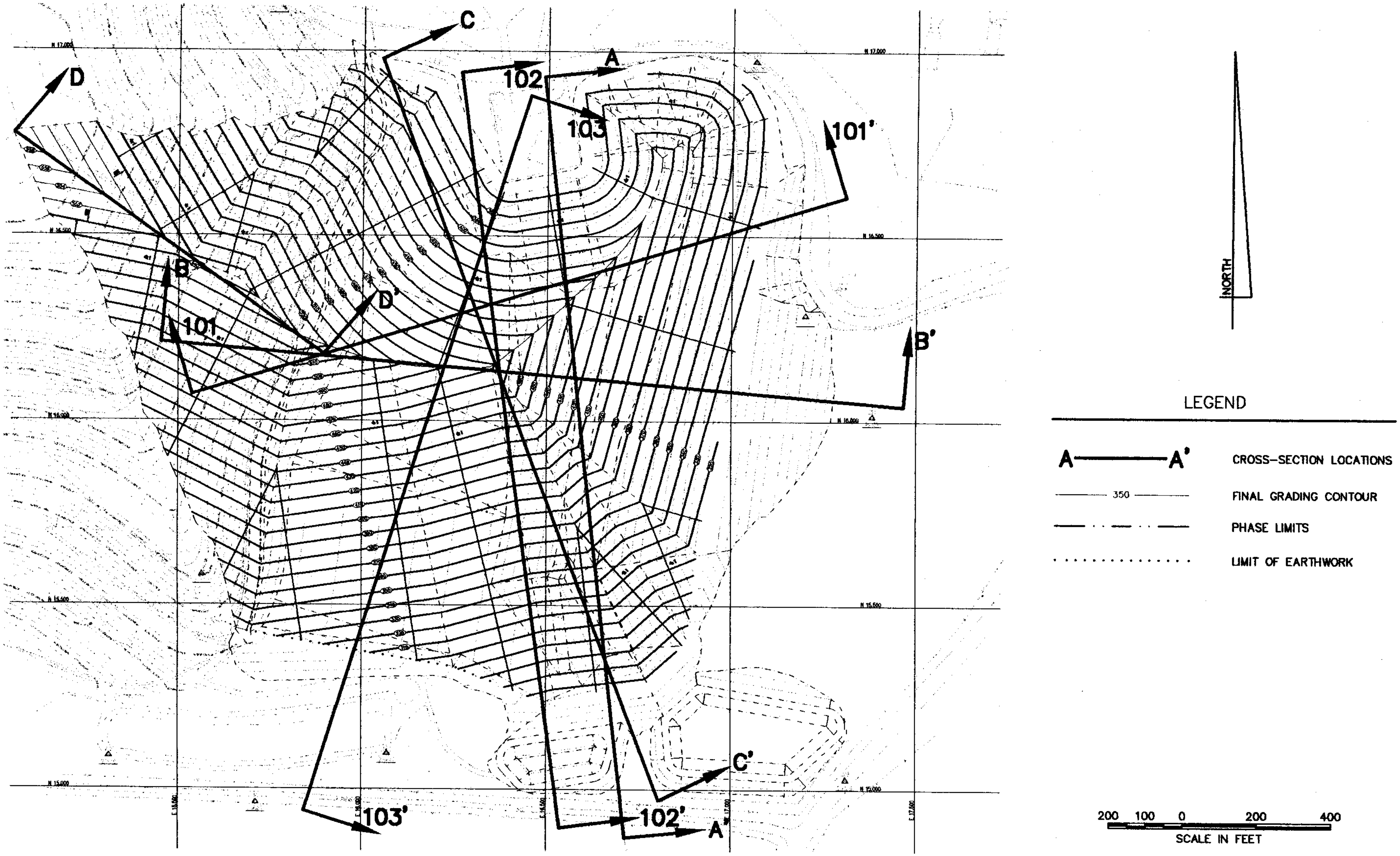
The various features of the surface-water management system have been designed with the capacity to contain peak discharges from the design storm as defined by the federal, state, and local regulations. Sediment control features erosion such as revegetation of cut and fill slopes and interim/final cover surfaces are also included in the surface water management plan to minimize erosion.



CUT SLOPE CROSS-SECTION LOCATIONS

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

FIGURE NO.	9-1
PROJECT NO.	WL0062
DOCUMENT NO.	WC97552
FILE NO.	CUTSLOPE.DWG



WASTE MASS CROSS-SECTION LOCATIONS

GEOSYNTEC CONSULTANTS
WALNUT CREEK, CALIFORNIA

FIGURE NO.	9-2
PROJECT NO.	WL0062
DOCUMENT NO.	WC97552
FILE NO.	WASTMAS2.DWG

10. PRELIMINARY CLOSURE PLAN

The latest update of the Central Disposal Site (CDS) Preliminary Closure Plan (PCP) is included in the Preliminary Closure and Postclosure Maintenance Plans (PCPMPs) report presented in Appendix G of this Joint Technical Document (JTD).

11. PRELIMINARY POSTCLOSURE MAINTENANCE PLAN

The latest update of the Central Disposal Site (CDS) Preliminary Postclosure Maintenance Plan (PPMP) is included in the Preliminary Closure and Postclosure Maintenance Plans (PCPMPs) report presented in Appendix G of this Joint Technical Document (JTD).

12. PRELIMINARY CONSTRUCTION QUALITY ASSURANCE PLAN

12.1 Introduction

The performance of the base containment system and final cover system and related facilities will be a function of the quality of construction. Implementation of a construction quality assurance (CQA) program is an established method for improving the performance of constructed facilities as well as for documenting the quality of the construction. In order to facilitate CQA activities, a CQA plan is needed which outlines the necessary work.

State regulations in Sections 20323, 20324, 21710, and 21090 of Title 27 give requirements for construction quality assurance. Specifically, Section 20323 states, "*... RWQCB shall require construction for all liner systems and final cover systems to be carried out in accordance with a CQA Plan certified by an appropriately registered professional to satisfy the requirements of Section 20324.*" Thus, this document serves as a preliminary CQA plan describing key elements of the CQA program.

A detailed CQA plan for each construction project will be prepared prior base containment system and final cover system and related facilities construction. The detailed CQA plan will contain field and laboratory monitoring, testing, and documentation procedures to establish that the cover system construction is performed in compliance with the construction drawings and specifications. The CQA plan will be a comprehensive, site-specific document prepared and/or reviewed by a registered civil engineer or certified engineering geologist in the State of California. The CQA plan will address matters pertaining to the implementation and documentation of the CQA program.

The following subsections of this preliminary CQA Plan provide an outline of the minimum requirements of the CQA program. The items in the outline will be addressed in the detailed CQA plans. These revised CQA plans will be submitted at least two weeks before beginning construction of any base containment system or final cover system in accordance with Section 21710(5)(A) of Title 27.

12.2 CQA Personnel

12.2.1 Introduction

The County will manage the overall CQA program and its implementation. The County Resident Engineer will act as the CQA engineer-of-record per Section 20324 of Title 27. As such, the County Resident Engineer shall supervise the implementation of the CQA activities. Actual field and laboratory CQA work shall be performed by both County and independent CQA consultant.

The CQA consultant will be an established engineering firm incorporated or otherwise registered in the United States with a documented history of successfully providing similar services on other landfill projects. The CQA consultant will have the practical experience necessary to effectively implement the CQA plan for the project.

The minimum qualifications for the CQA personnel are described below.

12.2.2 Qualifications

CQA personnel will be experienced in: (i) geology and geotechnical engineering; (ii) landfill design and preparation of construction drawings and specifications, and CQA plans; (iii) surveying; (iv) earthwork construction, including excavation, fill placement, and construction of high- and low-permeability soil layers; (v) geosynthetics, including geomembranes and geotextiles; and (vi) landfill piping and appurtenant structures. At a minimum, the CQA Consultant will have provided services similar to those that will be required at closure on five (5) other recent municipal solid waste landfill projects.

12.2.3 Key Personnel

Personnel representing the County will include the overall Project/Construction Manager, CQA engineer-of-record, CQA site manager, CQA monitors, and CQA surveyor. The Project/Construction Manager (PM) will be a County employee responsible for overall management of the project of which CQA is an integral component. The CQA engineer-of-record will also be a County employee and operate on-site as the Resident Engineer (RE) with responsibility for CQA program implementation. The remaining CQA personnel will be located at the site during various phases of construction to assist the RE. A single person may fill more than one role on a given project.

The CQA engineer-of-record will be a registered civil engineer or certified engineering geologist in the State of California. The CQA engineer-of-record will be required to communicate effectively, be experienced in landfill construction, and be familiar with the preparation and execution of CQA plans. The remaining CQA personnel will have formal training and practical experience in the testing and monitoring of landfill construction including performing field observations and testing, and preparing CQA documentation. The CQA engineer-of-record, as well as the CQA site manager, will be required to have at least two years of landfill-related CQA experience, and at least two years of experience on projects involving significant earthwork construction. CQA monitors will be required to have a minimum of one year experience documenting construction work related to earthwork and/or geosynthetics installation.

12.2.4 Responsibility and Authority

The CQA engineer-of-record or officer will be responsible for the implementation of the CQA plan which will include:

- reviewing the CQA plan and construction documents for accuracy and completeness;
- becoming familiar with the project design;
- attending meetings as required;
- preparing a schedule of CQA monitoring and testing activities and ensuring that a sufficient number of CQA personnel are on-site to perform the required monitoring, testing, and documentation activities;
- reviewing and interpreting data and reports prepared by CQA personnel;
- assuring that contractor submittals are reviewed and that the contractor's quality control program is monitored for compliance with the project requirements;
- resolving non-compliance issues;

- assuring that CQA activities are executed; and

- preparing and signing the final CQA report, including record drawings in accordance with 40 CFR 258 and Title 27 CCR.

The on-site CQA personnel's (both County and CQA consultant) responsibilities will include:

- becoming familiar with the project's CQA plan and construction documents;

- attending meetings as required;

- performing and/or documenting equipment calibrations;

- checking material certifications provided by the Contractor;

- obtaining material samples for conformance testing and performing conformance testing as required by the CQA plan;

- checking the results of the contractor's quality control testing;

- recording test results and observations on CQA forms; and

- reporting non-compliance issues to the CQA engineer-of-record.

12.3 Project Meetings

12.3.1 Introduction

Project meetings will be required as part of CQA plan implementation at closure. At a minimum, three types of meetings will be required by the CQA plan:

- pre-construction meetings;

- progress meetings; and

- non-compliance meetings.

Descriptions of these three types of meetings, and the key personnel that will be required to attend each, are provided below. The specific topics to be considered in each type of meeting will be enumerated in the final CQA plan. The CQA engineer-of-record will be responsible for preparing written minutes for project meetings.

12.3.2 Pre-Construction Meeting

The purpose of the pre-construction meeting is to coordinate tasks between the parties involved in construction, delineate areas of responsibility, present a schedule and sequence of work, agree on procedures to avoid difficulties and delays in construction, review the construction documents, and review the CQA plan. At a minimum, the meeting will be attended by the design engineer, general contractor, subcontractors (e.g., geosynthetics installer), CQA engineer-of-record, CQA site manager, CQA surveyor, and County PM.

12.3.3 Progress Meetings

During construction, weekly progress meetings will be held on-site between the general contractor, subcontractors, CQA engineer-of-record, CQA site manager, CQA surveyor, County PM, and, if necessary, design engineer. The purpose of the progress meetings will be to review the previous week's activities, review the upcoming week's activities, review conformance with the CQA plan requirements, and discuss anticipated upcoming needs or potential construction issues.

12.3.4 Non-Compliance Meetings

If a non-compliance issue arises, a special meeting may be convened by the CQA engineer-of-record, CQA Site Manager, or County PM. The purpose of the meeting will be to discuss the non-compliance issue, review alternative solutions, and implement an action plan to resolve the non-compliance issue. At a minimum, the meeting will be attended by the appropriate contractors, CQA engineer-of-record, CQA site manager, and County PM. If the non-compliance issue is related to the design, the design engineer may also be required to attend.

12.4 Field Monitoring and Testing Activities

12.4.1 Introduction

Field monitoring and testing activities will be performed by CQA personnel in accordance with the requirements of the CQA plan. Field monitoring and/or testing will be performed for: (i) earthwork; (ii) geosynthetics; and (iii) piping and appurtenant structures.

As part of their assignment, CQA personnel will document that the materials and construction operations used meet the requirements of the construction drawings and specifications. Testing will be performed as required by the CQA plan. Non-compliance with the construction drawings and specifications, or accepted industry standards, identified through observation or test results, will be brought to the attention of the CQA engineer-of-record and County PM. The non-compliance will be fully documented, as will all actions taken to resolve it. A description of the minimum CQA field monitoring and testing activities that will be carried out for the closure is provided in the following subsections.

12.4.2 Earthwork

As part of CQA program implementation, field monitoring and testing activities will be performed in conjunction with earthwork construction. At a minimum, field monitoring and/or testing activities will be performed (by County and CQA consultant personnel) associated with:

- construction quality control (CQC) field testing (e.g., soil unit weights, moisture contents, classifications, and compaction characteristics) (by County);
- field hydraulic conductivity testing (by CQA consultant);
- on-site conformance sampling and testing of earth materials (by County and CQA consultant);
- earth material processing operations (by County);
- construction of low-permeability compacted soil barrier layers (by County);

- construction of the drainage layer (by County); and
- placement of the operations and vegetative layer (by County);.

12.4.3 Geosynthetics and Related Materials

As part of CQA program implementation, field monitoring and testing activities will be performed (by CQA consultant) in conjunction with geosynthetics installation. At a minimum, field monitoring and/or testing activities will be associated with:

- manufacturing plant visit for off-site conformance sampling and testing;
- quality control documentation;
- conformance sampling and testing;
- geosynthetic storage;
- geosynthetic deployment;
- field seaming;
- nondestructive and destructive field CQC testing;
- joining and connecting adjacent geosynthetics; and
- geosynthetics repairs.

12.4.4 Piping and Appurtenant Structures

As part of CQA program implementation, field monitoring and testing activities will be performed in conjunction with installation of pipes and appurtenant structures used in closure. At a minimum, field monitoring and/or testing activities will be performed (by County and CQA consultant)) associated with:

- quality control documentation;
- conformance sampling and testing;
- pipe storage;

- pipe placement;
- welding of pipe sections;
- installation of piping details such as wyes and tees; and
- nondestructive hydrostatic testing of pipes.

12.5 Laboratory Testing Activities

12.5.1 Introduction

Laboratory testing of the various earth and geosynthetic materials used during construction will be performed as part of CQA plan implementation. Laboratory testing will be performed to ensure that the materials used in construction meet the requirements of the construction drawings and specifications.

12.5.2 Soils CQA Laboratory

Testing of earth materials will be conducted at a soils CQA laboratory by County and CQA consultant). CQA field personnel will obtain samples of earth materials at specified frequencies for conformance testing. Laboratory test results will be fully-documented and reported to the CQA engineer-of-record. The soils CQA laboratory will be required to have experience in the testing of earth materials and will be familiar with standards established by the American Society of Testing and Materials (ASTM) as well as other applicable test standards. The soils CQA laboratory will be required to maintain a consistent standard of testing throughout the project.

12.5.3 Geosynthetics CQA Laboratory

Geosynthetics testing will be performed at the geosynthetics CQA laboratory (CQA consultant). CQA personnel will obtain representative samples for conformance testing from geosynthetics delivered to the site, as well as from seams between adjacent sections of installed geosynthetics. Testing will be performed at the frequencies specified in the CQA plan. Laboratory results will be fully-documented and reported to the CQA engineer-of-record. The geosynthetics CQA laboratory will have experience in the testing of geosynthetics and will be familiar with ASTM standards as well as other applicable test standards. The geosynthetics CQA laboratory will be required to maintain a consistent standard of testing throughout the project.

12.6 Surveying

The CQA plan will contain minimum construction surveying requirements. Surveying of completed work will be performed (by County) for engineered earthwork layers, pipes, and structures. Surveying tolerances will be in accordance with industry standards. Surveying data will be presented in the final CQA report. The data will enable preparation of "*as built*" documentation (i.e., record drawings), as required by §258 Subtitle D and Title 27.

12.7 Documentation

12.7.1 General

The CQA plan for closure construction will include specific requirements for documentation of construction and CQA activities. The CQA plan will also include blank copies of the specific forms that will be used for CQA documentation. The CQA plan will require, at a minimum, the following documentation:

- project administration records;
- CQA field records;
- laboratory test records;
- photographic documentation;
- record drawings;
- supplemental specifications or addenda; and
- a final CQA report certified by the CQA engineer-of-record.

These documentation requirements are described in the following subsections.

12.7.2 Project Administration Records

The following project administration records will be maintained as part of CQA plan implementation:

- daily records;
- contractor and installer personnel log;
- material certifications;
- minutes of meetings; and
- weekly field report.

Daily records will be maintained in daily field reports prepared each day by CQA personnel, and in a summary daily report prepared by the CQA site manager. The daily field report will include, at a minimum, date, site and project information, weather information, daily observations, and specific testing results. The daily summary report prepared by the CQA site manager will be submitted to the CQA engineer-of-record. Also, the CQA site manager will be responsible for preparing a weekly field report that will be maintained in the project administration records.

12.7.3 CQA Field Records

CQA field records will consist of construction quality control (CQC) testing logs, equipment calibration certifications, and CQA monitoring forms. At a minimum, the following CQA records will be maintained by the CQA site manager:

- earthwork CQA/CQC records, such as:
    - soil sample logs,
    - field compaction test logs,
    - field moisture content logs, and

  - nuclear gauge and sand cone calibration logs; and

- geosynthetic CQA/CQC records, such as:
  - material inventory logs,
  - certificate of subgrade acceptance forms,
  - panel placement logs,
  - trial seam logs,
  - production seam logs,
  - destructive test logs,
  - nondestructive test logs, and
  - seam and panel repair logs.

12.7.4 Laboratory Test Records

Laboratory test records will consist of test results submitted by the soils and geosynthetics CQA laboratories, laboratory certifications, on-site laboratory test results, and on-site equipment calibrations.

12.7.5 Photographic Documentation

CQA personnel will document work progress, issues, and resolution activities in photographs. Photographic documentation will be in the form of color photographs of key landfill closure construction and field CQA activities. Photographic documentation will be included in the final CQA report.

12.7.6 Record Drawings

Record drawings will be prepared for closure. Record drawings will be prepared to show the actual surveyed limits of the closure cover system footprint, the elevations of the system components, and construction details that differ from the construction drawings. Record drawings will be included in the final CQA report.

12.7.7 Supplemental Specifications or Addenda

Supplemental specifications or addenda may be issued by the design engineer during construction due to design and/or specification changes or clarifications. The CQA site manager will be required to maintain an on-site record of the approved supplemental specifications or addenda.

12.7.8 Final CQA Report

At the completion of closure construction, a final CQA report will be submitted to the CRWQCB, CIWMCB, and the EA, as appropriate, for review and approval. The final report will include, at a minimum, a set of record drawings and the documentation listed in the previous subsections. The report will indicate that the work has been performed in general compliance with the construction drawings and specifications, the CQA plan, and supplemental specifications or addenda. Any acceptance of non-compliance with the construction drawings and specifications will be described. The CQA engineer-of-record will seal and sign the final CQA report. The project will not be deemed complete until the final CQA report addressing all components of construction has been approved by the regulatory agencies and placed in the operating record as required by Subtitle D and Title 27.

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14. LIMITATIONS

This Joint Technical Document and associated analyses was prepared in general accordance with the accepted standard of engineering practice, which existed in Northern California at the time. It should be recognized that the evaluation methodology employed may be subject to changes over time as more experience and data becomes available. Thus, assumptions made, analyses performed, and recommendations made are based on currently accepted methods at the time the evaluations were performed coupled with engineering judgement. No other representations, expressed or implied, and no warranty or guarantee is included or intended.

This report was prepared for the exclusive use of the County of Sonoma, and for the purpose of to satisfy the requirements of Section 21585 of Title 27, California Code of Regulations (CCR), Division 2, *"Solid Waste"*. The JTD presented information describing the siting, design, construction, operation, closure and post-closure maintenance of the Central Disposal Site. The information was intended to demonstrate compliance of the plan for landfill development with all applicable requirements of Title 27, CRWQCB Order No. 93-83, as well as federal regulations contained in Part 257, *"Criteria for Classification of Solid Waste Disposal Facilities and Practices"*, and Part 258, *"Criteria for Municipal Solid Waste Landfills,"* of Title 40 of the Code of Federal Regulations (CFR) (hereafter referred to as Subtitle D). Site conditions (both on-site and off-site) or other factors may change over time, which may require additional work.

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