SHELL MMC
RCRA

Shell Oil Company

P O Box 711
Martinez CA 94553

Telephone: (510) 313-3000

June 1, 1992

CALIFORNIA REGIONAL WATER
JUN 09 1992
QUALITY CONTROL BOARD

Mr. Terry Seward
Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, CA 94612

Dear Terry,

As you requested, enclosed is a copy of USEPA Administrative Order, No. RCRA-09-89-0014 for the Shell Oil Company, Martinez Manufacturing Complex. This order was received in March, 1989 and is currently under negotiation.

If you have any question regarding this order, please call me at (510) 313-3322.

Sincerely,

Jane E. Tocher

Jane E. Tocher
Associate Engineer

UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

REGION 9

IN THE MATTER OF:	)
	)
Shell Oil Company	) ADMINISTRATIVE ORDER
	)
RESPONDENT	) U.S. EPA Docket No.
	)
Shell Oil Company, Martinez Manufacturing Complex Marina Vista Avenue Martinez, California 94553	) RCRA-09-89-0014))) Proceeding under Section
	) 3008(h) of the Resource
EPA ID# CAD009164021	) Conservation and
	) Recovery Act, as
	) amended, 42 U.S.C.
	) Section 6928(h).

I. JURISDICTION

This Administrative Order ("Order") is issued pursuant to the authority vested in the Administrator of the United States Environmental Protection Agency ("EPA") by Section 3008(h) of the Solid Waste Disposal Act, commonly referred to as the Resource Conservation and Recovery Act of 1976 ("RCRA"), as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. Section 6928(h). The authority vested in the Administrator has been delegated to the Regional Administrators by EPA Delegation Nos. 8-31 and 8-32 dated April 16, 1985, and has been further delegated by the Regional Administrator of Region 9 to the Director of the Hazardous Waste Management Division ("Director").

This Order is issued to Shell Oil Company (hereinafter Respondent), owner/operator of the facility located on Marina Vista Avenue, Martinez, California (hereinafter Facility). The Respondent is ordered to undertake all actions required by the terms and conditions of this order.

II. PARTIES BOUND

1. This Order shall apply to and be binding upon Respondent and its officers, directors, employees, agents, successors and assigns, and upon all persons, independent contractors, contractors, and consultants acting under or on behalf of Respondent.

2. No change in ownership or corporate or partnership status relating to the Facility will in any way alter Respondent's responsibility under this Order.

3. Respondent shall provide a copy of this Order to all contractors, subcontractors, laboratories,and consultants retained to conduct or monitor any portion of the work performed pursuant to this Order within one (1) week of the effective date of this Order or date of such retention, and shall condition all such contracts on compliance with the terms of this Order.

4. Respondent shall give notice of this Order to any successor in interest prior to transfer of ownership or operation of the Facility and shall notify EPA no less than seven (7) days prior to such transfer.

III. STATEMENT OF PURPOSE

This Order directs the Respondent (1) to perform a RCRA Facility Investigation (RFI) to determine fully the nature and extent of any release of hazardous wastes and hazardous constituents at or from the Facility, and (2) to perform a Corrective Measure Study (CMS) to identify and evaluate alternatives for corrective action necessary to prevent or mitigate any migration or releases of hazardous wastes or hazardous constituents at or from the Facility.

IV. FINDINGS OF FACT

1. Respondent is a corporation under the laws of the State of Delaware, is authorized to do business in the State of California, and is a person as defined in Section 1004(15) of RCRA, 42 U.S.C. Section 6903(15).

2. Respondent is an owner and operator of a hazardous waste management facility located on Marina Vista Avenue, Martinez, California. Respondent engaged in the treatment and storage of hazardous waste at the Facility subject to interim status requirements (40 CFR Part 265).

3. Respondent owned and operated its Facility as a hazardous waste management facility on and after November 19, 1980, the applicable date which renders facilities subject to interim status requirements or the requirement to have a permit under Sections 3004 and 3005 of RCRA, 42 U.S.C. Sections 6924, 6925.

4. Pursuant to Section 3010 of RCRA, 42 U.S.C. Section 6930, Respondent notified EPA of its hazardous waste activity. In its notification, dated July 22, 1980, Respondent identified itself as a generator of hazardous waste and an owner/operator of a treatment, storage, and/or disposal facility for hazardous waste.

5. In its Part A permit application, dated November 12, 1980, and in its Notification of Hazardous Waste Activity, dated July 22, 1980, Respondent identified itself as handling the following hazardous wastes at the Facility:

5a. Hazardous wastes that exhibit the characteristic of ignitability, identified at 40 C.F.R. §261.21 (D001).

5b. Hazardous wastes that exhibit the characteristic of corrosivity, identified at 40 C.F.R. §261.22 (D002).

5c. Hazardous wastes that exhibit the characteristic of reactivity, identified at 40 C.F.R. §261.23 (D003).

5d. Hazardous wastes containing spent non-halogenated solvents from non-specific sources, as identified at 40 C.F.R. §261.31 (F003).

5e. Hazardous wastes containing dissolved air flotation float from the petroleum refining industry, identified at 40 C.F.R. §261.32 (K048).

5f. Hazardous wastes containing slop oil emulsion solids from the petroleum refining industry, identified at 40 C.F.R. §261.32 (K049).

5g. Hazardous wastes containing heat exchanger bundle cleaning sludge from the petroleum refining industry, identified at 40 C.F.R. §261.32 (K050).

5h. Hazardous waste containing API separator sludge from the petroleum refining industry, identified at 40 C.F.R. §261.32 (K051).

5i. Hazardous waste containing tank bottoms (leaded) from the petroleum refining industry, identified at 40 C.F.R. §261.32 (K052).

5j. Commercial chemical products, manufacturing chemical intermediates, off-specification commercial chemical products, or chemical intermediates identified at 40 C.F.R. Section 261.33(e) (P053, P110).

5k. Commercial chemical products, manufacturing chemical intermediates, off-specification commercial chemical products, or chemical intermediates identified at 40 C.F.R. Section 261.33(f) (U013, U052, U056, U122, U125, U031, U188, U220, U239, U140, U154, U159).

6. On or about April 14, 1987, Respondent modified the Part A permit application for the Facility. In the revised Part A, Respondent identified treatment and storage of the following wastes at the Facility:

6a. Hazardous wastes that exhibit the characteristic of EP Toxicity for Chromium, identified at 40 C.F.R. §261.24 (D007).

6b. Hazardous wastes containing spent non-halogenated solvents from non-specific sources, as identified at 40 C.F.R. §261.31 (F005).

6c. Hazardous wastes containing dissolved air flotation float from the petroleum refining industry, identified at 40 C.F.R. §261.32 (K048).

7. Facility Description

(Unless otherwise noted, information in this Paragraph and in Paragraphs 8 and 9 is from the "RCRA Facility Assessment Report, Shell Oil Company Martinez Manufacturing Complex" completed by A.T. Kearney for EPA, February, 1988. Hereinafter, this report will be referred to as the "RFA Report." The RFA Report is based on information found in the RCRA files and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) files of EPA Region 9, files and reports of the California Department of Health Services (DHS), and files and reports of the San Francisco Region of the California Regional Water Quality Control Board (RWQCB). The RFA Report contains information collected during records review, data evaluation, interviews, and a visual site inspection (VSI) performed November 11, 12, and 13, 1987 to evaluate the potential for releases of hazardous constituents from solid waste management units and areas of concern at the Facility.)

7a. Operational History: The Facility was established at its present location in 1913 with a product terminal. In 1916, Respondent commenced refining operations at this site, at which time it processed 20,000 barrels of crude oil per day. In 1931 Respondent constructed a chemical plant at this site for the production of secondary butyl alcohol. Since 1913, Respondent has produced up to 50 different chemicals at the Facility, including alcohols, peroxides, solvents, and catalysts. Currently, most chemical produc-

tion areas are now inactive and some have been dismantled. Respondent presently continues catalyst production and refining operations at the Facility.

7b. Facility Location: Respondent owns and operates a petroleum refinery and chemical manufacturing plant located on a 1000-acre site on the south shore of the Carquinez Strait and Suisun Bay, near the city of Martinez (see Figures 1 and 2, attached hereto and incorporated by reference). The areas surrounding the Facility to the west, south, and southeast are generally residential and light industrial. A PG&E power plant is located immediately west of the Facility, and the Mountain View Sanitary District operates a wastewater treatment facility on the eastern edge of the refinery. Undeveloped marshland and open water border the facility to the north and northeast.

7c. Products: The Facility currently maintains a crude-run throughput of 107,400 barrels per day, and manufactures gasoline, intermediate fuels (jet, diesel, stove, kerosene), industrial fuels, spray oils, lubricants, gasoline additives, asphalts, and catalysts.

7d. Facility Units: The Facility consists of crude oil refining process units, several chemical production areas (many of which are currently inactive), hazardous waste transfer and storage areas, oil-water separator systems, and wastewater treatment units. Table 1, attached hereto and incorporated by reference, lists the active and inactive waste management units present at the Facility. The location of each unit is shown in Figures 3 through 11, attached hereto and incorporated by reference. A summary of wastes managed at each unit is given in the RFA report.

7e. Topography and Meteorology: The local topography varies from hilly south of and onto the Facility, to tidal flats north and northeast of the Facility (see Figure 2). In general, the topography slopes from the south to the north in the direction of the Carquinez Strait. The climate in the area around the Facility is mild, with an average high temperature in August of 70 degrees Fahrenheit and an average low in January of 42 degrees. Average annual rainfall is 18 inches, with most precipitation occurring between November and February. Less than 10% of the precipitation recharges the groundwater, with the remainder forming surface run-off. However, man-made topographic features (e.g. ponds and dikes) may influence local groundwater recharge.

7f. Surface Water and Floodplain: The Facility is divided into two watersheds. Surface and process waters in the west watershed are collected by the sewer system which drains to the effluent treating area north of Marina Vista Boulevard (see Figure 2). Process waste waters in the east watershed are discharged to the gross oil separator and then pumped to

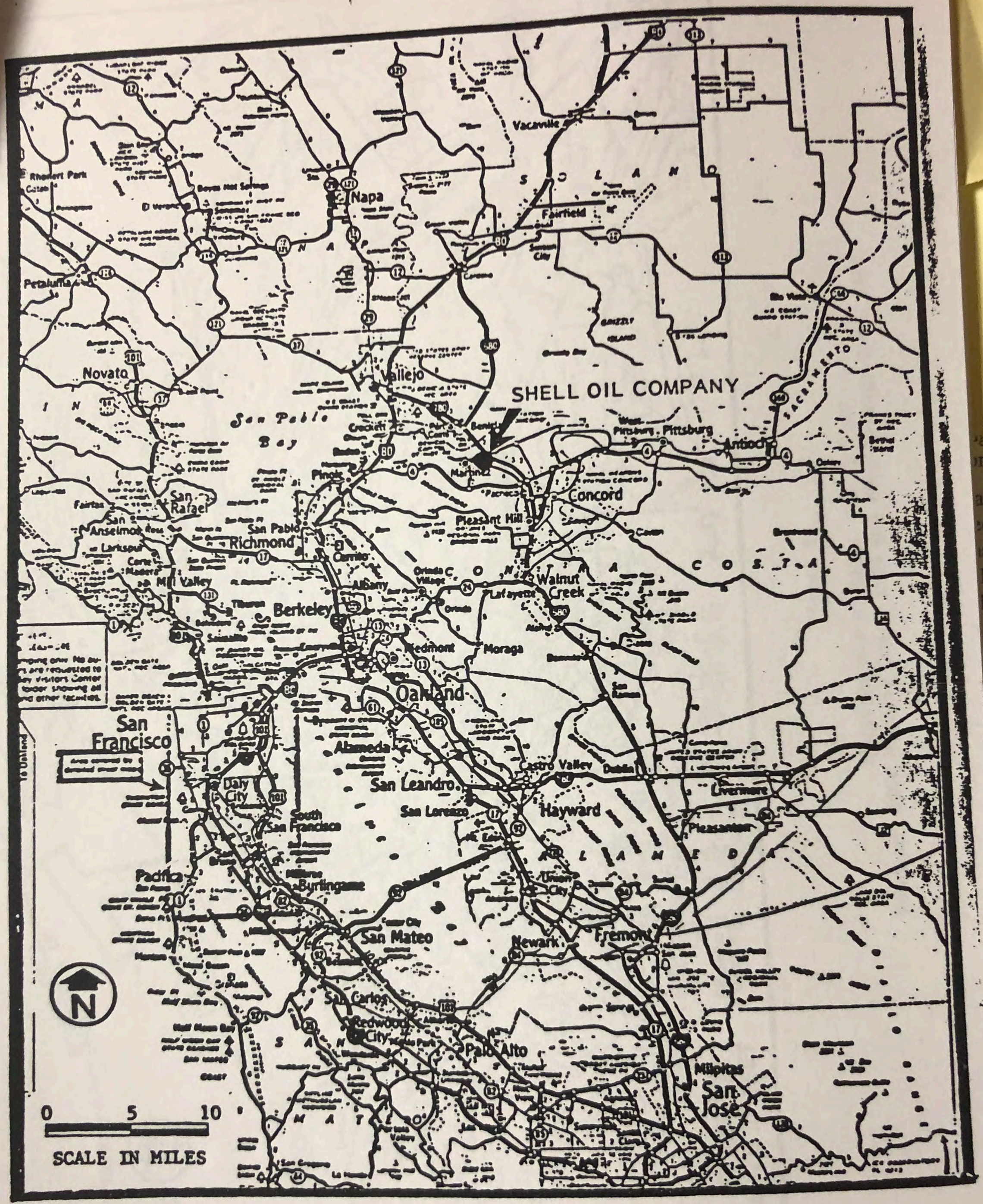


Figure 1

REGIONAL LOCATION OF SHELL OIL
Base Map: San Francisco Map, H.M. Gousha Company

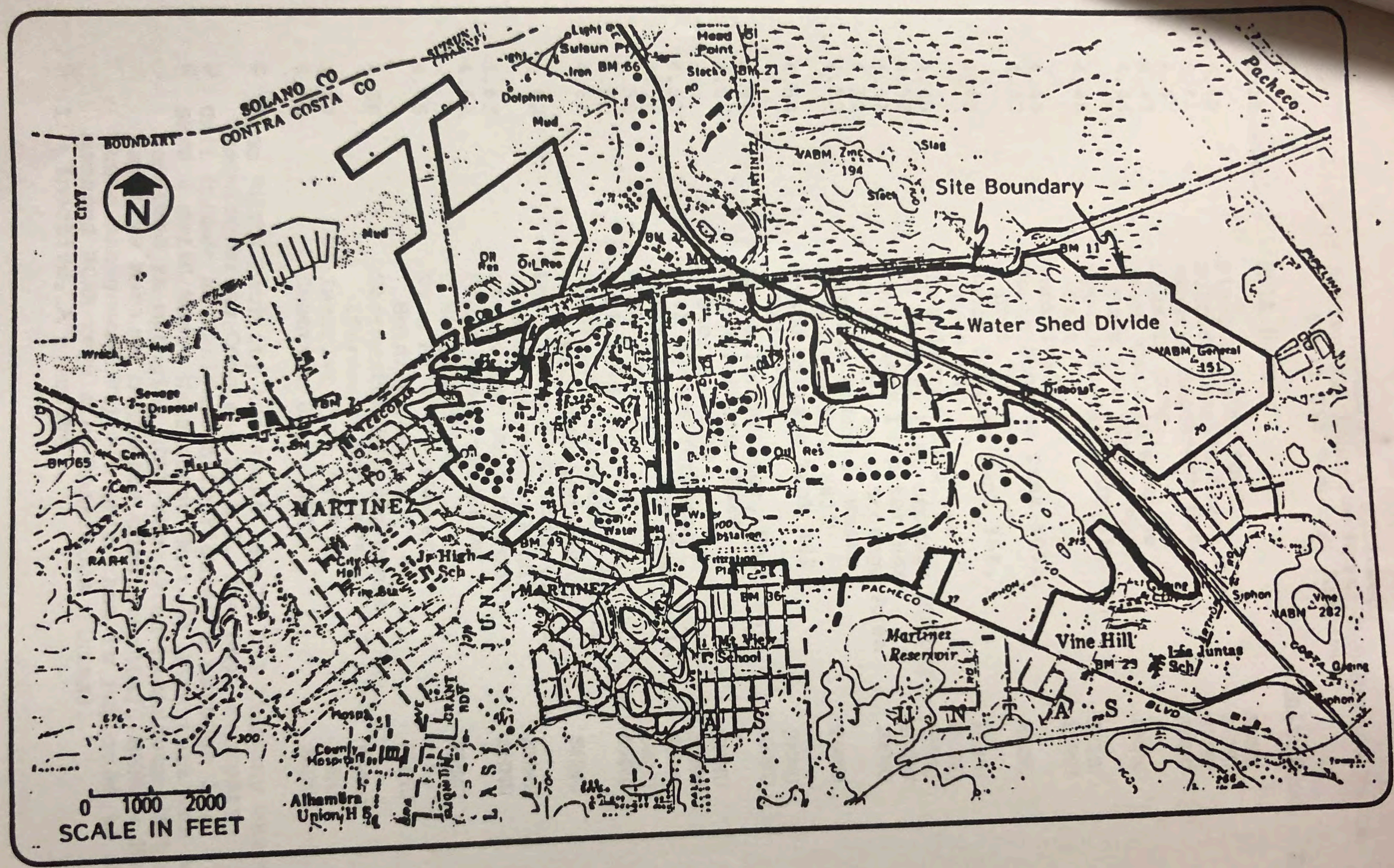


Figure 2

LOCATION MAP OF SHELL OIL COMPANY
Sources: USGS Benicia Quad, 1980 and Port Chicago Quad, 1968

Table 1 (Continued)
List of Active and Inactive Waste Management Units
Shell Oil Company, Martinez

Unit Label	Unit Name	Unit Type	Status
4.40	Final Holding Pond	SWMU	A
4.41	Sulfide Caustic Flash Pot	SWMU	A
4.42	Caustic Knock-Out Pot	SWMU	A
4.43	Caustic Sump	SWMU	A
4.44	Spent Caustic Storage Tank 952 (Unit "PP")	SWMU	A
4.45	Spent Caustic Neutralizer, Unit "V"	SWMU	A
4.46	Tank 1068	SWMU	A
4.47	Waste Storage Tank 1065, Unit "G"	HWMU	A
4.48	Waste Storage Tank 383, Unit "S"	HWMU	A
4.49	CO Boilers, Unit "T"	HWMU	A
4.50	CO Boilers Dust Storage Hopper	SWMU	A
4.51	CO Boilers Dumpster Box	SWMU	I
4.52	CO Boilers Dust Storage Area	SWMU	A
4.53	Organic Chloride Waste Storage Tank 881T	SWMU	I
4.54	Waste Storage Tank 482, Unit "B"	SWMU	A
4.55	Waste Incinerator, Unit "Z"	HWMU	A
4.56	Two ASD Filter Cake Storage Bins	SWMU	A
4.57	PG&E Sludge Terraces	SWMU	I
4.58	Spent Acid Storage Tank 1218	SWMU	A
4.59	Tank 1064	SWMU	A
4.60	Tank 1063	SWMU	A
4.61	Upper Lake Slobodnik (Stormwater Retention Pond)	SWMU	A
4.62	Lower Lake Slobodnik (Stormwater Retention Pond)	SWMU	A
4.63	Stormwater Holding Pond	SWMU	A
4.64	Flare Area Stormwater Holding Pond	SWMU	A
4.65	Vine Hill Stormwater Holding Pond	SWMU	A
4.66	Stormwater Holding Ponds (Formerly LTA "FF")	SWMU	A
4.67	Inactive Unit "YY"	SWMU	I
4.68	Inactive Unit "ZZ"	SWMU	I

[a] From "RCRA Facility Assesment, Shell Oil Company martinez Manufacturing Complex" by A.T. Kearney, February, 1988.
[b] Unit number as designated in Figures 3 through 12.
[c] SWMU = Solid Waste Management Unit (a unit that was not reported as managing RCRA-regulated hazardous wastes, but may have managed hazardous constituents), HWMU = Hazardous Waste Management Unit (a unit that is reported to have managed RCRA-regulated hazardous wastes).
[d] I = inactive, A = active.

Table 1[a]
List of Active and Inactive Waste Management Units
Shell Oil Company, Martinez

Unit Label[b]	Unit Name	Unit Type[c]	Status[d]
4.1	Land Treatment Area "FF"	SWMU	I
4.2	Inactive Unit "H"	SWMU	I
4.3	Inactive Unit "I"	SWMU	I
4.4	Inactive Unit "L"	SWMU	I
4.5	Oil Collection Tanks and Sumps	SWMU	I
4.6	Landfill Area "M"	SWMU	I
4.7	Landfill Area "O"	SWMU	I
4.8	Land Disposal Area "Q"	SWMU	I
4.9	Open Burning and Landfill Area	SWMU	I
4.10	Land Disposal Area "X"	SWMU	I
4.11	Impoundment "Y"	SWMU	I
4.12	Landfill Area "Z"	SWMU	I
4.13	Pond Area "AA"	SWMU	I
4.14	Land Disposal Area "DD"	SWMU	I
4.15	Ballast Water Pond	SWMU	I
4.16	Oily Water Sump "N"	SWMU	I
4.17	Oily Water Sump "K"	SWMU	A
4.18	Hazardous Waste Drum Storage Area "J"	SWMU	A
4.19	Waste Transfer Station "MM"	SWMU	A
4.20	PCB Storage Area	SWMU	A
4.21	Gross Oil Separator, Unit "U"	SWMU	A
4.22	Corrugated Plate Interceptor, Unit "TT"	SWMU	A
4.23	CPI Trash Screen and Waste Bin	SWMU	A
4.24	CPI Dumpster Boxes	SWMU	A
4.25	API Separator Bar Screen and Trash Bin	SWMU	A
4.26	API Separator, Unit "E"	SWMU	A
4.27	Sand Boxes, Unit "II"	SWMU	I
4.28	Centrifuge System, Unit "F"	SWMU	A
4.29	Flash Mixer/pH Adjustment, Unit "P"	SWMU	A
4.30	Dissolved Air Flotation, Unit "HH"	SWMU	A
4.31	Final pH Adjustment Unit	SWMU	A
4.32	Biotreater Equalization Feed Ponds, Unit "D"	SWMU	A
4.33	Emergency Wastewater Holding Ponds, Unit "C"	SWMU	A
4.34	Activated Sludge Biotreater	SWMU	A
4.35	Two-Stage Dissolved Air Floatation Clarifiers	SWMU	A
4.36	Biotreater Sludge Thickener, Unit "GG"	SWMU	A
4.37	Biosludge Storage Tank 1197	SWMU	I
4.38	Sand Filter Feed Pond	SWMU	A
4.39	Sand Filters	SWMU	A

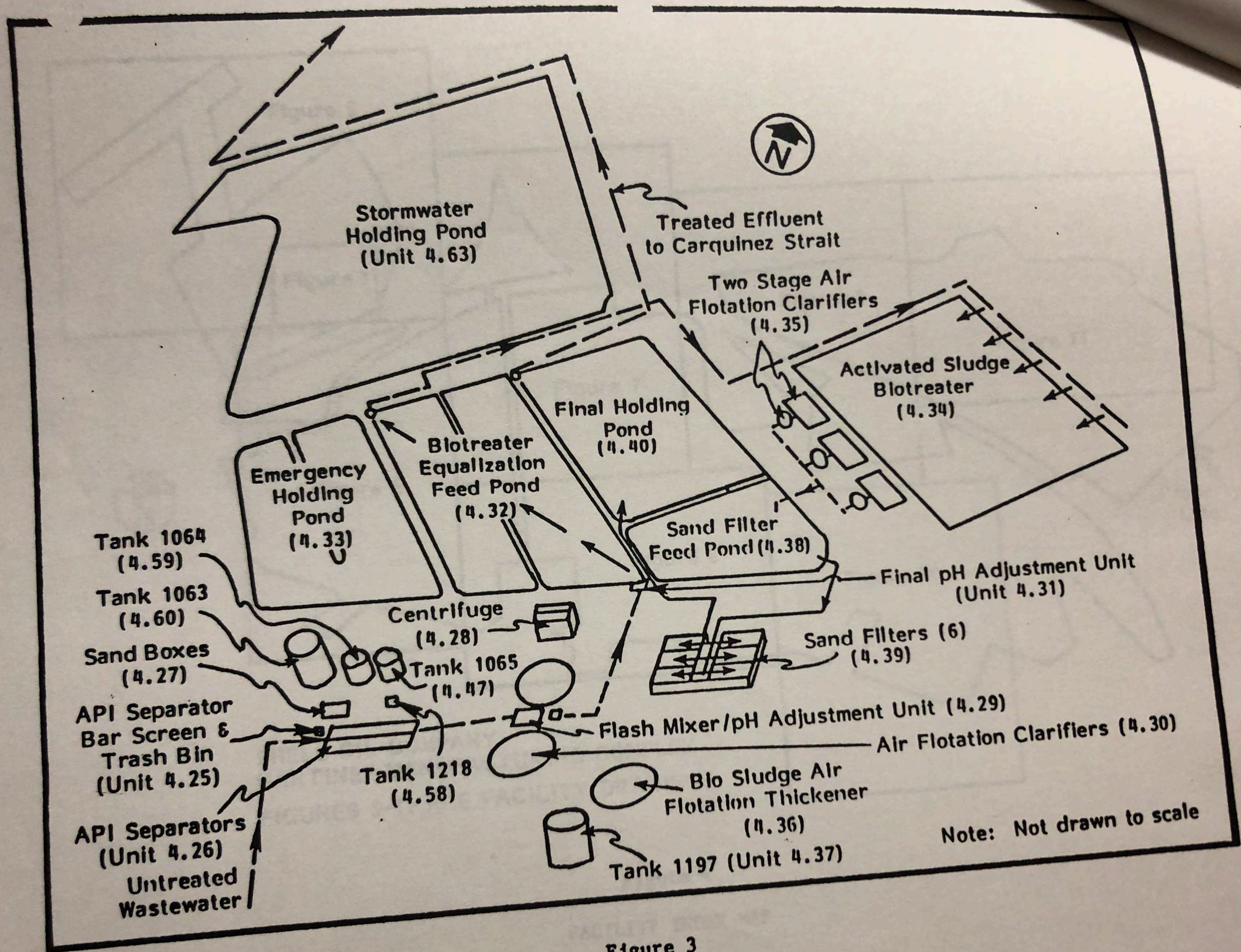
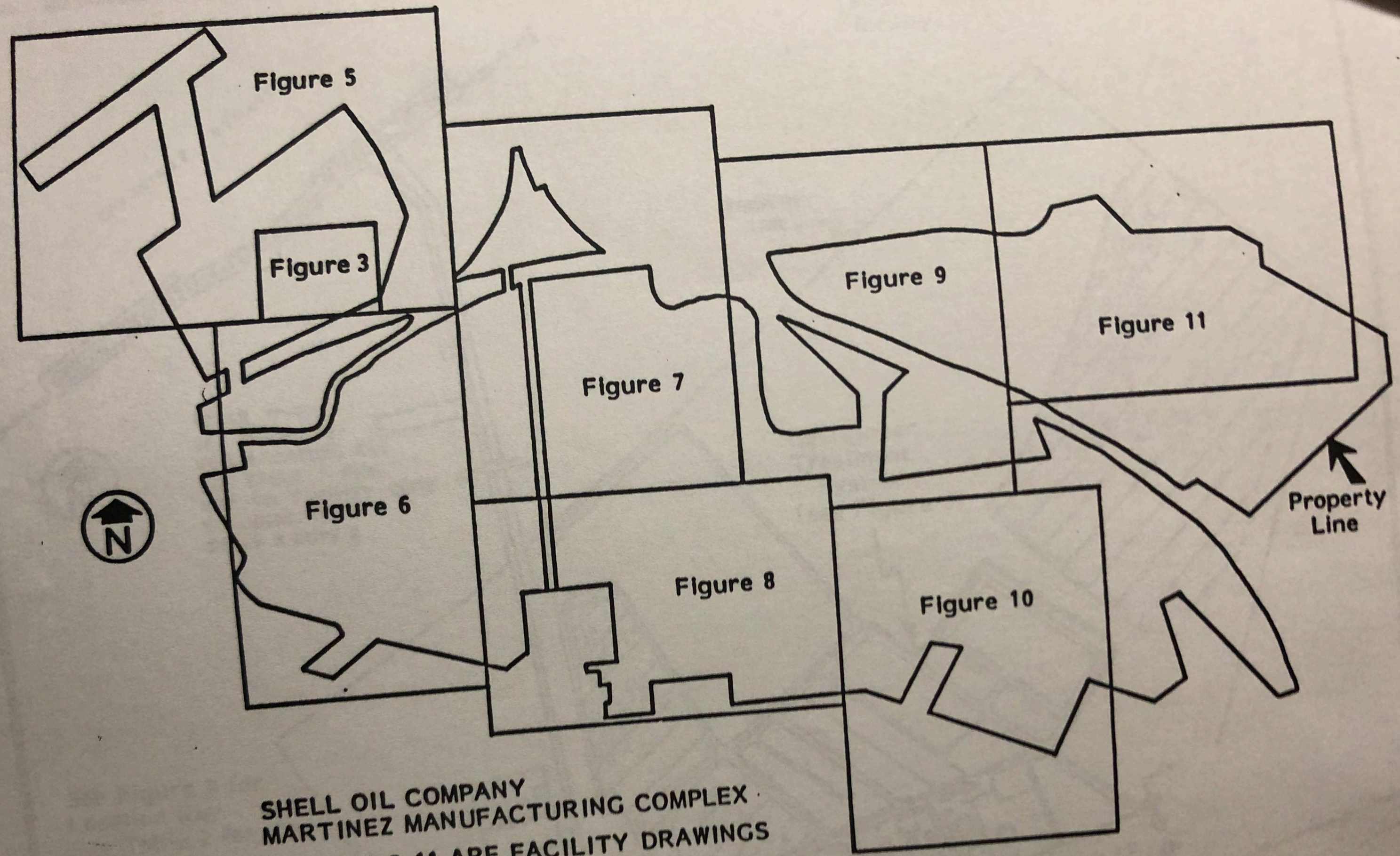


Figure 3

WASTEWATER TREATMENT SYSTEM - SHELL OIL COMPANY
Source: Reference 18 of the RFA Report



SHELL OIL COMPANY
MARTINEZ MANUFACTURING COMPLEX
FIGURES 5-11 ARE FACILITY DRAWINGS

Figure 4

FACILITY INDEX MAP

NOTE: Numbers other than SWMU designations signify tank numbers assigned by the facility.

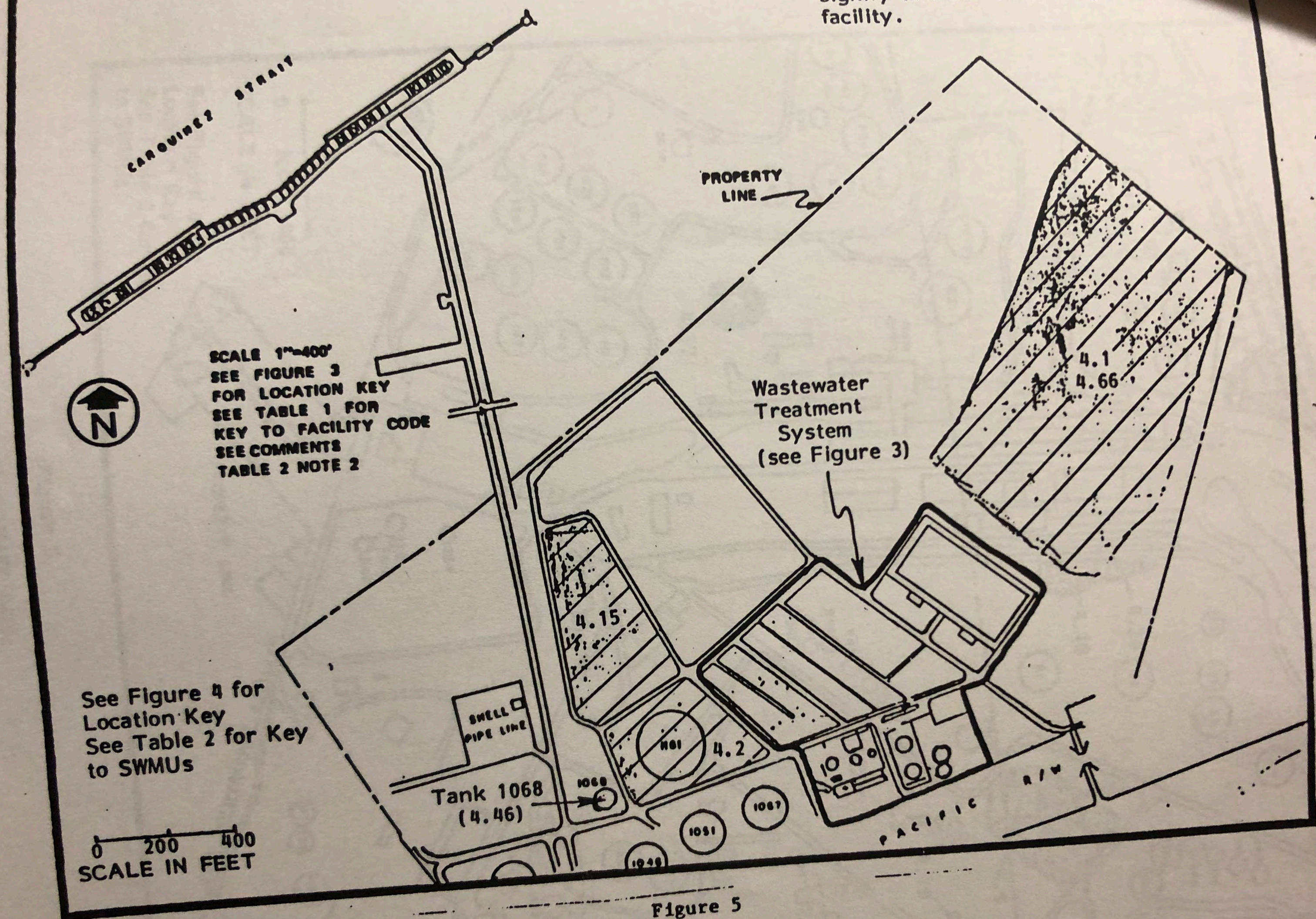


Figure 5

SHELL OIL COMPANY SWMUs

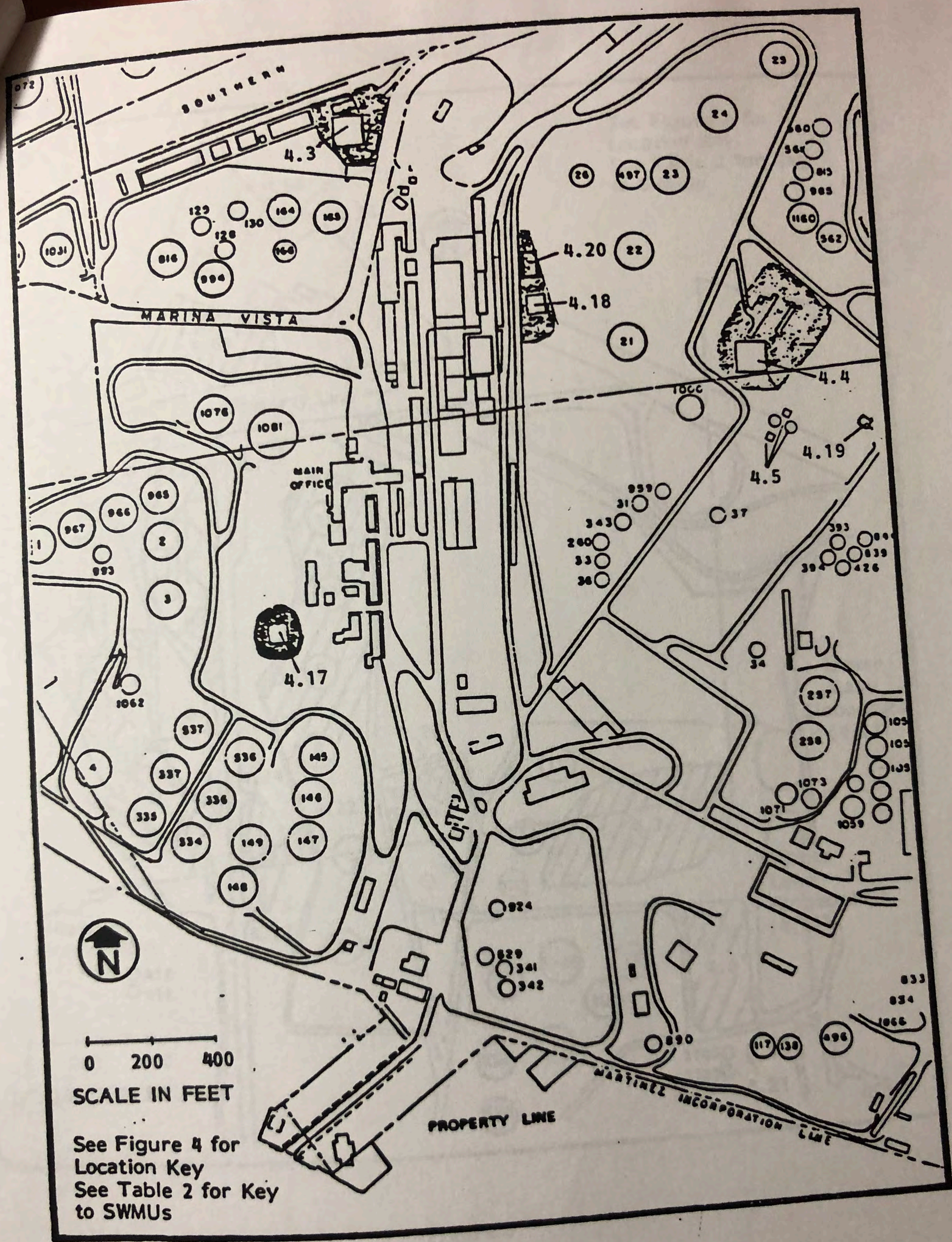


Figure 6

SHELL OIL COMPANY SWMUs

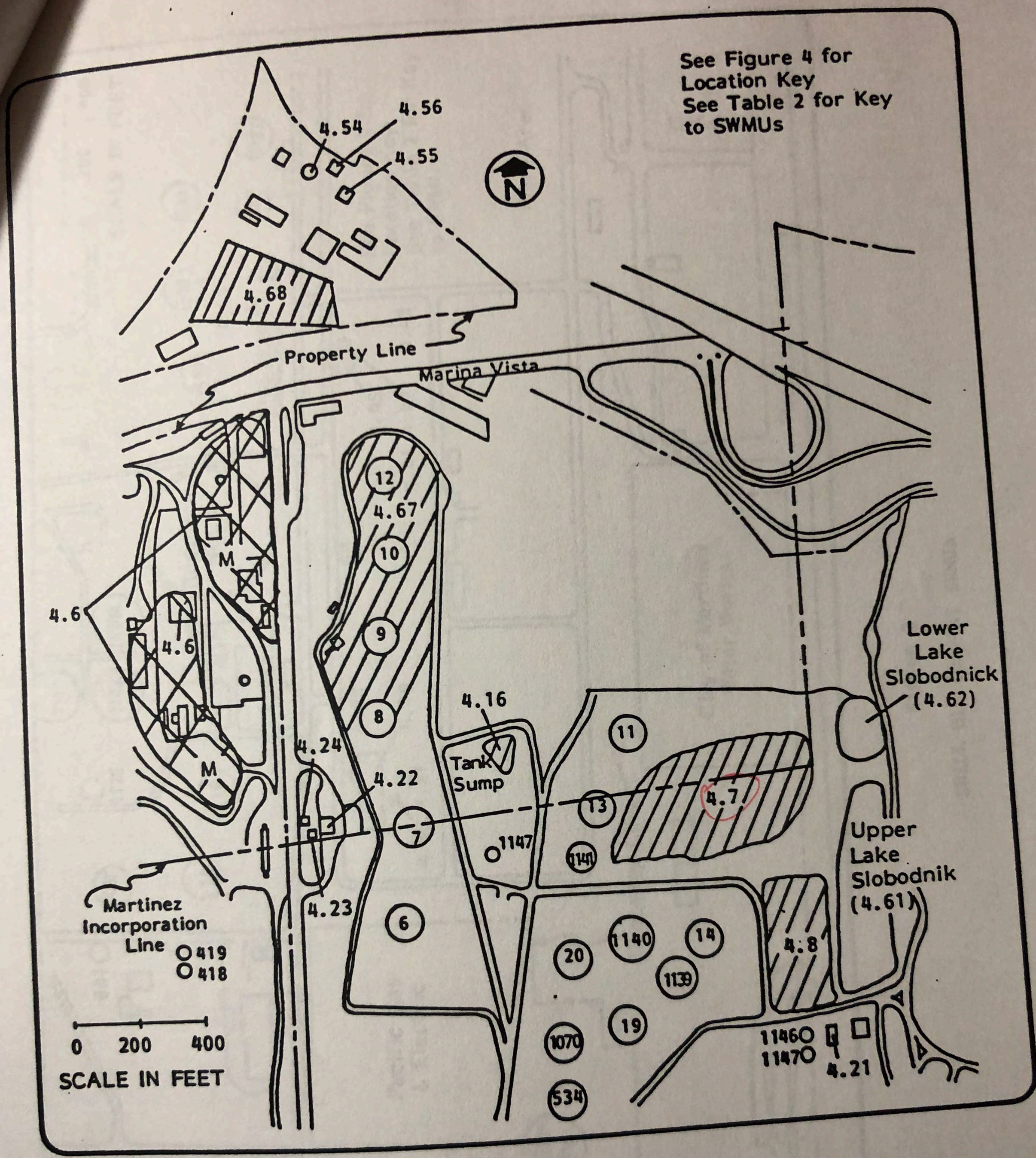


Figure 7

SHELL OIL COMPANY SWMUs

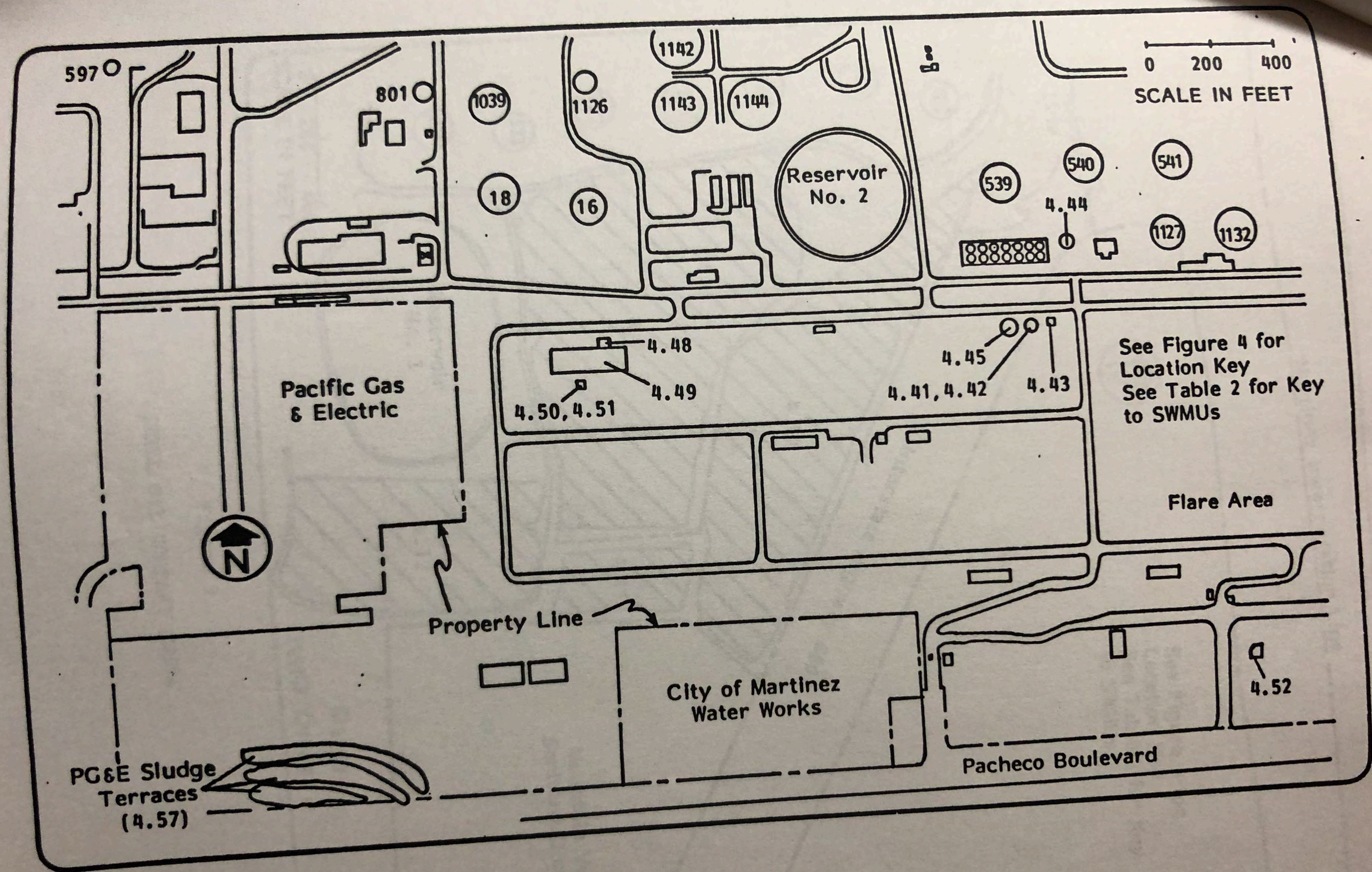


Figure 8

SHELL OIL COMPANY SWMUs

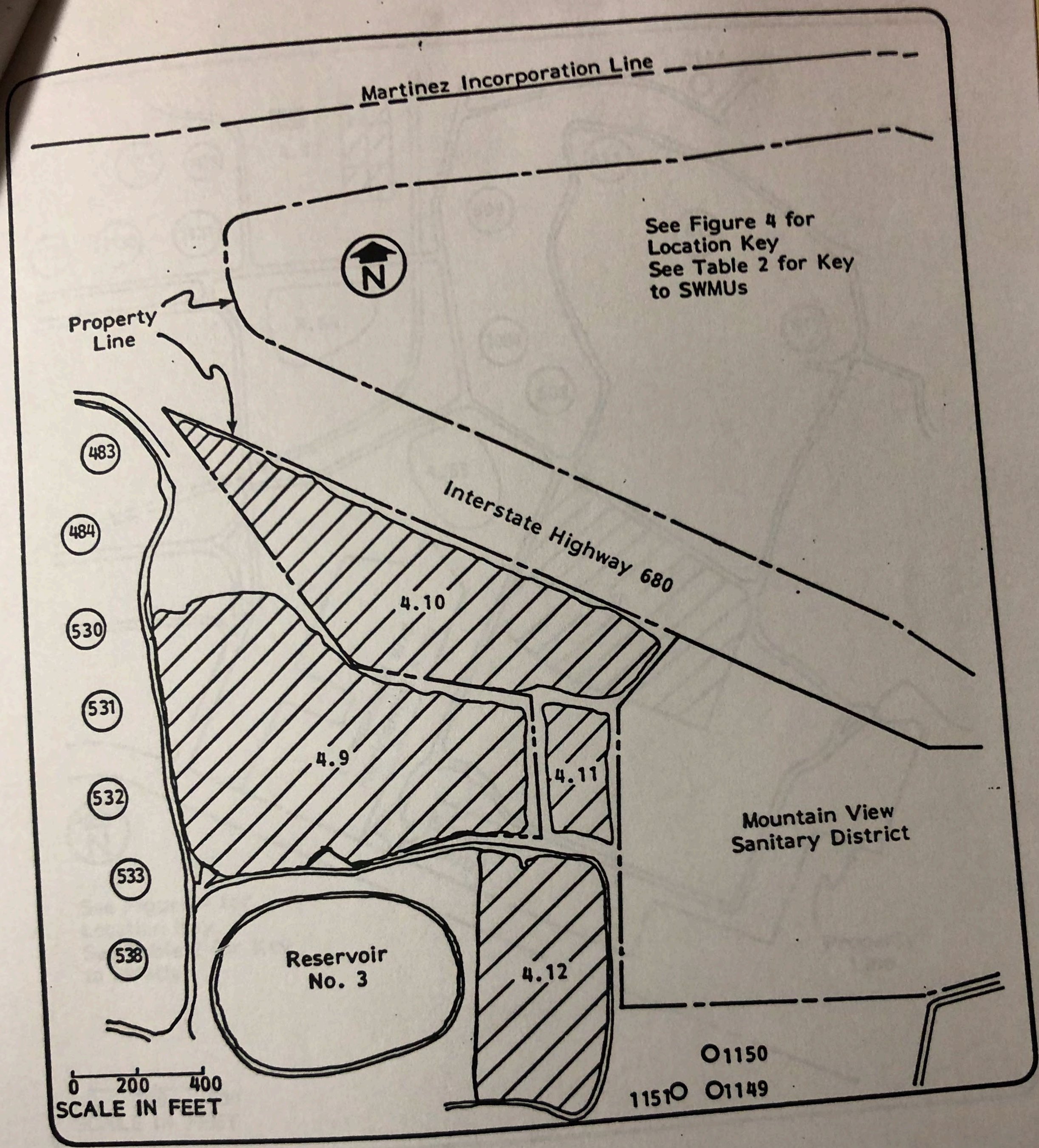


Figure 9

SHELL OIL COMPANY SWMUs

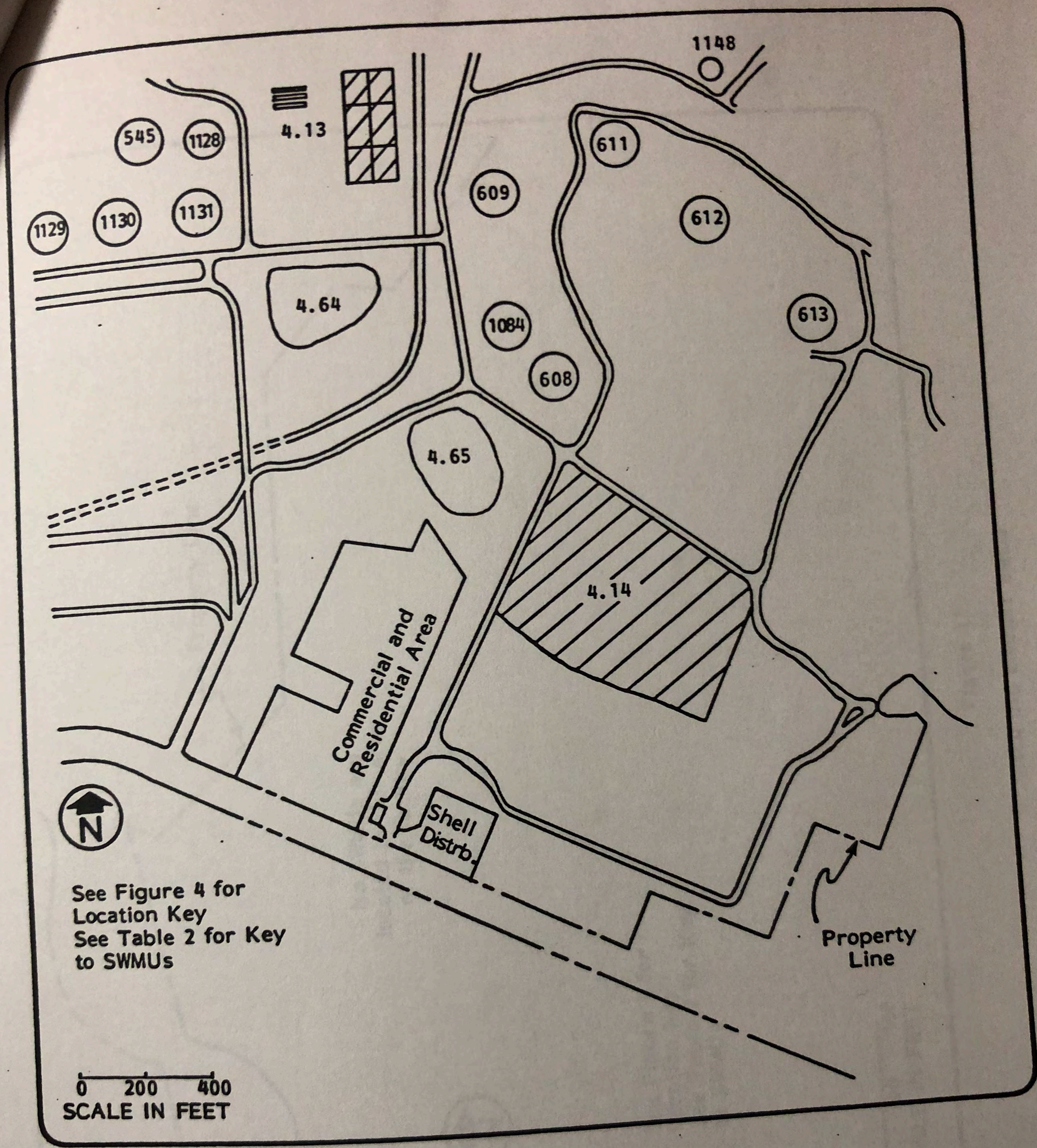


Figure 10

SHELL OIL COMPANY SWMUs

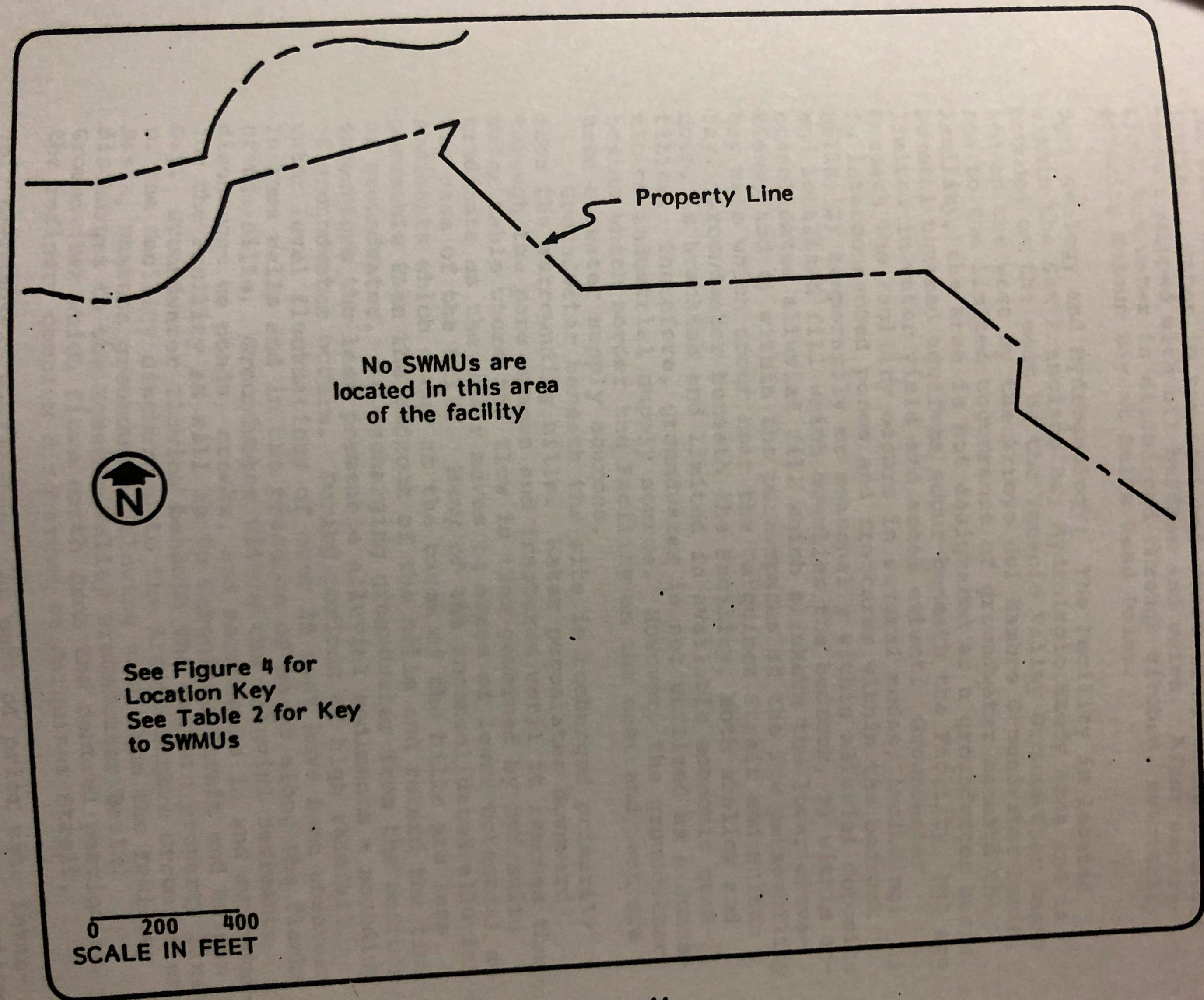


Figure 11

SHELL OIL COMPANY SWMUs

the west watershed for additional treatment. Storm (surface) water in the east watershed is diverted to storm ponds equipped with oil baffles and weirs. After separation, the water is discharged through ditches, eventually entering Suisun Bay at Bulls Head Point.

7g. Geology and Hydrogeology: The Facility is located within the San Francisco Bay Hydrologic Study Area and is bounded on the east by the Ygnacio Valley Groundwater Basin and on the west by the Arroyo del Hambre Groundwater Basin. Due to the limited occurrence of groundwater beneath the Facility, the area is not designated as a groundwater basin. Several unnamed aquifers occur beneath the Facility, but are limited in water yield and areal extent. Groundwater beneath the Facility occurs in several modes, including: 1) in interconnected pores and fractures within the bedrock hills, 2) temporarily or seasonally within alluvial deposits and localized fill which overlies the bedrock, 3) within unconsolidated alluvial fill which blankets the lower elevations, and 4) within the pore spaces of the low permeability bay muds which occur near the Carquinez Strait and Suisun Bay. Groundwater beneath the Facility, both shallow and deep, is brackish and limited in available economic quantities. Therefore, groundwater is not utilized as a domestic or industrial supply source. However, the groundwater basins which border the Facility on the east and west are used as water supply sources.

Groundwater beneath the site is recharged primarily from the surrounding hills. Water percolates downward through the pore spaces and fractures until it reaches the water table where the flow is then governed by hydraulic gradients as the water moves to areas of lower potential at the base of the hills. Many of the unconsolidated alluvial sediments which occur at the bases of the hills are less permeable than the bedrock of the hills and retard the flow of groundwater. As recharging groundwater from the bedrock encounters the less permeable alluvial sediments a mounding of groundwater occurs. During periods of high rainfall, water level fluctuations of over 25 feet have been observed in some wells and in the presence of seeps along the flanks of the hills. Groundwater within the alluvial sediments discharges to ponds, creeks, and marshlands in and surrounding the Facility as well as to Carquinez Strait and Suisun Bay. Groundwater flowing beneath the western property line of the Facility discharges to the Arroyo Hambre Groundwater Basin, whereas groundwater flowing east from the Facility discharges to the Ygnacio Valley Groundwater Basin. Groundwater which flows north from the central portion of the refinery complex discharges to Carquinez Strait.

7h. Groundwater Monitoring: As part of prior site investigation efforts and on-going quarterly groundwater monitoring, Respondent has drilled numerous groundwater monitoring

wells at the Facility. The locations of these wells are shown in Figures 12 and 13, attached hereto and incorporated by reference.

7i. Recent Regulatory Activities: In 1983 the California Regional Water Quality Control Board (RWQCB) issued a Waste Discharge Permit to Respondent for operation of three sludge drying ponds (Unit 4.1). Pursuant to the Permit requirements, Respondent began a site characterization study of this unit in 1984.

To address the California Water Code Calderon Requirements (Division 7, Chapter 4, Article 4, Section 13273), Respondent has initiated an environmental monitoring program for 17 inactive waste disposal units which it used to dispose of process-generated refinery wastes. These activities are overseen by RWQCB. Respondent submitted a Solid Waste Assessment Test (SWAT) report on these activities to RWQCB in June, 1987.

Respondent also submitted to RWQCB in August, 1987 a Report of Waste Discharge which examined the effects of 16 land disposal units on groundwater quality. Respondent further conducted a surface impoundment sampling and analysis study to determine if the wastewater treatment ponds and stormwater ponds were subject to the California Toxic Pits Cleanup Act of 1985. Respondent submitted this report to RWQCB in June, 1987. Respondent currently performs quarterly groundwater monitoring at the Facility.

Respondent submitted a Part B permit application to DHS and EPA in 1983 for operation of a hazardous waste incinerator (Unit 4.55) at the Facility. Respondent modified the Part B permit application in 1986 to include three carbon monoxide boilers (Unit 4.49) and associated tanks (Units 4.47 and 4.48) for waste disposal. Respondent has not yet received a RCRA permit for the operation of these units.

8. Documentation of Releases

8a. Soils:

Unit 4.1: An investigation by Respondent in response to Waste Discharge Permit requirements found elevated levels of chromium in soils along the western and southern perimeter of Unit 4.1 (Land Treatment Area "FF"). In addition, soil borings also showed high concentrations of petroleum hydrocarbons along the western side of the unit, indicating the further release of wastes from this unit. This area is now the location of stormwater retention ponds (Unit 4.66). Chromium is a hazardous constituent identified at 40 C.F.R. §261 Appendix VIII.

Units 4.2, 4.4, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.16, and 4.17: As part of site investigation efforts in 1986, Respondent sampled soils underneath several units at the Facility. Soil samples were taken at depths ranging from 5.5 to 46.5 feet. Soils underneath the following units were found to have elevated levels of barium, chromium, nickel, and lead:

4.2 Inactive Unit "H"
4.4 Inactive Unit "L"
4.6 Landfill Area "M"
4.7 Landfill Area "O"
4.8 Land Disposal Area "Q"
4.9 Open Burning and Landfill Area
4.10 Land Disposal Area "X"
4.11 Impoundment "Y"
4.12 Landfill Area "Z"
4.13 Pond Area "AA"
4.14 Land Disposal Area "DD"
4.16 Oily Water Sump "N"
4.17 Oily Water Sump "K"

Barium, chromium, nickel, and lead are hazardous constituents identified at 40 C.F.R. §261 Appendix VIII.

Unit 4.4: During the Visual Site Inspection (VSI) for the RCRA Facility Assessment, a seep was observed at the toe of the containment dam where the dam at Unit 4.4 (Inactive Unit "L") intersects the water table. EPA believes this seep contains hydrocarbons and tetraethyl lead, which are components of wastes managed at this unit. Tetraethyl lead is a hazardous constituent identified at 40 C.F.R. §261 Appendix VIII.

Part A - 6

Unit 4.15: Unit 4.15 (Ballast Water Pond) received ship ballast containing heavy metals and complex hydrocarbons. Crude oil and fuel hydrocarbons contain benzene, a hazardous constituent identified at 40 C.F.R. §261 Appendix VIII. During the VSI, oily sludges were observed in the unit. EPA believes that the oily sludges observed in the unit contain benzene and may contain other hazardous constituents identified at 40 C.F.R. §261 Appendix VIII. The unit is not covered, nor does it have a liner underneath. Since the unit contained liquids and is not lined, EPA believes that hazardous constituents from materials in the unit have migrated from the unit into the soils beneath the unit.

Unit 4.32: Unit 4.32 (Biotreater Equalization Feed Ponds, Unit "D") receives wastewater from the final pH adjustment unit (Unit 4.31). Wastewater in this unit contains the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: antimony, barium, chromium, dimethyl-

phenol, naphthalene, and phenol. Sediments at this unit contain the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: arsenic, barium, chromium, lead, nickel, mercury, silver, benzene, chrysene, and naphthalene. Since the unit has no liner underneath, and contains liquids, EPA believes that hazardous constituents have migrated from the unit into soils beneath the unit.

Pond 1&2

Unit 4.33: Wastewater in Unit 4.33 (Emergency Wastewater Holding Ponds, Unit "C") contains the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: nickel, selenium, silver, toluene, aniline, 2,4-dimethylphenol, naphthalene, and phenol. Sediments at this unit contain the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: arsenic, barium, chromium, lead, nickel, mercury, silver, benzene, toluene, benzo(a)pyrene, chrysene, 2-chloronaphthalene, fluoranthene, and naphthalene. Since the unit has no liner underneath, and contains liquids, EPA believes that hazardous constituents have migrated from the unit into soils beneath the unit.

Unit 4.34: Wastewater in Unit 4.34 (Activated Sludge Biotreater) contains the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: cadmium, selenium, thallium, and phenol. Since the unit has no liner underneath, and contains liquids, EPA believes that hazardous constituents have migrated from the unit into soils beneath the unit.

Unit 4.38: Wastewater in Unit 4.38 (Sand Filter Feed Pond) contains the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: chromium, nickel, lead, selenium, and silver. Sediments at this unit contain the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: arsenic, chromium, mercury, nickel, selenium, and silver. Since the unit has no liner underneath, and contains liquids, EPA believes that hazardous constituents have migrated from the unit into soils beneath the unit.

Unit 4.40: Wastewater in Unit 4.40 (Final Holding Pond) contains the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: chromium, nickel, and silver. Sediments at this unit contain the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: arsenic, barium, chromium, lead, mercury, nickel, and selenium. Since the unit has no liner underneath, and contains liquids, EPA believes that hazardous constituents have migrated from the unit into soils beneath the unit.

Unit 4.57: Unit 4.57 (PG&E Sludge Terraces) contains sludges with high pH (8.5-9.0) and the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII:

arsenic, barium, cadmium, chromium, nickel, and selenium. The unit is unlined, and rainwater falls on wastes in the unit. EPA believes that rainwater percolating through the sludge in the unit has leached heavy metal hazardous constituents from the sludge and carried them into the soils underlying the unit.

Unit 4.63: Wastewater in Unit 4.63 (Stormwater Holding Pond) contains the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: selenium, silver, benzene, toluene, aniline, chrysene, 2,4-dimethylphenol, naphthalene, and phenol. Sediments at this unit contain the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: arsenic, barium, chromium, lead, nickel, mercury, selenium, silver, toluene, chrysene, phenol, and naphthalene. Since the unit has no liner underneath, and contains liquids, EPA believes that hazardous constituents have migrated from the unit into soils beneath the unit.

Unit 4.66: Sediments in Unit 4.66 (Stormwater Holding Ponds - Formerly Land Treatment Area "FF") contain the following hazardous constituents identified at 40 C.F.R. §261 Appendix VIII: arsenic, barium, chromium, lead, mercury, nickel, silver, and toluene. Since the unit has no liner underneath, and contains liquids, EPA believes that hazardous constituents have migrated from the unit into soils beneath the unit.

Units 4.67 and 4.68: Pursuant to Solid Waste Assessment Test requirements, Respondent tested soils 2.5 to 5.5 feet underneath Unit 4.67 (Inactive Unit "YY") and 5 to 15 feet underneath Unit 4.68 (Inactive Unit "ZZ"). Barium, chromium, nickel, lead, and thallium were found in soils underneath both units. Barium, chromium, nickel, lead, and thallium are hazardous constituents as identified at 40 C.F.R. §261 Appendix VIII.

8b. Groundwater:

Facility: In 1987, Respondent conducted quarterly groundwater monitoring of 159 wells at the Facility for water level measurements and sampled 59 wells at the Facility for metals, Total Organic Carbon (TOC), benzene, toluene, xylene, sulfate, total phosphorous, and ammonia. According to the "Quarterly Groundwater Monitoring Report for Shell Oil Company Martinez Manufacturing Complex" prepared by EMCON Associates and submitted to RWQCB in September, 1987, third quarter monitoring showed widespread groundwater contamination (benzene, toluene, nickel, lead, xylene/ethylbenzene) in several geologic units underalying the Facility. This information is summarized in Table 2,

Table 2
Ground-water Contamination Found During
Third Quarter Monitoring (1987) at
Shell Oil Company Martinez Manufacturing Complex[a]

Geologic Formation	Maximum Levels Detected of:						
		Organics[b]			Metals[c]		
	TOC mg/l	B ug/l	T ug/l	X ug/l	Mn mg/l	Pb mg/l	Ni mg/l
Bay Mud	483	11	10	9	18	.26	.16
Bedrock-Sandstone	18	1.6	3	4	1.3	.36	---
Alluvium-Sand	48	710	2700	3200	7.8	---	---
Alluvium-and/or Silt	390	620	16	560	21	.58	.06
Bedrock-Claystone and/or Siltstone	38	36	2	13	11	.13	2.4

a From "Quarterly Groundwater Monitoring Report for Shell Oil Company Martinez Manufacturing Complex" prepared by EMCON Associates and submitted in September, 1987.

b TOC = total organic carbon, B = benzene, T = toluene, X = xylene/ethylbenzene.

c Mn = manganese, Pb = lead, Ni = nickel.

Identification Numbers of Wells in Which Ground-water Samples Taken During Quarterly Ground-water Monitoring Contained Benzene, Toluene, or Xylene (See Figures 12 and 13 for well locations):

37	60A	61	63	72	74	127	129	136	140
141	148	149	155	163	172	177	178	179	181

Identification Numbers of Wells Containing Floating Hydrocarbon During Quarterly Ground-water Monitoring (See Figures 12 and 13 for well locations):

2	11	12	21	23	24	38	39	53	57
60	62	69	73	102	111	115	124	132	137
139	145	151	165	168	179				

attached hereto and incorporated by reference. Benzene, toluene, lead, and nickel are hazardous constituents identified at 40 C.F.R. §261 Appendix VIII.

In addition, the RFA Report and EMCON's 1987 third quarterly monitoring data also have identified several areas of groundwater overlain with plumes of hydrocarbon material. These include two larger plumes and four smaller size plumes. (See Table 2 for a list of wells containing overlying hydrocarbon, and Figures 12 and 13 for the location of these wells.) One of the larger plumes, located approximately in the center of the refinery between Reservoirs #1 and #2 and Lake Slobodnick (Figure 7 and 8), contains approximately 15,000 barrels of crude oil, while the other large plume, located under Crude Hill (Figure 6), contains at least 5000 barrels of jet fuel. Crude oil and jet fuel both contain benzene, a hazardous constituent identified at 40 C.F.R. §261 Appendix VIII.

Units 4.9, 4.11, 4.12 and 4.13: Elevated levels of acetone and 1,2-dichloropropane have been detected in groundwater (well 177) downgradient of Unit 4.9 (Open Burning and Landfill area), elevated levels of phenols have been detected in groundwater (well 66) near Unit 4.11 (Impoundment "Y"), elevated levels of nickel have been detected in groundwater (well 148) downgradient of Unit 4.12 (Inactive Landfill "Z"), and elevated levels of nickel have been detected in groundwater (well 90) near Unit 4.13 (Inactive Pond Area "AA"). Acetone, phenol, nickel and 1,2-dichloropropane are hazardous constituents identified at 40 C.F.R. §261 Appendix VIII.

P 3&4 P 1&2 5A 4? 5B 6

Units 4.32, 4.33, 4.38, 4.38, 4.40, and 4.63: These units are all part of the wastewater treatment system at the Facility (see Figure 3). The units contain liquids but have no underlying liners to retard the migration of wastes from the units to the underlying soils and groundwater (see Paragraph 8.a.). Groundwater samples taken during Quarterly Groundwater Monitoring in 1987 show that samples from wells downgradient of these units have elevated levels of lead, benzene, and xylenes compared to wells upgradient of the units. These compounds have also been identified in wastewater and sediments in these units. Lead and benzene are hazardous constituents identified at 40 C.F.R. §261 Appendix VIII.

8c. Surface Water:

Unit 4.1: Sludge in Unit 4.1 (Inactive Land Treatment Area "FF") has been found to contain nickel and lead, which are hazardous constituents identified at 40 C.F.R. §261 Appendix VIII. Since the unit is located in marshland and portions of the containment dikes have been constructed from

permeable material, EPA believes that hazardous constituents have escaped from this unit and have contaminated the marshland.

Unit 4.57: Sludge in Unit 4.57 (PG&E sludge terrace) contains arsenic, cadmium, chromium, nickel, and selenium, which are hazardous constituents identified at 40 C.F.R. §261 Appendix VIII. The terraces are unlined and have no storm water run-off control. EPA believes that uncontrolled run-off from this unit has released to surface water metals which are Appendix VIII hazardous constituents.

8d. Air:

Unit 4.32: Unit 4.32 (Biotreater Equalization Pond) has been shown to contain the following volatile organic compounds which have also been identified at 40 C.F.R. §261 Appendix VIII: toluene, 2,4-dimethylphenol, naphthalene, and phenol. This unit is open and aerated, and, therefore, EPA believes that volatile hazardous constituents have been released from this unit to the air.

9. Releases of hazardous constituents to the soil are likely to continue due to water percolating through the soils and carrying hazardous constituents into the underlying groundwater, since the depth to underlying groundwater is small. According to the 1987 Quarterly Groundwater Monitoring Report, at many locations the groundwater is less than 5 feet below the surface.

Although groundwater under the Facility is generally of poor quality and is not used for industrial or domestic purposes, contaminated groundwater under the Facility can impact surrounding bodies of groundwater and surface water. Since the Facility is located on a groundwater divide, groundwater contamination under the Facility can migrate in several directions and impact groundwater and surface water bodies. Groundwater contamination moving east could contaminate the Ygnacio Valley Groundwater Basin, which is used as a water supply source. Groundwater contamination moving west could contaminate the Arroyo del Hambre Groundwater Basin, which is also used as a public water supply.

In addition, groundwater from the central part of the Facility flows north to the nearby Carquinez Strait and Suisun Bay, which are used for recreational purposes including boating, fishing, and swimming. Since the Facility is located on the shore of the Carquinez Strait, contaminated storm-water surface run-off from the Facility may also impact the Strait.

10. The hazardous constituents identified in paragraph 8 above have impacts on human health. According to "Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites, Final Report" prepared by Clement Associates (September, 1985), Chromium VI compounds have been found to be carcinogenic in rats and can cause DNA and chromosome damage in animals and humans; soluble barium salts are highly toxic after

acute exposure; epidemiological evidence has shown an excess of lung and nasal cancers for workers at nickel refineries; exposure to lead has been shown to cause kidney damage, anemia, and central nervous system damage; acute exposure to toluene causes depression and potential damage to the central nervous system; 1,2-dichloropropane has been shown to cause adenomas and carcinomas in rats and has been found to be mutagenic according to the Ames assay; subchronic exposure to phenol caused liver, kidney, heart, and lung damage in animal tests. According to the Superfund Public Health Evaluation Manual, benzene is a human carcinogen ingestion or inhalation, and chrysene and benzo(a)pyrene are probable human carcinogens by ingestion or inhalation.

11. Contamination in soils at the Facility are likely to cause continuing contamination of the groundwater. Existing and continuing contamination of the groundwater presents a potential contamination threat to neighboring groundwater basins which are used as public water supplies. This contamination therefore may pose a threat to human health.

In addition, contaminated groundwater and storm-water runoff threatens to contaminate and degrade the quality of the Carquinez Strait, Suisun Bay and nearby marshlands. The marshlands are habitat for water fowl. In addition, Suisun Bay is used as a habitat for migratory fish and birds. Recreational uses of Suisun Bay include aesthetic enjoyment and navigation.

Releases of hazardous constituents to the air poses a potential threat to the health of Facility workers and people living in residences near the Facility.

V. CONCLUSIONS OF LAW AND DETERMINATIONS

Based on the Findings of Fact set out above, and after consideration of the administrative record, the Director has made the following conclusions of law and determinations:

1. Respondent is a "person" within the meaning of Section 1004(15) of RCRA, 42 U.S.C. Section 6903(15).

2. Respondent is the owner and operator of a facility that has operated or is operating subject to Section 3005(e) of RCRA, 42 U.S.C. Section 6925(e).

3. Certain wastes and constituents thereof found at the Facility are hazardous wastes or hazardous constituents as defined by Section 1004(5) of RCRA, 42 U.S.C. Section 6903(5). These are also hazardous wastes or hazardous constituents within the meaning of Section 3001 of RCRA, 42 U.S.C. Section 6921 and 40 C.F.R. Part 261.

4. There is or has been a release of hazardous wastes and/or hazardous constituents into the environment from Respondents' Facility.

5. The actions required by this Order are necessary to protect human health or the environment.

VI. WORK TO BE PERFORMED

Pursuant to Section 3008(h) of RCRA, 42 U.S.C. Section 6928(h), Respondent is hereby ordered to perform the following acts in the manner and by the dates specified herein. All work undertaken pursuant to this Order shall be performed in a manner consistent with, at a minimum: the attached Scopes of Work, the EPA-approved RCRA Facility Investigation Workplan and Corrective Measures Study Workplan; RCRA and its implementing regulations; and applicable EPA guidance documents. Relevant guidance includes, but is not limited to: the "RCRA Facility Investigation (RFI) Guidance" (EPA 530/SW-87-001), "RCRA Groundwater Monitoring Technical Enforcement Guidance Document" (OSWER Directive 9950.1, September 1986), "Test Methods For Evaluating Solid Waste" (SW-846, November 1986) and "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities" (EPA 530/SW-85-031, July 1986).

RCRA FACILITY INVESTIGATION (RFI)

1. Within one hundred and eighty (180) days of the effective date of this Order, Respondents shall submit to EPA a Workplan for a RCRA Facility Investigation ("RFI Workplan"). The RFI Workplan is subject to approval by EPA and shall be performed in a manner consistent with the generic RFI Scope of Work contained in Attachment 1. Based on the types of releases documented in this Order, EPA believes that all sections of Attachment 1 are applicable to the Facility. Attachment 1 to this Order is incorporated by reference as if fully set forth herein.

2. The RFI Workplan shall be designed to define the presence, magnitude, extent, direction, and rate of movement of any hazardous wastes or hazardous constituents from the releases documented in Paragraph 8 above, entitled "Documentation of Releases." The RFI Workplan shall document the procedures the Respondents shall use to conduct those investigations necessary to: (1) characterize the geology and hydrogeology in and around the Facility; (2) characterize the existence, nature and extent of any groundwater and surface water contamination in and around the Facility; (3) characterize the existence, nature and extent of any soils contamination in and around the Facility; (4) characterize the existence, nature and extent of any air and subsurface gas contamination; (5) characterize the potential pathways of contaminant migration; (6) characterize the sources of contamination; (7) identify actual or potential receptors; and (8) support the development of alternatives from which a corrective measure will be selected by EPA. A specific schedule for implementation of all activities shall be included in the RFI Workplan.

24 units 4.1, 4.2, 4.4, 4.6, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, 4.17, 4.32, 4.33, 4.34, 4.38, 4.40, 4.57, 4.43, 4.64, 4.67, 4.68

3. In accordance with the provisions of Attachment 1 herein, the RFI Workplan shall include: (1) a Project Management Plan; (2) a Data Collection Quality Assurance Plan; (3) a Data Management Plan; (4) a Health and Safety Plan; and (5) a Public Involvement Plan.

CORRECTIVE MEASURES STUDY

4. Within thirty (30) days of EPA's written approval of the final RFI report, Respondent shall submit to EPA a Corrective Measures Study (CMS) Workplan. The CMS Workplan and activities conducted pursuant to this Order are subject to approval by EPA and shall be performed in a manner consistent with the Scope of Work for a Corrective Measures Study contained in Attachment 2. Attachment 2 to this Order is incorporated by reference as if fully set forth herein.

CORRECTIVE MEASURES IMPLEMENTATION

5. Upon EPA's selection of the corrective measure, if Respondent has complied with the terms of this Order, EPA shall provide a ninety (90) day period for negotiation of an administrative order on consent (or a judicial consent decree) for implementation of the selected corrective measure(s). If agreement is not reached during this period, EPA reserves all rights it has to implement the corrective measure or other remedial response and to take any other appropriate actions under RCRA, CERCLA, or any other available legal authority, including the issuance of a unilateral administrative order directing Respondent to implement the corrective measure.

SUBMISSIONS/AGENCY APPROVAL/ADDITIONAL WORK

6. EPA will review all draft and final Workplans, and notify Respondent in writing of EPA's approval/disapproval or modification of the Workplan or any part thereof. In the event of a disapproval, EPA shall specify in writing the deficiencies and reasons for disapproval. Within thirty (30) days of the receipt of EPA's disapproval of any Workplan, Respondent shall amend and submit a revised Workplan. EPA approved Workplans shall be deemed incorporated into and part of this Order.

7. Within thirty (30) days of approval or modification by EPA of any Workplans, Respondent shall commence work and implement the tasks required by the Workplans submitted pursuant to the Scopes of Work contained in Attachments 1 and 2 in accordance with the requirements, specifications and schedules stated in the Workplans as approved or modified by EPA.

8. Beginning with the month following the effective date of this Order, Respondent shall provide EPA with progress reports for each month on the tenth day of the following month. The progress reports shall conform to requirements in relevant Scopes of Work contained in Attachments 1 and 2.

9. Respondent shall provide draft and final RCRA Facility Investigation and Corrective Measure Study reports to EPA in accordance with the schedule contained in this Order and its attachments.

10. EPA will review all draft or final reports, and notify Respondent in writing of EPA's approval/disapproval or modification of the report or any part thereof. In the event of any disapproval, EPA shall specify in writing the deficiencies and reasons for such disapproval. Within thirty (30) days of receipt of EPA's disapproval of any report, Respondent shall amend and submit a revised report. EPA approved reports shall be deemed incorporated into and part of this Order.

11. Three (3) copies of all documents, including Workplans, Program Plans, preliminary and final reports, progress reports, and other correspondence to be submitted pursuant to this Order shall be hand delivered or sent by certified mail, return receipt requested, to the Project Coordinators designated pursuant to Section XII of this Order.

12. All work performed pursuant to this Order shall be under the direction and supervision of a professional engineer or geologist with expertise in hazardous waste site cleanup. Within sixty (60) days from the effective date of this Order Respondent shall notify EPA in writing of the name, title, and qualifications of the engineer or geologist, and of any contractors, subcontractors and their personnel to be used in carrying out the terms of this Order.

13. EPA may determine that certain tasks, including investigatory work or engineering evaluation, are necessary in addition to the tasks and deliverables included in the RFI Workplan and/or CMS Workplan when new information indicates that such additional work is necessary. EPA shall request in writing that Respondent perform the additional work in this situation and shall specify the basis and reasons for EPA's determination that the additional work is necessary. Within fourteen (14) days after the receipt of such request, Respondent may request a meeting with EPA to discuss the additional work. Within forty-five (45) days after the receipt of such request, Respondent must submit to EPA for approval a revised Workplan. Upon EPA approval of the revised Workplan, Respondent shall perform the additional work EPA has requested according to the revised Workplan. All additional work performed by Respondent under this paragraph shall be performed in a manner consistent with this Order.

VII. QUALITY ASSURANCE

Throughout all sample collection and analysis activities, Respondent shall use EPA-approved quality assurance, quality control, and chain-of-custody procedures as specified in the approved Workplans and Scopes of Work. In addition, Respondent shall:

1. Ensure that laboratories used by Respondent for analyses perform such analyses according to the EPA methods included in the third edition of "Test Methods for Evaluating Solid Waste (SW-846, November 1986) or other methods deemed satisfactory to EPA. If methods other than the EPA methods are to be used, Respondent shall submit all protocols to be used for analyses to EPA for approval sixty (60) days prior to the commencement of analyses.

2. Ensure that laboratories used by Respondent for analyses participate in a quality assurance/quality control program equivalent to that which is followed by EPA. As part of such a program, and upon request by EPA, such laboratories shall perform analyses of samples provided by EPA to demonstrate the quality of analytical data.

3. Inform the EPA Project Coordinator thirty (30) days in advance which laboratories will be used by Respondent and ensure that EPA personnel and EPA authorized representatives have reasonable access to the laboratories and personnel used for analyses.

4. Use the EPA guidance to evaluate all data to be used in the proposed plans required by Section VI of this Order. This evaluation shall be provided to EPA as part of the RFI Workplan and CMS Workplan required by Section VI of this Order, and shall be updated as required by EPA.

VIII. PUBLIC COMMENT AND PARTICIPATION

1. Upon approval by EPA of a Corrective Measure Study Final Report, EPA shall make both the RCRA Facility Investigation Final Report (or summary of report) and the Corrective Measure Study Final Report (or summary of report) and a summary of EPA's proposed corrective measure(s) and EPA's justification for proposing selection of that (those) corrective measure(s) available for public review and comment for at least twenty-one (21) days.

2. Following the public review and comment period, EPA shall notify Respondent of the corrective measure selected by EPA. If the corrective measure recommended in the Corrective Measure Study Final Report is not the corrective measure selected

by EPA after consideration of public comments, EPA will inform Respondent in writing of the reasons for such decision, and Respondent shall modify the RFI/CMS as directed to do so by EPA.

3. The Administrative Record supporting the selection of the corrective measure(s) will be available for public review at the U.S. EPA Region 9 library, Sixth Floor, 215 Fremont Street, San Francisco, California, from 8 a.m. to 4:30 p.m., weekdays.

IX. ON-SITE AND OFF-SITE ACCESS

1. EPA and/or any EPA representative, including EPA contractors, are authorized to enter and freely move about all property at the Facility during the effective dates of this Order for the purposes of, inter alia: interviewing Facility personnel and contractors; inspecting records, operating logs, and contracts related to the Facility; reviewing the progress of the Respondent in carrying out the terms of this Order; conducting such tests, sampling, or monitoring as EPA or its Project Coordinator deems necessary; using a camera, sound recording, or other documentary type equipment; and verifying the reports and data submitted to EPA by Respondent. Respondent shall permit such persons to inspect and copy all records, files, photographs, documents, and other writings, including all sampling and monitoring data, that pertain to work undertaken pursuant to this Order.

2. To the extent that work required by any approved Scopes of Work and/or Workplans prepared pursuant hereto must be done on property not owned or controlled by Respondent, Respondent will use its best efforts to obtain site access agreements from the present owner(s) of such property within sixty (60) days of approval of the plans for which site access is required. Best efforts as used in this Section shall include, at a minimum, a certified letter from Respondent to the present owners of such property requesting access agreements to permit Respondent and EPA and its authorized representatives to access such property. Any such access agreement shall be incorporated by reference into this Order. In the event that agreements for site access are not obtained within sixty (60) days of the effective date of such plans, Respondent shall notify EPA regarding both the lack of and its failure to obtain such agreements within seven (7) days thereafter. In the event that EPA obtains access, Respondent shall undertake EPA approved work on such property.

3. Nothing in this section limits or otherwise affects EPA's right of access and entry pursuant to applicable law, including RCRA and CERCLA.

X. SAMPLING AND DATA/DOCUMENT AVAILABILITY

1. Respondent shall submit to EPA the results of sampling and/or tests or other data generated by, or on behalf of Respondent, in accordance with the requirements of this Order and its attachments.

2. Respondent shall notify EPA at least fourteen (14) days before engaging in any field activities, any well drilling, installation of equipment, or sampling. At the request of EPA, Respondent shall provide or allow EPA or its authorized representative to take split samples of all samples collected by Respondent pursuant to this Order.

3. Respondent may assert a business confidentiality claim under 40 CFR 260.2(b) covering all or part of any information submitted to EPA pursuant to this Order. Any assertion of confidentiality shall be adequately substantiated by Respondent when the assertion is made. Information determined to be confidential by EPA shall be disclosed only to the extent permitted by 40 CFR Part 2. If no such confidentiality claim accompanies the information when it is submitted to EPA, it may be made available to the public by EPA without further notice to Respondent. Physical or analytical data shall not be deemed confidential.

XI. RECORD PRESERVATION

Respondent shall preserve, during the pendency of this Order and for a minimum of ten (10) years after its termination, all data, records, and documents in its possession or in the possession of its divisions, employees, agents, consultants, contractors, successors and assigns which relate in any way to this Order or to hazardous waste management and/or disposal at the Facility. After ten (10) years, Respondent shall make such records available to EPA for inspection or shall provide copies of any such records to EPA. Respondent shall notify EPA thirty (30) days prior to the destruction of any such records, and shall provide EPA with the opportunity to take possession of any such records.

XII. PROJECT COORDINATOR

1. Within thirty (30) days of the effective date of this Order, EPA and Respondent shall each designate a Project Coordinator. Respondent shall notify EPA in writing of the Project Coordinator they have selected. Each Project Coordinator shall be responsible for overseeing the implementation of this Order. The EPA Project Coordinator will be EPA's designated representative at the Facility. All communications between Respondent and EPA, and all documents, reports, approvals, and other correspondence concerning the activities performed pursuant to the terms and conditions of this Order, shall be directed through the Project Coordinators.

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2. Respondent shall provide EPA at least fourteen (14) days written notice prior to changing Project Coordinators.

3. If EPA determines that activities in compliance or non-compliance with this Order have caused or may cause a release of hazardous waste, hazardous constituent, or a pollutant or contaminant, or have caused or may cause a threat to human health or the environment, or if EPA determines that Respondent is not capable of undertaking any studies or corrective measures ordered, EPA may order Respondent to stop further implementation of this Order for such period of time as EPA determines may be needed to abate any such releases or threat and/or to undertake any action which EPA determines is necessary to abate such releases or threat.

4. The absence of the EPA Project Coordinator from the Facility shall not be cause for the stoppage of work.

XIII. NOTIFICATION

Unless otherwise specified, reports, notices or other submissions required under this Order shall be in writing and shall be sent to:

Steve Johnson
Chief, Enforcement Section
Hazardous Waste Management Division
U.S. EPA, Region 9
215 Fremont Street, T-2-4
San Francisco, CA 94105

XIV. PENALTIES FOR NONCOMPLIANCE

If Respondent fails to comply with the terms and provisions of this Order, EPA may commence a civil action to require compliance and to assess a civil penalty not to exceed $25,000 for each day of non-compliance.

XV. RESERVATION OF RIGHTS

1. EPA expressly reserves all rights and defenses that it may have, including the right both to disapprove of work performed by the Respondent pursuant to this Order and to request that the Respondent perform tasks in addition to those stated in the Work Plans and Scopes of Work.

2. EPA hereby reserves all of its statutory and regulatory powers, authorities, rights, remedies, both legal and equitable, which may pertain to Respondent's failure to comply with any of the requirements of this Order, including without limitation the assessment of penalties under Section 3008(h)(2) of RCRA, 42 U.S.C. 6928(h)(2). This order shall not be construed as a

covenant not to sue, release, waiver or limitation of any rights, remedies, powers, and/or authorities, civil or criminal, which EPA has under RCRA, CERCLA, or any other statutory, regulatory, or common law enforcement authority of the United States.

3. Compliance by Respondent with the terms of this Order shall not relieve Respondent of its obligations to comply with RCRA or any applicable local, State, or federal laws and regulations.

4. This Order shall not limit or otherwise preclude EPA from taking additional enforcement action pursuant to Section 3008(h) of RCRA or other available legal authorities should EPA determine that such actions are warranted and necessary to protect human health or the environment.

5. This Order is not intended to be nor shall it be construed as a permit. This Order does not relieve Respondent of any obligation to obtain and comply with any local, State, or federal permits.

6. EPA reserves the right to perform any portion of the work herein or any additional site characterization, feasibility study, and response/corrective actions as it deems necessary to protect human health and the environment. EPA may exercise its authority under CERCLA to undertake removal actions or remedial actions at any time. In any event, EPA reserves its right to seek reimbursement from Respondent for such additional costs incurred by the United States. Notwithstanding compliance with the terms of this Order, Respondent is not released from liability, if any, for the costs of any response actions taken or authorized by the EPA.

XVI. OTHER CLAIMS

Nothing in this Order shall constitute or be construed as a release from any claim, cause of action or demand in law or equity against any person, firm, partnership, or corporation for any liability it may have arising out of or relating in any way to the generation, storage, treatment, handling, transportation, release, or disposal of any hazardous constituents, hazardous substances, hazardous wastes, pollutants, or contaminants found at, taken to, or taken from the Facility.

XVII. OTHER APPLICABLE LAWS

All actions required to be taken pursuant to this Order shall be undertaken in accordance with the requirements of all applicable local, State, and federal laws and regulations. Respondent shall obtain or cause its representatives to obtain all permits and approvals necessary under such laws and regulations.

XVIII. INDEMNIFICATION OF THE UNITED STATES GOVERNMENT

Respondent shall indemnify and save and hold harmless the United States Government, its agencies, departments, agents, and employees, from any and all claims or causes of action arising from or on account of acts or omissions of Respondent or its agents, independent contractors, receivers, trustees, and assigns in carrying out activities required by this Order. The United States government shall not be held out or construed to be a party to any contract entered into by Respondent in carrying out activities pursuant to this Order.

XIX. SUBSEQUENT MODIFICATION

1. This Order may be amended by EPA to ensure protection of human health or the environment. Such amendments shall be in writing, shall have as their effective date the date on which they are signed by EPA, and shall be incorporated into this Order.

2. Any reports, plans, specifications, schedules, and attachments required by this Order are, upon written approval by EPA, incorporated into this Order. Any non-compliance with such EPA-approved reports, plans, specifications, schedules, and attachments shall be considered a violation of this Order and shall subject Respondent to the statutory penalty provisions referenced in Section XIV of this Order.

3. No informal advice, guidance, suggestions, or comments by EPA regarding reports, plans, specifications, schedules, and any other written material submitted by Respondent will be construed as relieving Respondent of its obligation to obtain written approval, if and when required by this Order.

XX. SEVERABILITY

If any provision or authority of this Order or the application of this Order to any party or circumstances is held by any judicial or administrative authority to be invalid, the application of such provisions to other parties or circumstances and the remainder of the Order shall remain in force and shall not be affected thereby.

XXI. NOTICE OF OPPORTUNITY TO REQUEST A HEARING

In accordance with Section 3008(b) of RCRA, 42 U.S.C. Section 6928(b), this Order shall become final unless Respondent requests a public hearing in writing no later than thirty (30) days after service of the Order and Notice of Opportunity for Hearing. Section 3008(b) of RCRA, 42 U.S.C. Section 6928(b), also requires Respondent to file a response in writing no later than thirty (30) days after service of the Order and Notice of Opportunity for Hearing.

The response and a request for hearing must be filed with:

Regional Hearing Clerk
Office of Regional Counsel
U.S. EPA Region 9
215 Fremont Street
San Francisco, California 94105

The response must specify each factual or legal determination or relief provision that is contested and for which the hearing is requested, with specificity, raising all the issues regarding the appropriateness of the terms of the Order, including any proposals for modifications of the Order. Any hearings on the Order will be conducted in accordance with the attached hearing procedures.

EPA believes that the Subpart B hearing procedures contained in 40 C.F.R. Part 24 are the appropriate procedures to govern any hearing requested under this Order. This belief is based on the fact that this Order directs Respondent to undertake such investigations and/or studies necessary to characterize the extent of contamination at the Facility and to support the development of corrective measures alternatives. Further, this Order does not require Respondent to implement the corrective measures selected by EPA which would require that the Subpart C hearing procedures be followed.

In its response to this Order and request for a hearing, Respondent may include a statement indicating whether it believes the Subpart B or Subpart C procedures should be employed for the requested hearing and the reason(s) therefore. [40 C.F.R. §24.05(d)]

If Respondent fails to file a response and request for hearing within thirty (30) days after service of the Order, Respondent will be deemed to have waived its right to a hearing and the Order will become final.

XXII. SETTLEMENT CONFERENCE

Whether or not Respondent requests a hearing, an informal conference may be requested in order to discuss the facts of this case and to arrive at settlement. The informal conference may be pursued simultaneously with the public hearing procedure. To request an informal conference, contact:

Karen Goldberg
Assistant Regional Counsel
Office of Regional Counsel
U.S. EPA Region 9
215 Fremont Street
San Francisco, CA 94105
(415)-974-0717

A request for an informal conference does not extend the thirty (30) day period during which a request for a hearing and a response to this Order must be submitted.

XXIII. TERMINATION AND SATISFACTION

The provisions of this Order shall be deemed satisfied upon Respondent's receipt of written notice from EPA that Respondent has demonstrated, to the satisfaction of EPA, that the terms of this Order, including any additional tasks determined by EPA to be required pursuant to this Order, or any continuing obligation or promises (e.g. Record Retention, Reservation of Rights) have been satisfactorily completed.

XXIV. SURVIVABILITY/PERMIT INTEGRATION

Subsequent to the issuance of this Order, a RCRA permit may be issued to the Facility incorporating the requirements of this Order by reference into the permit.

Any requirements of this Order shall not terminate upon the issuance of a RCRA permit unless the requirements are expressly replaced by more stringent requirements in the permit.

XXV. EFFECTIVE DATE

This Order shall become effective thirty (30) days after it is served unless Respondent requests a public hearing pursuant to RCRA section 3008(b), 42 U.S.C. Section 6928(b).

IT IS SO ORDERED:

BY: _____ 2-24-89
Director, Hazardous Waste Management Division — Date
U.S. Environmental Protection Agency

Effective Date:

Attachment 1

SCOPE OF WORK FOR A RCRA FACILITY INVESTIGATION (RFI) AT SHELL OIL COMPANY, MARTINEZ MANUFACTURING COMPLEX

PURPOSE

The purpose of this RCRA Facility Investigation is to determine the nature and extent of releases of hazardous waste or constituents, identified in Paragraph IV.8 of this Order, from regulated units, solid waste management units, and other source areas at the facility and to gather all necessary data to support the Corrective Measures Study. The Respondent shall furnish all personnel, materials, and services necessary for, or incidental to, performing the RCRA remedial investigation at Shell Oil Company, Martinez Manufacturing Complex.

SCOPE

The RCRA Facility Investigation consists of seven tasks:

Task I: Description of Current Conditions

A. Facility Background
B. Nature and Extent of Contamination
C. Implementation of Interim Measures

Task II: Pre-Investigation Evaluation of Corrective Measure Technologies

Task III: RFI Workplan Requirements

A. Project Management Plan
B. Data Collection Quality Assurance Plan
C. Data Management Plan
D. Health and Safety Plan
E. Community Relations Plan

Task IV: Facility Investigation

A. Environmental Setting
B. Source Characterization
C. Contamination Characterization
D. Potential Receptor Identification

Task V: Investigation Analysis

A. Data Analysis
B. Protection Standards

Task VI: Laboratory and Bench-Scale Studies

Task VII: Reports

A. Preliminary and Workplan
B. Progress
C. Draft and Final

I: DESCRIPTION OF CURRENT CONDITIONS

Respondent shall submit for U.S. EPA approval a report providing the background information pertinent to the Facility, contamination and interim measures as set forth below. The data gathered during any previous investigations or inspections and other relevant data shall be included.

. Facility Background

Respondent's report shall summarize the regional location, pertinent boundary features, general Facility physiography, hydrogeology, and historical use of the Facility for the treatment, storage or disposal of solid and hazardous waste. Respondent's report shall include:

1. Map(s) depicting the following:
   a. General geographic location;
   b. Property lines, with the owners of all adjacent property clearly indicated;
   c. Topography and surface drainage (with a contour interval of 10 feet and a scale of 1 inch = 100 feet) depicting all waterways, wetlands, floodplains, water features, drainage patterns, and surface-water containment areas;
   d. All tanks, buildings, utilities, paved areas, easements, rights-of-way, and other features;
   e. All solid or hazardous waste treatment, storage or disposal areas active after November 19, 1980;
   f. All known past solid or hazardous waste treatment, storage or disposal areas regardless of whether they were active on November 19, 1980;
   g. All known past and present product and waste underground tanks or piping;
   h. Surrounding land uses (residential, commercial, agricultural, recreational); and
   i. The location of all production and ground-water monitoring wells. These wells shall be clearly labeled and ground and top of casing elevations and construction details included (these elevations and details may be included as an attachment).

   All maps shall be consistent with the requirements set forth in 40 CFR §270.14 and be of sufficient detail and accuracy to locate and report all current and future work performed at the site;

2. A history and description of ownership and operation, solid and hazardous waste generation, treatment, storage and disposal activities at the Facility;

3. Approximate dates or periods of past product and waste spills, identification of the materials spilled, the amount spilled, the location where spilled, and a description of the response actions conducted (local, state, or federal response units or private parties), including any inspection reports or technical reports generated as a result of the response; and

4. A summary of past permits requested and/or received, any enforcement actions and their subsequent responses and a list of documents and studies prepared for the Facility.

B. Nature and Extent of Contamination

Respondent shall prepare and submit for U.S. EPA approval a preliminary report describing the existing information on the nature and extent of contamination.

1. Respondent's report shall summarize all possible source areas of contamination. This, at a minimum, should include all regulated units, solid waste management units, spill areas, and other suspected source areas of contamination. For each area, Respondent shall identify the following:

   a. Location of unit/area (which shall be depicted on a facility map);
   b. Quantities of solid and hazardous wastes;
   c. Hazardous waste or constituents, to the extent known; and
   d. Identification of areas where additional information is necessary.

2. Respondent shall prepare an assessment and description of the existing degree and extent of contamination. This should include:

   a. Available monitoring data and qualitative information on locations and levels of contamination at the Facility;
   b. All potential migration pathways including information on geology, pedology, hydrogeology, physiography, hydrology, water quality, meteorology, and air quality; and
   c. The potential impact(s) on human health and the environment, including demography, ground-water and surface-water use, and land use.

C. Implementation of Interim Measures

Respondent's report shall document interim measures which were or are being undertaken at the Facility. This shall include:

1. Objectives of the interim measures: how the measure is mitigating a potential threat to human health and the environment and/or is consistent with and integrated into any long term solution at the Facility;
2. Design, construction, operation, and maintenance requirements;
3. Schedules for design, construction and monitoring; and
4. Schedule for progress reports.

[illegible]K III. PRE-INVESTIGATION EVALUATION OF CORRECTIVE MEASURE [illegible]CHNOLOGIES

Prior to starting the Facility investigation, Respondent shall submit to EPA a report that identifies the potential corrective measure technologies that may be used on-site or off-site for the containment, treatment, remediation, and/or disposal of contamination. This report shall also identify any field data that needs to be collected in the Facility investigation to facilitate the evaluation and selection of the final corrective measure or measures (e.g., compatibility of waste and construction materials, information to evaluate effectiveness, treatability of wastes, etc.).

TASK III: RFI WORKPLAN REQUIREMENTS

Respondent shall prepare a RCRA Facility Investigation (RFI) Workplan. This RFI Workplan shall include the development of several plans, which shall be prepared concurrently. During the RCRA Facility Investigation, it may be necessary to revise the RFI Workplan to increase or decrease the detail of information collected to accommodate the Facility-specific situation. The RFI Workplan includes the following:

A. Project Management Plan

Respondent shall prepare a Project Management Plan which will include a discussion of the technical approach, schedules, budget, and personnel. The Project Management Plan will also include a description of qualifications of personnel performing or directing the RFI, including contractor personnel. This plan shall also document the overall management approach to the RCRA Facility Investigation.

B. Data Collection Quality Assurance Plan

Respondent shall prepare a plan to document all monitoring procedures: sampling, field measurements and sample analysis performed during the investigation to characterize the environmental setting, source, and contamination, so as to ensure that all information, data and resulting decisions are technically sound, statistically valid, and properly documented.

1. Data Collection Strategy

The strategy section of the Data Collection Quality Assurance Plan shall include but not be limited to the following:

a. Description of the intended uses for the data, and the necessary level of precision and accuracy for these intended uses;

b. Description of methods and procedures to be used to assess the precision, accuracy and completeness of the measurement data;

c. Description of the rationale used to assure that the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition or an environmental condition. Examples of factors which shall be considered and discussed include:

i) Environmental conditions at the time of sampling;

ii) Number of sampling points;

iii) Representativeness of selected media; and

iv) Representativeness of selected analytical parameters.

d. Description of the measures to be taken to assure that the following data sets can be compared to each other:

i) RFI data generated by Respondent over some time period;
ii) RFI data generated by an outside laboratory or consultant versus data generated by Respondent;
iii) Data generated by separate consultants or laboratories; and
iv) Data generated by an outside consultant or laboratory over some time period.

e. Details relating to the schedule and information to be provided in quality assurance reports. The reports should include but not be limited to:

i) Periodic assessment of measurement data accuracy, precision, and completeness;
ii) Results of performance audits;
iii) Results of system audits;
iv) Significant quality assurance problems and recommended solutions; and
v) Resolutions of previously stated problems.

2. Sampling

The Sampling section of the Data Collection Quality Assurance Plan shall discuss:

a. Selecting appropriate sampling locations, depths, etc.;
b. Providing a statistically sufficient number of sampling sites;
c. Measuring all necessary ancillary data;
d. Determining conditions under which sampling should be conducted;
e. Determining which media are to be sampled (e.g., ground water, air, soil, sediment, etc.);
f. Determining which parameters are to be measured and where;
g. Selecting the frequency of sampling and length of sampling period;
h. Selecting the types of sample (e.g., composites vs. grabs) and number of samples to be collected;
i. Measures to be taken to prevent contamination if the sampling equipment and cross contamination between sampling points;
j. Documenting field sampling operations and procedures, including;

i) Documentation of procedures for preparation of reagents or supplies which become an integral part of the sample (e.g., filters, and adsorbing reagents);
ii) Procedures and forms for recording the exact location and specific considerations associated with sample acquisition;
iii) Documentation of specific sample preservation method;
iv) Calibration of field devices;
v) Collection of replicate samples;
vi) Submission of field-biased blanks, where appropriate;
vii) Potential interferences present at the Facility;
viii) Construction materials and techniques, associated with monitoring wells and piezometers;
ix) Field equipment listing and sample containers;
x) Sampling order; and
xi) Decontamination procedures.

k. Selecting appropriate sample containers;
l. Sample preservation; and
m. Chain-of-custody, including:

i) Standardized field tracking reporting forms to establish sample custody in the field prior to and during shipment; and
ii) Pre-prepared sample labels containing all information necessary for effective sample tracking.

3. Field Measurements

The Field Measurements section of the Data Collection Quality Assurance Plan shall discuss:

a. Selecting appropriate field measurement locations, depths, etc.;
b. Providing a statistically sufficient number of field measurements;
c. Measuring all necessary ancillary data;
d. Determining conditions under which field measurement should be conducted;
e. Determining which media are to be addressed by appropriate field measurements (e.g., ground water, air, soil, sediment, etc.);
f. Determining which parameters are to be measured and where;
g. Selecting the frequency of field measurement and length of field measurements period; and

h. Documenting field measurement operations and procedures, including:

i) Procedures and forms for recording raw data and the exact location, time, and facility-specific considerations associated with the data acquisition;
ii) Calibration of field devices;
iii) Collection of replicate measurements;
iv) Submission of field-biased blanks, where appropriate;
v) Potential interferences present at the Facility;
vi) Construction materials and techniques associated with monitoring wells and piezometers use to collect field data;
vii) Field equipment listing;
viii) Order in which field measurements were made; and
ix) Decontamination procedures.

4. Sample Analysis

The Sample Analysis section of the Data Collection Quality Assurance Plan shall specify the following:

a. Chain-of-custody procedures, including:

i) Identification of a responsible party to act as sample custodian at the laboratory facility authorized to sign for incoming field samples, obtain documents of shipment, and verify the data entered onto the sample custody records;
ii) Provision for a laboratory sample custody log consisting of serially numbered standard lab-tracking report sheets; and
iii) Specification of laboratory sample custody procedures for sample handling, storage, and dispersement for analysis.

b. Sample storage procedures and storage times;
c. Sample preparation methods;
d. Analytical procedures, including:

i) Scope and application of the procedure;
ii) Sample matrix;
iii) Potential interferences;
iv) Precision and accuracy of the methodology; and
v) Method detection limits.

e. Calibration procedures and frequency;
f. Data reduction, validation and reporting;

g. Internal quality control checks, laboratory performance and systems audits and frequency, including:

i) Method blank(s);
ii) Laboratory control sample(s);
iii) Calibration check sample(s);
iv) Replicate sample(s);
v) Matrix-spiked sample(s);
vi) "Blind" quality control sample(s);
vii) Control charts;
viii) Surrogate samples;
ix) Zero and span gases; and
x) Reagent quality control checks.

h. Preventive maintenance procedures and schedules;
i. Corrective action (for laboratory problems); and
j. Turnaround time.

C. Data Management Plan

Respondent shall develop and initiate a Data Management Plan to document and track investigation data and results. This plan shall identify and set up data documentation materials and procedures, project file requirements, and project-related progress reporting procedures and documents. The plan shall also provide the format to be used to present the raw data and conclusions of the investigation.

1. Data Record

The data record shall include the following:

a. Unique sample or field measurement code;
b. Sampling or field measurement location and sample or measurement type;
c. Sampling or field measurement raw data;
d. Laboratory analysis ID number;
e. Property or component measured; and
f. Result of analysis (e.g., concentration).

2. Tabular Displays

The following data shall be presented in tabular displays:

a. Unsorted (raw) data;
b. Results for each medium, or for each constituent monitored;
c. Data reduction for statistical analysis;
d. Sorting of data by potential stratification factors (e.g., location, soil layer, topography); and
e. Summary data.

3. Graphical Displays

The following data shall be presented in graphical formats (e.g., bar graphs, line graphs, area or plan maps, isopleth plots, cross-sectional plots or transects, three dimensional graphs, etc.):

a. Display sampling location and sampling grid;
b. Indicate boundaries of sampling area, and areas where more data are required;
c. Displays levels of contamination at each sampling location;
d. Display geographical extent of contamination;
e. Display contamination levels, averages, and maxima;
f. Illustrate changes in concentration in relation to distance from the source, time, depth or other parameters; and
g. Indicate features affecting intramedia transport and show potential receptors.

D. Health and Safety Plan

Respondent shall prepare a Facility Health and Safety Plan.

1. Major elements of the Health and Safety Plan shall include:

a. Facility description including availability of resources such as roads, water supply, electricity and telephone service;
b. Describe the known hazards and evaluate the risks associated with the incident and with each activity conducted;
c. List key personnel and alternates responsible for site safety, responses operations, and for protection of public health;
d. Delineate work area;
e. Describe levels of protection to be worn by personnel in work area;
f. Establish procedures to control site access;
g. Describe decontamination procedures for personnel and equipment;
h. Establish site emergency procedures;
i. Address emergency medical care for injuries and toxicological problems;
j. Describe requirements for an environmental surveillance program;
k. Specify any routine and special training required for responders; and
l. Establish procedures for protecting workers from weather-related problems.

The Facility Health and Safety Plan shall be consistent with:

a. NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985);
b. EPA Order 1440.1 - Respiratory Protection;
c. EPA Order 1440.3 - Health and Safety Requirements for Employees engaged in Field Activities;
d. Facility Contingency Plan;
e. EPA Standard Operating Safety Guide (1984); f. OSHA regulations particularly in 29 C.F.R. §1910 and §1926;
g. State and local regulations; and
h. Other EPA guidance as provided.

Community Relations Plan

Respondent shall prepare a plan, for the dissemination of information to the public regarding investigation activities and results.

The Facility Health and Safety Plan shall be consistent with:

a. NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985);
b. EPA Order 1440.1 - Respiratory Protection;
c. EPA Order 1440.3 - Health and Safety Requirements for Employees engaged in Field Activities;
d. Facility Contingency Plan;
e. EPA Standard Operating Safety Guide (1984); f. OSHA regulations particularly in 29 C.F.R. §1910 and §1926;
g. State and local regulations; and
h. Other EPA guidance as provided.

E. Community Relations Plan

Respondent shall prepare a plan, for the dissemination of information to the public regarding investigation activities and results.

TASK IV: FACILITY INVESTIGATION

Respondent shall conduct those investigations necessary to: characterize the Facility (Environmental Setting); define the source (Source Characterization); define the degree and extent of contamination (Contamination Characterization); and identify actual or potential receptors.

The investigations should result in data of adequate technical quality to support the development and evaluation of the corrective measure alternative or alternatives during the Corrective Measures Study.

The site investigation activities shall follow the plans set forth in Task III. All sampling and analyses shall be conducted in accordance with the Data Collection Quality Assurance Plan. All sampling locations shall be documented in a log and identified on a detailed site map.

A. Environmental Setting

Respondent shall collect information to supplement and verify existing information on the environmental setting at the Facility. Respondent shall characterize the following:

1. Hydrogeology

Respondent shall conduct a program to evaluate hydrogeologic conditions at the Facility. This program shall provide the following information:

a. A description of the regional and Facility-specific geologic and hydrogeologic characteristics affecting ground-water flow beneath the Facility, including:

i) Regional and Facility-specific stratigraphy: description of strata including strike and dip, identification of stratigraphic contacts;

ii) Structural geology: description of local and regional structural features (e.g., folding, faulting, tilting, jointing, etc.);

iii) Depositional history;

iv) Identification and characterization of areas and amounts of recharge and discharge.

v) Regional and Facility-specific ground-water flow patterns; and

vi) Characterize seasonal variations in the ground-water flow regime.

b. An analysis of any topographic features that might influence the ground-water flow system.

c. Based on field data, test, and cores, a representative and accurate classification and description of the hydrogeologic units which may be part of the migration pathways at the Facility (i.e., the aquifers and any intervening saturated and unsaturated units), including:

i) Hydraulic conductivity and porosity (total and effective);
ii) Lithology, grain size, sorting, degree of cementation;
iii) An interpretation of hydraulic interconnections between saturated zones; and
iv) The attenuation capacity and mechanisms of the natural earth materials (e.g., ion exchange capacity, organic carbon content, mineral content etc.).

d. Based on field studies and cores, structural geology and hydrogeologic cross sections showing the extent (depth, thickness, lateral extent) of hydrogeologic units which may be part of the migration pathways identifying:

i) Sand and gravel deposits in unconsolidated deposits;
ii) Zones of fracturing or channeling in consolidated or unconsolidated deposits;
iii) Zones of higher permeability or low permeability that might direct and restrict the flow of contaminants;
iv) The uppermost aquifer: geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs; and
v) Water-bearing zones above the first confining layer that may serve as a pathway for contaminant migration including perched zones of saturation.

e. Based on data obtained from ground-water monitoring wells and piezometers installed upgradient and downgradient of the potential contaminant source, a representative description of water level or fluid pressure monitoring including:

i) Water-level contour and/or potentiometric maps;
ii) Hydrologic cross sections showing vertical gradients;
iii) The flow system, including the vertical and horizontal components of flow; and

iv) Any temporal changes in hydraulic gradients, for example, due to tidal or seasonal influences.

f. A description of manmade influences that may affect the hydrogeology of the site, identifying:

i) Active and inactive local water-supply and production wells with an approximate schedule of pumping; and

ii) Manmade hydraulic structures (pipelines, french drains, ditches, unlined ponds, septic tanks, NPDES outfalls, retention areas, etc.).

2. Soils

Respondent shall conduct a program to characterize the soil and rock units above the water table in the vicinity of the contaminant release(s). Such characterization shall include but not be limited to, the following information:

a. SCS soil classification;
b. Surface soil distribution;
c. Soil profile, including ASTM classification of soils;
d. Transects of soil stratigraphy;
e. Hydraulic conductivity (saturated and unsaturated);
f. Relative permeability;
g. Bulk density;
h. Porosity;
i. Soil sorptive capacity;
j. Cation exchange capacity (CEC);
k. Soil organic content;
l. Soil pH;
m. Particle size distribution;
n. Depth of water table;
o. Moisture content;
p. Effect of stratification on unsaturated flow;
q. Infiltration
r. Evapotranspiration;
s. Storage capacity;
t. Vertical flow rate; and
u. Mineral content.

3. Surface Water and Sediment

Respondent shall conduct a program to characterize the surface - water bodies in the vicinity of the Facility. Such characterization shall include, but not be limited to, the following activities and information:

a. Description of the temporal and permanent surface-water bodies including:

i) For lakes and estuaries: location, elevation, surface area, inflow, outflow, depth, temperature stratification, and volume;
ii) For impoundments: location, elevation, surface area, depth, volume, freeboard, and purpose of impoundment;
iii) For streams, ditches, drains, swamps and channels: location, elevation, flow, velocity, depth, width, seasonal fluctuations, and flooding tendencies (i.e., 100 year event);
iv) Drainage patterns; and
v) Evapotranspiration.

b. Description of the chemistry of the natural surface water and sediments. This includes determining the pH, total dissolved solids, total suspended solids, biological oxygen demand, alkalinity, conductivity, dissolved oxygen profiles, nutrients (NH_3, NO_3^-/NO_2^-, PO_4^{-3}), chemical oxygen demand, total organic carbon, specific contaminant concentrations, etc.

c. Description of sediment characteristics including:

i) Deposition area;
ii) Thickness profile; and
iii) Physical and chemical parameters (e.g., grain size, density, organic carbon content, ion exchange capacity, pH, etc.)

4. Air

Respondent shall provide information characterizing the climate in the vicinity of the Facility. Such information shall include, but not be limited to:

a. A description of the following parameters:

i) Annual and monthly rainfall averages;
ii) Monthly temperature averages and extremes;
iii) Wind speed and direction;
iv) Relative humidity/dew point;
v) Atmospheric pressure;
vi) Evaporation data;
vii) Development of inversions; and
viii) Climate extremes that have been known to occur in the vicinity of the Facility, including frequency of occurrence.

Submission Summary

The summary of the information reporting requirements contained in the Corrective Measure Study Scope of Work is presented below:

Facility Submission	Due Date
Preliminary CMS Workplan	thirty (30) days after approval of RFI report
Final CMS Workplan	thirty (30) days from the receipt of EPA comments on the draft Workplan
Draft CMS Report (Tasks VIII, IX, and X)	according to the approved schedule in the CMS Workplan
Final CMS Report (Tasks VIII, IX, and X)	thirty (30) days after EPA comments on the Draft CMS
Progress Reports on Tasks VIII, IX, and X	BI-MONTHLY

CERTIFICATION OF SERVICE

I hereby certify that the original of the foregoing Administrative Order was filed with the Regional Hearing Clerk, Region 9, and that a copy was sent, certified mail, return receipt requested, to:

Frank Richardson
President
Shell Oil Company
900 Louisiana
Houston, Texas 77210

3/6/89
Date

Hazardous Waste Management Division