CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN FRANCISCO BAY REGION

ORDER NO. 95-233

SITE CLEANUP REQUIREMENTS FOR:

THE CLOROX COMPANY

For the property located at:

850 - 42nd AVENUE
OAKLAND
ALAMEDA COUNTY

The California Regional Water Quality Control Board, San Francisco Bay Region (hereinafter the Board), finds that:

1. **Site Location**: The Clorox Company's (Clorox) Oakland Plant Site (the "Site") is located at 850 - 42nd Avenue, off High Street in Oakland, Alameda County, California. The Site is about 0.4 miles east-northeast of the Alameda-Oakland Estuary (the "Estuary"). The Site elevation is between 15 to 18 feet above mean sea level (MSL). The southwestern side of the Site is bordered by Southern Pacific railroad tracks. The north-northwestern side is bordered by State Highway 185. A map of the Site is attached (Figure 1).

2. **Site History**: Clorox manufactured a 5% sodium hypochlorite solution (liquid bleach) at the Site from 1919 until 1981. Elemental mercury was used as an electrical conductor in a mercury-cell manufacturing process to produce raw materials for the bleach during the period from 1919 to 1957. The use of mercury cells was discontinued in 1957; production of liquid bleach was discontinued in 1981. Dry bleach production began in 1972 and continued until 1992, when operations ceased. The building has been vacant since 1992.

   To determine compliance with Federal CERCLA regulations, Clorox commissioned an initial soil sampling program at the Site in 1981. Results of the initial investigation indicated that the upper soils contained mercury at various locations throughout the Site. It was believed that the source of the mercury was the old cells, which had become inefficient and were crushed and retorted to recover mercury. Concrete remnants from the cells, after retorting of mercury, may have been used as fill material in some areas at the Site from 1919 to 1945.

Initial groundwater studies were conducted in 1982, and mercury contamination was found in the shallow groundwater zone. The mercury has not migrated to the deeper aquifer below the shallow groundwater zone. A maximum of 18 lbs of mercury was estimated to have been discharged to the shallow groundwater since production began in 1919.

3. **Named Dischargers**: The Clorox Company is named as the discharger because it owned and operated the property at the time of the discharge, and currently owns the Site. If additional information is submitted indicating that any other parties caused or permitted any waste to be discharged on the Site where it entered or could have entered waters of the State, the Board will consider adding that party's name to this Order. Clorox is hereinafter referred to as the Discharger.

4. **Regulatory Status**: The Board has adopted the following orders for this Site:

   - Waste Discharge Requirements (Order No. 86-21), adopted March 19, 1986.
   - NPDES Permit (Order No. 91-078; Permit No. CA 0028959), adopted May 15, 1991.

5. **Site Hydrogeology**: The Site is located in the Temescal Formation and is covered from the surface environment by concrete floor slabs in the buildings, and asphalt on the parking areas. The soil under the concrete and asphalt areas consists of a deep deposit of geologically young water-deposited native soils, overlain by a layer of fill materials. The native soil at the Site is a mottled gray or yellow brown silty clay. Inter-bedded granular layers consisting of clayey to clean sands and gravels, of moderate hydraulic conductivity, are present in the depth ranges between 8 to 18 feet, 40 to 80 feet, 120 to 140 feet, and 200 to 230 feet below the ground surface. They are separated by silty clay layers called clay aquitards.

   The shallow groundwater zone has been identified between approximate depths of 8 to 18 feet below ground surface. A 22-foot-thick stratum of plastic silty clay, which appears to be continuous laterally and vertically at the Site, separates the shallow groundwater from the deeper confined aquifer, which is present at an approximate depth range of 40 to 80 feet below ground surface. The average rate of shallow groundwater flow was calculated to be about 595 gallons per day over a width of 400 feet and a thickness of 7 feet. The section of the State Highway 185 that borders the Site is an underpass. The California Department of Transportation (Caltrans) periodically de-waters the retaining wall drainage system of the underpass section. The direction and gradients of the shallow groundwater at the Site are controlled by the retaining wall drainage system. Shallow groundwater at the Site flows into the retaining wall drainage system and is then pumped, along with any storm water, to a storage box and is finally discharged to the Estuary through a storm sewer outfall.

The groundwater flow direction at the Site has predominantly been in the northwest to west direction since the construction of the retaining wall drainage system.

6. **Remedial Investigation**:

Soil

Early soil investigations were conducted from 1981 to 1983 to obtain estimates of the extent of mercury contamination at the Site. Concentrations detected in the soil ranged from 0.02 mg/kg to 1995 mg/kg. Early investigations indicated that elevated mercury levels were detected in the surface soils only, and therefore it was unclear if and how these levels could be contributing to the mercury in the groundwater. Elevated chloride levels were also detected in soil and are believed to be the long-term result of unloading dry sodium chloride from railroad cars at Clorox's spur line along the west side of the plant and from use of saturated sodium chloride solution as feed material to the mercury cell process. High chloride levels at the groundwater table are known to facilitate the transport of mercury from soil to groundwater, and migration via groundwater. Thus, the chloride levels are likely to be the most important factor controlling the mercury sorption capacity of soils at the Site, and the migration of mercury in groundwater.

Subsequent investigations were conducted in December 1994 to locate and characterize a potential soil mercury source in the historic mercury cell area. Soil sample results ranged from concentrations of 3.4 mg/kg to 5500 mg/kg. The additional soil investigations indicate that a uniform distribution of mercury concentrations exist in the upper 3 feet of soils throughout the Site, and mercury concentrations in these upper soils have not been transported to deeper locations, and are not contributing to groundwater contamination. A localized area of elevated mercury concentrations (the "elevated mercury area"), at the historic location of the mercury cells, was identified where concentrations extended to the depth of groundwater. In the elevated mercury area necessary conditions for leaching are present - elevated mercury levels in soil, and contact of this soil with groundwater containing chloride thereby increasing the potential solubility of mercury.

The elevated mercury area is located between soil borings 16M and 11M and is the only area where conditions necessary for leaching are present (Figure 2). The mercury mass in this elevated mercury area is estimated to be approximately 1000 lbs and the total mercury mass in on-site soils outside of the elevated mercury area is approximately 2000 lbs.

Groundwater

The presence of mercury in the shallow groundwater at the Site was established in 1982. Thirteen monitoring wells were installed and screened in the shallow

groundwater zone. Mercury was found in concentrations ranging from <0.1 ppb to 10,000 ppb in these wells. Nine other wells were installed to monitor the deeper confined aquifer. No mercury was found in the deep wells. Since 1982, several shallow monitoring wells and all but one of the deep wells have been closed. Wells MW-49 through 52 were added over time to aid monitoring the on-site shallow groundwater mercury pollution. Locations of the current monitoring wells are shown in Figure 3.

Groundwater mercury concentrations in on-site monitoring wells 49, 50, 51 and 52 have decreased by an order of magnitude since 1986 and mercury concentrations in wells 49, 50 and 52 are approaching asymptotic levels. Groundwater mercury concentrations in off-site monitoring wells (21, 26, 42, 45R, 46, 47, 48) have been almost constant over the past 5 years and reflect the historical migration of mercury in the groundwater.

Chloride concentrations in monitoring wells exhibited a wide range of values. As with the soil chloride concentrations, levels of chloride concentrations in monitoring wells are likely due to historic use of sodium chloride at the Site. Chloride levels are higher in on-site monitoring wells and significantly decrease with distance from the Site.

Groundwater samples were subjected to full mercury speciation analyses which included analysis of total mercury, inorganic mercury, ionic mercury forms, particulate mercury, elemental mercury, methyl mercury, and dimethyl mercury. The majority of the mercury was determined to be inorganic mercury (60%) in the Hg (II) ionic form, particulate mercury (30%), and elemental mercury (10%). Alkyl mercury compounds are not the primary species of interest at the Site. From an environmental fate standpoint, the processes that lead to methylation of Hg (II) species are not occurring at the Site, since mono and dimethyl mercury levels in the groundwater are virtually non-detect. This is an important consideration since the mercury species that are most likely to bioaccumulate are the alkyl mercury species.

Hydrogeologic mercury transport studies were conducted to evaluate the maximum probable extent of mercury in the groundwater at the Site. Approximately 4 lbs of mercury is estimated to exist currently in the groundwater out of which 1 - 2 ounces is in the off-site groundwater.

7. **Adjacent Sites**: There are no adjacent properties whose contamination or cleanup activities affect the current status of investigation or potential cleanup at the Site.

8. **Interim Remedial Measures**: A Remedial Action Assessment report, dated June 1985, describes three remedial alternatives, and indicates that other potential alternatives were also considered . The chosen alternative included a groundwater extraction and

treatment (GET) system, built in 1987, to hydraulically control the off-site migration of mercury in groundwater. The groundwater extraction system consists of a drainage gallery, 300 feet long and about 23 feet deep, located along the west side of the Site. Shallow groundwater flows into the gallery and collects at two sumps, in the north and south ends of the gallery. The groundwater elevation contours indicate that the drainage gallery has an influence that extends for a distance of approximately 100 to 150 feet, on to the off-site area west of the Site.

The extracted groundwater is treated in a serial system consisting of equalization, precipitation, filtration, pH-adjustment, ion exchange, carbon adsorption and aeration. The system is designed to treat 2500 gallons per day. The effluent is discharged, pursuant to NPDES permit No. CA 0028959, into a storm sewer which drains into the Estuary. The GET system has been operating continually since January 1988 except for a brief period in 1990 when the treatment plant was upgraded from a pilot facility to a full-scale facility. Through March 1995, about 1.847 Million gallons of water have been treated, and approximately 12 lbs of mercury have been removed from the groundwater. The average rate of mercury removal from the groundwater has been about 1.7 lbs/year.

9. **Feasibility Study:** To address the mercury levels in the elevated mercury area, a soil remediation plan was evaluated. As a part of this plan, soils in the elevated mercury area that exhibit the appropriate leaching characteristics will be excavated and treated. The overriding factors in favor of a focused soil source remediation are an anticipated mass reduction of mercury in soil, and the elimination of future threats to groundwater.

   The methodologies that the Discharger evaluated to treat the soils excavated from the elevated mercury area are as follows: 1) Low Temperature Thermal Treatment, 2) High Temperature Thermal Treatment, 3) Soil Washing, and 4) In-Situ Soil Stabilization. An evaluation of these alternatives is summarized in Figure 4. The evaluation factors used were mercury source removal and elimination of threat to groundwater from the residual mercury in soil, cost analysis, and treatment effectiveness. The in-situ soil stabilization alternative does not demonstrate a reduction in mercury mass in the soil column. The three ex-situ alternatives satisfy the objective of source removal. The recommended alternative is low temperature thermal treatment which has less uncertainty about treatment effectiveness than soil washing, and is lower in cost than high temperature thermal treatment or soil washing.

10. **Cleanup Plan:** The Non-Attainment Area (NAA) concept was developed from Board, other documented nation-wide agency, and responsible party experiences that cleanup to background is often impracticable; that most pollution of soil and groundwater is limited in extent; that dissolved phase groundwater cleanup to low levels is costly compared to the benefits; and that polluted sites in limited risk areas can be managed to prevent risk to water quality, public health and the environment without cleanup to

background levels. NAA provides the Board and dischargers with an acceptable cleanup management option for polluted soil and groundwater cleanups, at sites with limited risk. With the information available at this time, the Board believes that the Clorox Site can utilize the NAA concept to manage the residual mercury pollution. To ensure the protection of beneficial uses of useable groundwater not contaminated beneath and adjacent to the Site and adjacent surface waters, the public health and environment, this Board Order requires the discharger to implement a remedial strategy for adequate mercury source removal to limit further groundwater impacts in addition to containing and managing the existing and/or remaining mercury pollution in soil and groundwater. To document compliance, this Board Order further requires a long term groundwater monitoring program to ensure that groundwater mercury concentrations are not exceeding established containment standards at the containment monitoring points. These monitoring points will be located at or adjacent to the plume boundary, along preferential pathways, and at other appropriate locations as needed.

The discharger has proposed an alternate remedial strategy, for the residual mercury pollution, based on the NAA concept. The alternate remedial strategy is detailed in the report "Draft Alternative Remedial Action Plan (ARAP) for the Clorox Plant", dated October 19, 1995. The ARAP consists of 1) Remediation of the elevated mercury area to limit future migration of mercury to groundwater; 2) Cessation of the current GET system and establishment of "containment standards" in groundwater monitoring wells termed as source, guard, and perimeter wells; and 3) Implementation of management measures, and a contingency plan if necessary, to ensure residual human health and environmental risks are managed.

Remediation of the Elevated Mercury Area

To eliminate future groundwater impacts, soil excavation and treatment in the elevated mercury area will occur. Side and bottom wall samples in the excavated area will be collected to confirm the limits of the focused remediation area. Treatability studies for a low thermal treatment system have been conducted. The discharger proposes to treat all soils removed from the elevated mercury area to a mercury level of 20 ppm or lower. The location of the area that will be remediated is shown in Figure 5. Prior to replacing treated soils, a foot of clean clay fill will be placed in the excavated area. The cost estimate for the proposed remediation of the elevated mercury area is approximately half a million dollars.

Cessation of the GET System

Cessation of the GET system will occur only after the remediation of the elevated mercury area has been completed, and elimination of further migration of mercury into groundwater has been verified. The GET system will remain in operation for approximately one year after completion of the remediation. To ensure that the cessation of the GET system will be protective of human health and the environment,

mercury containment standards for source, guard, and perimeter monitoring wells are established by this Order. If groundwater concentrations in these monitoring wells exceed the containment standards, a contingency plan will be implemented. Following cessation of the GET system, the northern 120 feet of the groundwater drainage gallery will be abandoned, using pressure grouting abandonment methodology, to prevent preferential lateral migration of the polluted groundwater. Abandonment procedures will follow the guidelines established in the State of California, Department of Water Resources, Water Well Standards, Bulletin 74-81 and will be performed under an Alameda Flood Control Zone 7 abandonment permit. All work will be performed by a California licensed well driller. The rest of the GET system will be maintained in case groundwater extraction and treatment needs to be conducted in future.

Management of Residual Risks

- On-Site

The ARAP includes an assessment of human health and environmental risks; proposed management measures (e.g., deed notifications/restrictions, indemnification agreements, Site operation and maintenance plans, health and safety plans, utility workers notice etc.); contingency options; and regular groundwater monitoring.

Proposed institutional constraints for the Site include a deed restriction that notifies future owners of sub-surface mercury contamination and prohibits the use of shallow groundwater beneath the Site.

- Off-Site

The discharger is in the process of notifying affected downgradient neighbors namely Caltrans, Southern Pacific Lines, and Larms and Garden Building Supply, Inc. regarding the off-site groundwater mercury levels and the need to comply with off-site pollution management measures. The discharger will develop off-site pollution management measures that will prohibit the use of shallow groundwater, prohibit the creation of potential vertical conduits between the shallow and deeper groundwaters, and require preparation of appropriate health and safety plans for any excavation activities, at the affected downgradient properties. The discharger will take all reasonable steps to obtain acknowledgement letters from the affected downgradient neighbors that indicate their willingness to comply with the off-site pollution management measures. Access to install current monitoring wells on Caltrans and Southern Pacific Lines property was obtained and the discharger has been monitoring the wells since 1983. The discharger plans to continue to conduct groundwater monitoring on off-site properties.

11. **Risk Assessment**: A risk evaluation was conducted to evaluate the human and ecological health risks due to residual levels of mercury present in soil and groundwater at the Site.

Human Health Risk Evaluation

The evaluation determined that the residual levels of mercury in soil at the Site would not pose a human health risk through the potential exposure pathways to mercury in soil (namely, incidental ingestion of soil, inhalation of mercury vapors from soil, and dermal contact with soil) due to the following reasons:

- The Site is completely covered with concrete and asphalt, and there are no exposed areas where potential dermal contact with soil or accidental ingestion of soil may occur. The concrete and asphalt cover shall be maintained in future as required by this Order. The concrete and asphalt cover also prevents the mercury in soil from volatilizing into ambient air; and

- An ambient air monitoring program was conducted at the Site on a regular basis between November 1987 and December 1989 to monitor the building interior air quality. The results indicate that the detected levels of mercury were less than the respective American Industrial Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and the Occupational Safety and Health Association (OSHA) Permissible Exposure Levels (PELs).

The soils in the off-site area are not polluted with mercury. The shallow groundwater beneath the Site will be prohibited from any use through a deed restriction. The off-site pollution management measures would prohibit the use of the shallow groundwater at the affected downgradient properties. Hence, no potential exposure pathways to mercury in groundwater exist. The off-site pollution management measures will also require preparation of appropriate health and safety plans for any activities requiring excavation at the affected downgradient properties.

Ecological Risk Evaluation:

A three year (1986-1989) study was conducted by the discharger to evaluate mercury bioaccumulation in shellfish at the Estuary. The details of the study are documented in the report "Shellfish Biomonitoring Study", dated October 1989. The study evaluated potential incremental impacts, if any, to biota resulting from two types of groundwater discharges from the Site to the Estuary: 1) pursuant to NPDES permit No. CA 0028959, treated groundwater

was discharged into a storm sewer which drains into the Estuary through the storm sewer outfall; and 2) shallow groundwater flows into the Highway 185 retaining wall drainage system, and is ultimately discharged into the Estuary through the storm sewer outfall.

Biomonitoring was conducted before and after commencement of the NPDES discharge. The maximum average tissue concentrations of bioaccumulated mercury was close to 1 ppm, both during the pre-NPDES discharge and post-NPDES discharge monitoring phases, indicating no measurable impact to the biota due to the NPDES discharge. The historical maximum concentration of mercury detected at the retaining wall drainage system is 8.1 ppb. The biomonitoring data collected at the control and experimental locations show that the observed bioaccumulation has no relation to the water discharged from the storm sewer outfall. Thus, no incremental risk to ecological receptors at the Estuary due to the residual levels of mercury in groundwater at the Site is expected.

Due to the residual mercury levels that will be present at the Site, institutional constraints are appropriate and adequate to limit potential on-site and off-site exposures. Institutional constraints include deed restrictions that notify future owners of subsurface contaminations and prohibit the use of shallow groundwater at the site.

12. **Basis for Cleanup Standards**

a. **General**: State Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California," applies to this discharge and requires attainment of background levels of water quality, or the highest level of water quality which is reasonable if background levels of water quality cannot be restored. Cleanup levels higher than background must be consistent with the maximum benefit to the people of the State, not unreasonably affect present and anticipated beneficial uses of such water, and not result in exceedance of applicable water quality objectives. This Order and its requirements are consistent with the provisions of Resolution No. 68-16.

State Board Resolution No. 92-49, "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304," applies to this discharge. This Order and its requirements are consistent with the provisions of Resolution No. 92-49, as amended.

The Board adopted a revised Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) on December 17, 1986, and the State Board approved it on May 21, 1987. The Board has amended the Basin Plan several times since then. The Basin Plan was amended by the Board on August 17, 1994, to

include a NAA policy. The NAA policy has been incorporated into State Board Resolution No. 92-49 and is currently under consideration by the State Board. Although similar in concept to the Basin Plan amendments, this Order stands alone and does not depend upon the Basin Plan in the implementation of a Non-Attainment Area(s).

b. **Beneficial Uses and Associated Water Quality Objectives**: The Basin Plan defines beneficial uses and water quality objectives for waters of the State, including surface waters and groundwaters.

Board Resolution No. 89-39, "Sources of Drinking Water," defines potential sources of drinking water to include all groundwater in the region, with limited exceptions for areas of high total dissolved solids (TDS) content, low yield, or naturally-high contaminant levels.

The Basin Plan designates the following potential beneficial uses of groundwater underlying and adjacent to the Site:

- Municipal and domestic water supply
- Industrial process water supply
- Industrial service water supply
- Agricultural water supply

At present, there is no reported beneficial use of groundwater underlying the Site. The shallow groundwater zone at the Site does not qualify for a municipal or domestic use due to the following reasons: 1) the maximum TDS of the groundwater (10,500 mg/l) is significantly higher than the maximum acceptable level of 3,000 mg/l for beneficial use in a public water system; and 2) the productivity of wells installed in the shallow zone would produce a sustained yield of no more than 70 to 80 gallons per day. Area-specific investigations indicate that the groundwater is not presently being used as an industrial process and service water supply, or as an agricultural water supply. The groundwater at the Site flows into the Highway 185 retaining wall drainage system, and is ultimately discharged into the Estuary along with any storm water through the storm sewer outfall. However, based on the results of the three-year bioaccumulation study the groundwater does not pose any incremental risk to the ecological receptors of the Estuary.

The existing and potential beneficial uses of the Estuary include:

- Industrial services supply
- Water contact and non-contact recreation
- Wildlife habitat
- Fish migration and spawning

- Navigation
- Estuarine habitat
- Shellfish harvesting
- Preservation of rare and endangered species
- Ocean Commercial and sport fishing

The following qualify as water quality objectives to protect these beneficial uses

TABLE 1

MERCURY WATER QUALITY OBJECTIVES

Water Quality Objective (ppb)	Description	Source
2.1	1-hour average; saltwater-aquatic life protection	California Enclosed Bays and Estuaries Plan (1991)
0.025	30-day average; saltwater-human health protection	California Enclosed Bays and Estuaries Plan (1991)
2.1	Maximum concentration (1-hour average); saltwater-aquatic life protection	USEPA; National Ambient Water Quality Criteria (1992b)
0.025	Continuous concentration (4-day average; saltwater-aquatic life protection	USEPA; National Ambient Water Quality Criteria (1992)
2.1	1-hour average; marine surface waters-aquatic life protection	Basin Plan, San Francisco Bay Region (1986)
0.025	30-day average; marine surface waters-human health protection	Basin Plan, San Francisco Bay Region (1986)
Effluent Limitations (ppb)	**Description**	**Source**
2.1	Marine surface waters-protection of aquatic life	Basin Plan, San Francisco Bay Region (1986)
1.0	Marine surface waters-protection of human health	Basin Plan, San Francisco Bay Region (1986)

c. **Basis for Groundwater Cleanup/ Containment Standards**: The groundwater cleanup/ containment standards for the on-site and off-site areas are based on the NAA concept. Available options for removing or treating *insitu* groundwater pollution are limited for this Site. At many sites in this region and elsewhere, pump and treat technology has proven inadequate to meet low cleanup objectives because the costs and time frame are prohibitive.

The GET system at the Site has successfully contained and removed the mercury in groundwater that had migrated for short distances. For example, mercury concentrations have decreased from approximately 10,000 ppb to 1000 ppb in MW-49, from 9000 ppb to 500 ppb in MW-50, and from 19,000 ppb to 2000 ppb in MW-51. However the rate of mercury removal has been cost intensive and slow (an average of 1.7 lbs/yr), and the recovery rates are expected to become lower as groundwater concentrations further decrease. The lack of continued significant decline in the areas of high mercury concentrations is due to the slow groundwater velocity and hence, ability to treat only limited quantities of groundwater because of low groundwater extraction volumes. This implies the GET system would need to operate "*ad infinitum*" in order to achieve on-site groundwater mercury levels below the maximum containment level (MCL) of 2 ppb.

The Discharger has documented the following:

- Based on site specific hydrogeologic transport studies the mass of mercury discharged to groundwater was estimated to be a maximum of 18 pounds. Approximately 12 pounds of mercury have been recovered from the GET system over a 7 year period at a cost of $ 485,000 per pound of mercury. Currently, the amount of mercury in the groundwater is estimated to be approximately 4 pounds. It is more technically and economically effective to remove the 1000 pounds of mercury from the elevated mercury area in soil, and eliminate potential future groundwater impacts at a cost estimate of $ 500 per pound, than to continue to use limited financial resources to remove the remaining 4 pounds of mercury from groundwater, over a period of several years.

- The discharger conducted a conservative fate and transport study which estimated a maximum mercury mass loading rate of 9.9 mg/day, to the retaining wall drainage system of the Highway 185 underpass section, after a period of 188 years. Based on Site specific leachability and adsorption studies, mercury in the shallow groundwater will adsorb to the soil-medium as groundwater flows through it, and the actual mass loading rates are expected to be lower.

- The discharger conducted dilution studies before and after the installation of the GET system. The studies involved measuring water flow and

mercury concentrations at the retaining wall drainage system and the storm water outfall to the Estuary, and an average dilution factor of 100 - 171 was estimated.

- The three year shellfish bioaccumulation study described under Finding 11 did not indicate any incremental impacts, associated with the groundwater discharges at the Site, to the ecological receptors at the Estuary.

Thus,

- An appropriate cleanup program, has been fully implemented and reliably operated for a period of time which is adequate to understand both the hydrogeology of the Site and pollutant dynamics. Adequate pollutant source removal and/or isolation has been undertaken to limit future migration of pollutants to groundwater. Additionally, a limited pollutant source in soil has been identified and its removal will be accomplished as described under Finding 10 above. The mass of mercury to be removed is estimated to be approximately 1000 pounds.

- Groundwater pollutant concentrations in most monitoring wells have reached or are approaching asymptotic levels, and the mass removed from the groundwater is no longer significant using appropriate technology.

- The best available technologies are no longer technically or economically feasible to achieve further significant reductions in groundwater pollutant concentrations or mass.

- The remaining human health, water quality, and environmental risks posed by residual soil and groundwater pollution will be contained and managed through the ARAP, and as required by this Order. The ARAP includes pollution management measures, a contingency plan, regular groundwater monitoring, and a commitment to mitigating measures such as participation in a regional groundwater monitoring or protection program.

Based on the above, and in consideration of the reasonable protection of beneficial uses consistent with the maximum benefit to the people of the State pursuant to State Board Resolution 68-16, a limited NAA is appropriate. Within this area, pollutant concentrations may exceed relevant water quality objectives, as long as they are contained as specified in this Order.

d. **Basis for Soil Cleanup Standards**: All soils excavated from the elevated mercury area will be treated to a mercury level of 20 mg/kg or lower. Based on site-specific soil leaching tests, cleanup to this level should prevent leaching of mercury in soil to groundwater. This level is compatible with a commercial/ industrial land use at the Site. Following remediation of the elevated mercury area there will be scattered residual levels of elevated mercury concentrations, within the upper 6 feet of soil, with a site-wide average concentration of 7 mg/kg . The residual mercury should be immobilized in the shallow soils as the Site is covered by building concrete floors and asphalt, preventing infiltration and volatilization. The concrete and asphalt cap shall be maintained as required by this Order. An ambient air monitoring program was conducted at the site on a regular basis between 1987 and 1989 to monitor the building interior air quality. The results indicate that detected levels of mercury were less than the TLVs recommended by the ACGIH and the PELs recommended by the OSHA. Thus, the residual levels of mercury at the Site should be protective of human health, water quality, and the environment.

13. **Reuse or Disposal of Extracted Groundwater**: Board Resolution No. 88-160 allows discharges of extracted, treated groundwater from Site cleanups to surface waters only if it has been demonstrated that neither reclamation nor discharge to the sanitary sewer is technically and economically feasible. Based on a review of the Site conditions reclamation or discharge to the sanitary sewer does not appear to be feasible.

14. **Authority and Basis for Order**: This Order has been prepared for Board adoption pursuant to Section 13304 of the California Water Code and Section 25356.1(h)(1) of the Health and Safety Code. The discharger has caused or permitted waste to be discharged or deposited where it is or probably will be discharged into waters of the State and creates or threatens to create a condition of pollution or nuisance.

15. **Cost Recovery**: Pursuant to California Water Code Section 13304, the discharger is hereby notified that the Board is entitled to, and may seek reimbursement for, all reasonable costs actually incurred by the Board to investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, required by this order.

16. **CEQA**: This action is an order to enforce the laws and regulations administered by the Board. As such, this action is categorically exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to Section 15321 of the Resources Agency Guidelines.

17. **Notification**: The Board has notified the discharger and all interested agencies and persons of its intent under California Water Code Section 13304 to prescribe site cleanup requirements for the discharge, and has provided them with an opportunity to submit their written comments. Further, to comply with the Health and Safety

Code, Chapter 6.8, Section 25356.1(h)(1), this Order was circulated for public comment from October 26, 1995 through November 27, 1995, a notice was published in the Oakland Tribune, Legal Notices Section, Page A 16, on November 13, 1995, notices were posted on November 10, 1995 in the local area of the Site, the owners of property contiguous to the Site were notified by direct mail, and Board Staff held a public meeting on December 7, 1995, to address any issues pertaining to the Order.

18. **Public Hearing**: The Board, at a public meeting, heard and considered all comments pertaining to this discharge.

IT IS HEREBY ORDERED, pursuant to Section 13304 of the California Water Code, that the discharger (or its agents, successors, or assigns) shall cleanup and abate the effects described in the above findings as follows:

A. PROHIBITIONS

1. The discharge of wastes or hazardous substances in a manner which will degrade water quality or adversely affect beneficial uses of waters of the State is prohibited.

2. Further significant migration of wastes or hazardous substances through subsurface transport to waters of the State is prohibited.

3. Activities associated with the subsurface investigation and cleanup which will cause significant adverse migration of wastes or hazardous substances are prohibited.

B. CLEANUP PLAN AND CLEANUP STANDARDS

1. The Discharger shall implement the cleanup plan described in Finding 10 in a manner that is acceptable to the Regional Board Executive Officer (the "Executive Officer").

2. **Groundwater Cleanup/ Containment Standards**:

a. Concentrations of polluted groundwater sampled from the monitoring wells as defined in the groundwater sampling and monitoring program, and as may be designated according to Task 7 of this Order, shall not exceed the containment standards, as shown in Table 2, or the discharger shall comply with the following contingency plan.

TABLE 2

GROUNDWATER CONTAINMENT STANDARDS FOR MONITORING WELLS (PPB)

Monitoring Well	Containment Standards for mercury, ppb	Contingency Plan Well Type	Basis
MW-42	6	Guard	[a] Conservative fate and transport modeling
MW-45R	6	Guard	,,
MW-49	2500	Source	[b]Statistical analysis
MW-50	1000	Source	,,
MW-51	7600	Source	,,
MW-52	1500	Source	,,
MW-54	8/10[c]	Perimeter	[d] Best Professional Judgement
MW-55	8/10[c]	Perimeter	,,

[a]The conservative fate and transport study predicted a maximum groundwater concentration of approximately 6 ppb in these wells.

[b] Mean plus two standard deviations calculated from groundwater data collected between March 1993 through March 1995, except for well MW-51, which is mean plus one standard deviation.

[c] If mercury groundwater concentrations in these wells exceed 8 ppb, following confirmation of the exceedance, a bioaccumulation study shall be conducted. If they exceed 10 ppb, following confirmation of the exceedance, groundwater extraction/ treatment shall occur as described in the contingency plan.

[d] Best professional judgement is based on the factors listed under finding 12 c.

Contingency Plan

The groundwater contingency plan in the ARAP as amended is as follows:

Step 1: Quarterly monitoring shall continue according to the Self-Monitoring Program for the Site. If and when mercury concentrations in any of the monitoring wells exceed the proposed containment standards, the following actions shall be implemented:

- the monitoring frequency at the monitoring wells of concern shall be increased to monthly, to more accurately record small changes in mercury concentrations;

- the Executive Officer shall be notified within 30 days of the first observation of an elevated mercury level;

- the monthly monitoring schedule shall be maintained until one of the following events occurs: a) two consecutive mercury concentrations are below the containment standards set for the monitoring wells; or b) six of the past seven consecutive mercury concentrations are above the containment standards set for the monitoring wells. If two consecutive mercury concentrations are below the containment standards at any time, the groundwater monitoring shall return to the regular schedule. If six of the past seven consecutive mercury concentrations are above the containment standards, Step 2 of the contingency plan shall be implemented.

Step 2: If six of the past seven consecutive mercury concentrations are above the containment standards at any of the monitoring wells, the following actions shall be taken depending on whether it is a source, guard, or perimeter monitoring well.

Elevated Mercury levels at Source Wells:

1) Mercury transport in groundwater shall be re-modeled using site-specific parameters collected during the period when the GET system is turned off. This will verify results of the previous modeling and indicate any anomalous movement of mercury.

2) Additional mercury source evaluation shall be conducted in residual on-site soils to determine if there are any areas from which mercury may be leaching into groundwater.

Based on the results of the above investigations, the need to re-start the GET system shall be evaluated. Items 1 and 2 above, and the evaluation with a time schedule shall be completed within a period of 90 days following completion of Step 1, and must be acceptable to the Executive Officer.

Elevated Mercury levels at Guard Wells:

The groundwater dilution factor between D-3, a subdrain at the Highway 185 retaining wall drainage system, and the storm sewer outfall to the Estuary shall be evaluated. If there is a dilution of 100-fold or more, regular monitoring schedule shall be restored. If the dilution observed is less than 100-fold, the need for further action shall be evaluated, and may be required by the Executive Officer. These evaluations shall be completed within a period of 30 days following completion of Step 1 and must be acceptable to the Executive Officer .

Elevated mercury levels at Perimeter wells:

1) If mercury levels are in excess of 8 ppb at the perimeter wells, a bio-monitoring program shall be conducted at the storm drain outfall to the Estuary. This shall involve a limited-scope bioaccumulation study for mercury in mussel shellfish. The details of the program must be acceptable to the Executive Officer. If the study indicates a measurable impact to the shellfish, the need for further action shall be evaluated, and may be required by the Executive Officer. The bioaccumulation study and the evaluation shall be completed within a period of 180 days following completion of Step 1, and must be acceptable to the Executive Officer.

2) If mercury levels are in excess of 10 ppb at the perimeter wells, groundwater extraction shall commence at the perimeter wells, and/ or the GET system shall be re-started, within a period of 30 days following completion of Step 1. Southern Pacific Lines shall be consulted before commencement of groundwater extraction at the perimeter wells.

If the GET system is turned on, it shall be operated for a period of at least 90 days, after which the need for further action shall be evaluated based on groundwater concentrations in the source, guard, and perimeter wells. If monitoring wells are converted to extraction wells, groundwater from these wells shall be pumped for a period of at least 30 days, after which the need for further action shall be evaluated based on groundwater concentrations in the extraction wells. A flow-chart diagram of the contingency plan is presented in Figure 6.

A technical report acceptable to the Executive Officer shall be submitted documenting completion of any actions taken under the contingency plan within a period of 60 days following the return of groundwater monitoring to the regular schedule or after completion of Step 2 .

b. The mean plus two standard deviation (M2SD) concentrations, calculated from groundwater data between March 1993 through March 1995, for monitoring wells MW-46

and MW-53 are 29 and 18 ppb respectively. If the mercury concentrations in monitoring wells MW-53 and /or MW-46 exceed the respective M2SD concentrations, monthly monitoring shall be conducted until two consecutive mercury concentrations are below the respective M2SD concentrations. The Executive Officer shall be notified within 30 days of the first observation of an elevated mercury level. If two consecutive mercury concentrations are below the M2SD concentrations at any time, groundwater monitoring shall return to the regular schedule. If six of the past seven consecutive mercury concentrations in MW-53 and/or MW-46 exceed the respective M2SD concentrations the need for further action shall be evaluated, and may be required by the Executive Officer. The evaluation shall be completed within a period of 60 days and must be acceptable to the Executive Officer.

3. **Soil Cleanup Standards**: To confirm the limits of soil excavation in the elevated mercury area the following action levels shall be used: for soils approximately 3-7 feet below ground surface mercury levels greater than 50 mg/kg shall be excavated; for deeper soils approximately 7-9 feet below ground surface mercury levels greater than 25 mg/kg shall be excavated. All soils excavated shall be treated to a mercury level of 20 mg/kg or lower prior to their replacement in the excavated area.

C. TASKS

1. SOIL REMEDIATION WORKPLAN

COMPLIANCE DATE: *(March 1, 1996)*

Submit a workplan acceptable to the Executive Officer to implement soil remediation in the elevated mercury area. The workplan should include a health and safety plan, and describe all significant implementation steps with an implementation schedule.

2. SOIL REMEDIATION REPORT

COMPLIANCE DATE: 90 days after completion of soil remediation

Submit a technical report acceptable to the Executive Officer documenting the soil remediation activities and compliance with the soil cleanup standards indicated in this Order.

3. IMPLEMENTATION OF INSTITUTIONAL RESTRAINTS AND DEED RESTRICTIONS

COMPLIANCE DATE: *(July 1, 1997)*

Submit a technical report acceptable to the Executive Officer which documents the institutional restraints and deed restrictions for all legal parcels located on Site, notification of affected downgradient neighbors of the need to comply with off-site pollution management measures, acknowledgements to comply with the off-site pollution management measures from the affected downgradient neighbors, and agreements to conduct groundwater monitoring in the off-site area owned by Caltrans and Southern Pacific Lines. The technical report should also document that the deed restriction for the Clorox properties has been filed with the proper County Office and is in effect. The discharger shall take all reasonable steps to obtain acknowledgement letters from the affected downgradient neighbors to ensure compliance with the off-site pollution management measures. The technical report should include such acknowledgement letters obtained.

4. **FIVE-YEAR STATUS REPORT**

COMPLIANCE DATE: *(January 1, 2001)*

Submit a technical report acceptable to the Executive Officer evaluating the effectiveness of the approved cleanup plan. The report should include:

a. Summary of effectiveness in controlling contaminant migration and protecting human health and the environment
b. Comparison of containment standards with groundwater concentrations
c. Comparison of anticipated versus actual costs of cleanup activities
d. Summary of additional investigations (including results) and significant modifications to remedial and pollution management measures

5. **IMPLEMENTATION OF CURTAILMENT**

COMPLIANCE DATE: 60 days after cessation of the GET system

Submit a technical report acceptable to the Executive Officer documenting completion of the cessation of the GET system.

6. **EVALUATION OF NEW HEALTH OR ECOLOGICAL CRITERIA**

COMPLIANCE DATE: 90 days after requested by Executive Officer

Submit a technical report acceptable to the Executive Officer evaluating the effect on the approved cleanup plan of revising one or more cleanup/ containment standards in response to revision of drinking water standards, maximum contaminant levels, aquatic life protection standards, or other human health/ecological-based criteria.

7. **EVALUATION OF NEW TECHNICAL INFORMATION**

COMPLIANCE DATE: 90 days after requested by Executive Officer

Submit a technical report acceptable to the Executive Officer evaluating new technical information which bears on the approved cleanup plan and cleanup standards for this Site. In the case of a new cleanup technology, the report should evaluate the technology using the same criteria used in the feasibility study. Such technical reports shall not be requested unless the Executive Officer determines that the new information is reasonably likely to warrant a revision in the approved cleanup plan or cleanup standards.

8. **Delayed Compliance**: If the discharger is delayed, interrupted, or prevented from meeting one or more of the completion dates specified for the above tasks, the discharger shall promptly notify the Executive Officer and the Board may consider revision to this Order.

D. PROVISIONS

1. **No Nuisance**: The storage, handling, treatment, or disposal of polluted soil or groundwater shall not create a nuisance as defined in California Water Code Section 13050(m).

2. **Good O&M**: The discharger shall maintain in good working order and operate as efficiently as possible any facility or control system installed to achieve compliance with the requirements of this Order.

3. **Cost Recovery**: The discharger shall be liable, pursuant to California Water Code Section 13304, to the Board for all reasonable costs actually incurred by the Board to investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action, required by this Order. If the Site addressed by this Order is enrolled in a State Board-managed reimbursement program, reimbursement shall be made pursuant to this Order and according to the procedures established in that program. Any disputes raised by the discharger over reimbursement amounts or methods used in that program shall be consistent with the dispute resolution procedures for that program.

4. **Access to Site and Records**: In accordance with California Water Code Section 13267(c), the discharger shall permit the Board or its authorized representative:

   a. Entry upon premises in which any pollution source exists, or may potentially exist, or in which any required records are kept, which are relevant to this Order.

b. Access to copy any records required to be kept under the requirements of this Order.

c. Inspection of any monitoring or remediation facilities installed in response to this Order.

d. Sampling of any groundwater or soil which is accessible, or may become accessible, as part of any investigation or remedial action program undertaken by the discharger.

5. **Self-Monitoring Program**: The discharger shall comply with the Self-Monitoring Program as attached to this Order and as may be amended by the Executive Officer.

6. **Technical report Qualifications**: All hydrogeologic documents (plans, specifications, and reports) shall be signed by and stamped with the seal of a California registered geologist, a California certified engineering geologist, or a California registered civil engineer.

7. **Lab Qualifications**: All samples shall be analyzed by State-certified laboratories or laboratories accepted by the Board using approved EPA methods for the type of analysis to be performed. All laboratories shall maintain quality assurance/quality control (QA/QC) records for Board review. This provision does not apply to analyses that can only reasonably be performed on-site (e.g. temperature). Soil samples may be analyzed for mercury in the field using XRF instrument methods, however, confirmatory soil samples shall be analyzed in State-certified laboratories.

8. **Document Distribution**: Copies of all correspondence, technical reports, and other documents pertaining to compliance with this Order shall be provided to the following agencies:

   a. Department of Toxic Substances Control (DTSC)
   b. Alameda County Hazardous Materials Program

9. **Reporting of Changed Owner or Operator**: The discharger shall file a technical report on any changes in Site occupancy or ownership associated with the property described in this Order.

10. **Reporting of Hazardous Substance Release**: If any hazardous substance is discharged in or on any waters of the State, or discharged or deposited where it is, or probably will be, discharged in or on any waters of the State, the discharger shall report such discharge to the Regional Board by calling (510) 286-1255 during regular office hours (Monday through Friday, 8:00 to 5:00).

A written report shall be filed with the Board within five working days. The report shall describe: the nature of the hazardous substance, estimated quantity involved, duration of incident, cause of release, estimated size of affected area, nature of effect, corrective actions taken or planned, schedule of corrective actions planned, and persons/agencies notified.

This reporting is in addition to reporting to the Office of Emergency Services required pursuant to the Health and Safety Code.

12. **Rescission of Existing Order**: This Order rescinds the WDR, Order No: 86-21.

13. **Periodic SCR Review**: The Board will review this Order periodically and may revise it when necessary.

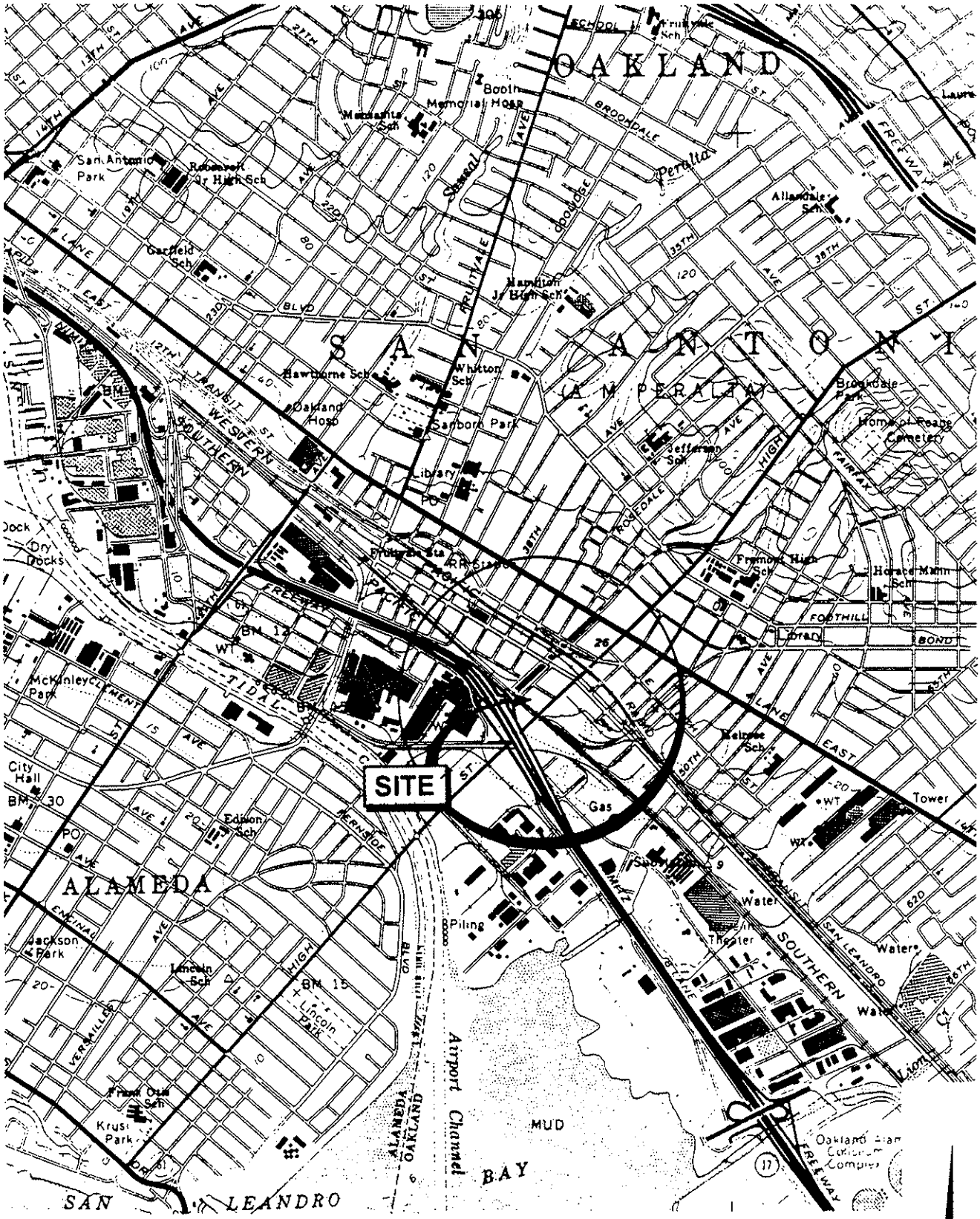
I, Loretta K. Barsamian, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on December 13, 1995.

Loretta K. Barsamian

Loretta K. Barsamian
Executive Officer

FAILURE TO COMPLY WITH THE REQUIREMENTS OF THIS ORDER MAY SUBJECT YOU TO ENFORCEMENT ACTION, INCLUDING BUT NOT LIMITED TO: IMPOSITION OF ADMINISTRATIVE CIVIL LIABILITY UNDER WATER CODE SECTIONS 13267 OR 13350, OR REFERRAL TO THE ATTORNEY GENERAL FOR INJUNCTIVE RELIEF OR CIVIL OR CRIMINAL LIABILITY

Attachments: Figures
Self-Monitoring Program



SOURCE: USGS 7.5', Oakland West Quadrangle, 1980.

FIGURE 1

SITE LOCATION MAP
CLOROX INSTALLATION

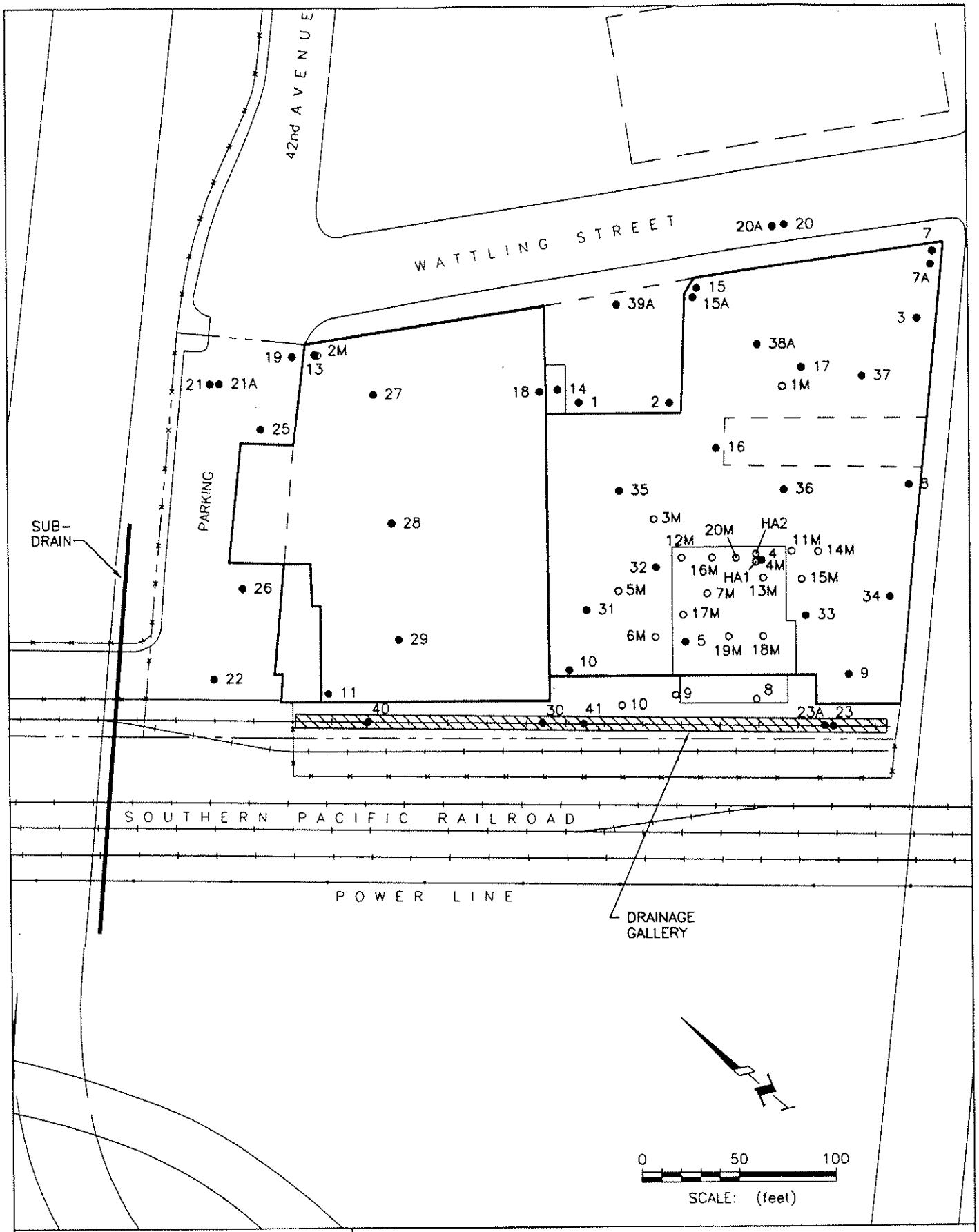


Figure 2

SITE MAP WITH ALL SOIL BORINGS

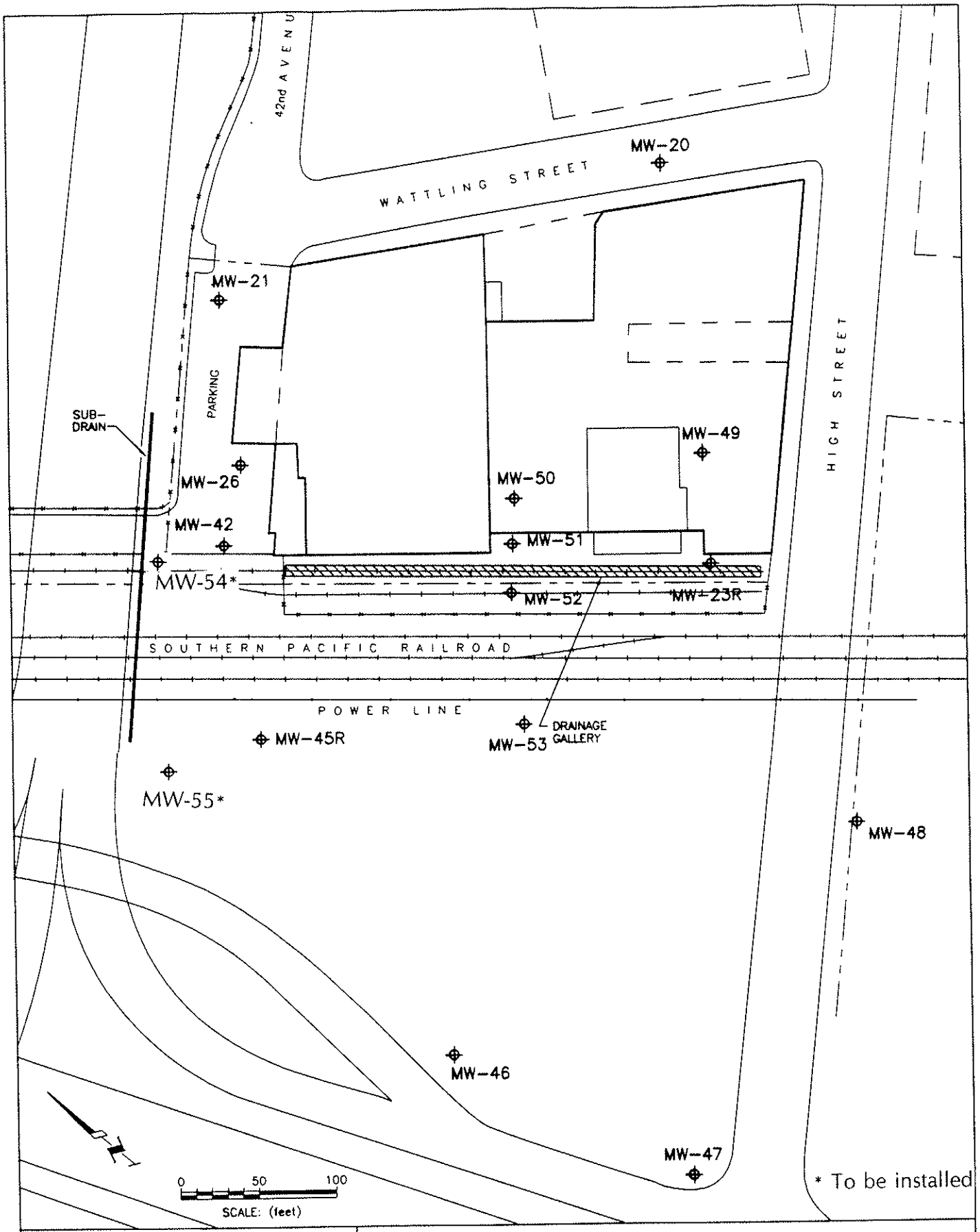


Figure 3
SITE MAP WITH
MONITORING WELL LOCATIONS

SUMMARY OF PROPOSED REMEDIAL ALTERNATIVES FOR SOIL

Alternative	Effectiveness	Implementability	Estimated Cost	Comments
Low Temperature Thermal Treatment Soil excavation, on-site thermal treatment (less than 200°F), treated soil placed into excavation	Good	Moderate	$500,000	Satisfies objective to perform adequate source removal. Hazardous waste treatment permit or permit variance would be required.
High Temperature Thermal Treatment Soil excavation, off-site incineration, imported fill placed into excavation.	Very Good	Moderate	$13,100,000	Satisfies objective to perform adequate source removal. Hazardous waste treatment permit or permit variance would not be required.
Soil Washing Soil excavation, on-site soil washing, treated soil placed into excavation, off-site sludge disposal or elemental mercury recycling.	Moderate to Good	Moderate	$2,500,000	Satisfies objective to perform adequate source removal. Hazardous waste treatment permit or permit variance would not be required.
In-Situ Soil Stabilization Additives mixed with impacted soils to reduce contaminant mobility.	Poor	Difficult	N/A	Alternative eliminated as discussions with vendors indicate that stabilization will not be effective in immobilizing elemental mercury.

Note: Estimated cost based on 3,000 yd^3

Figure 4

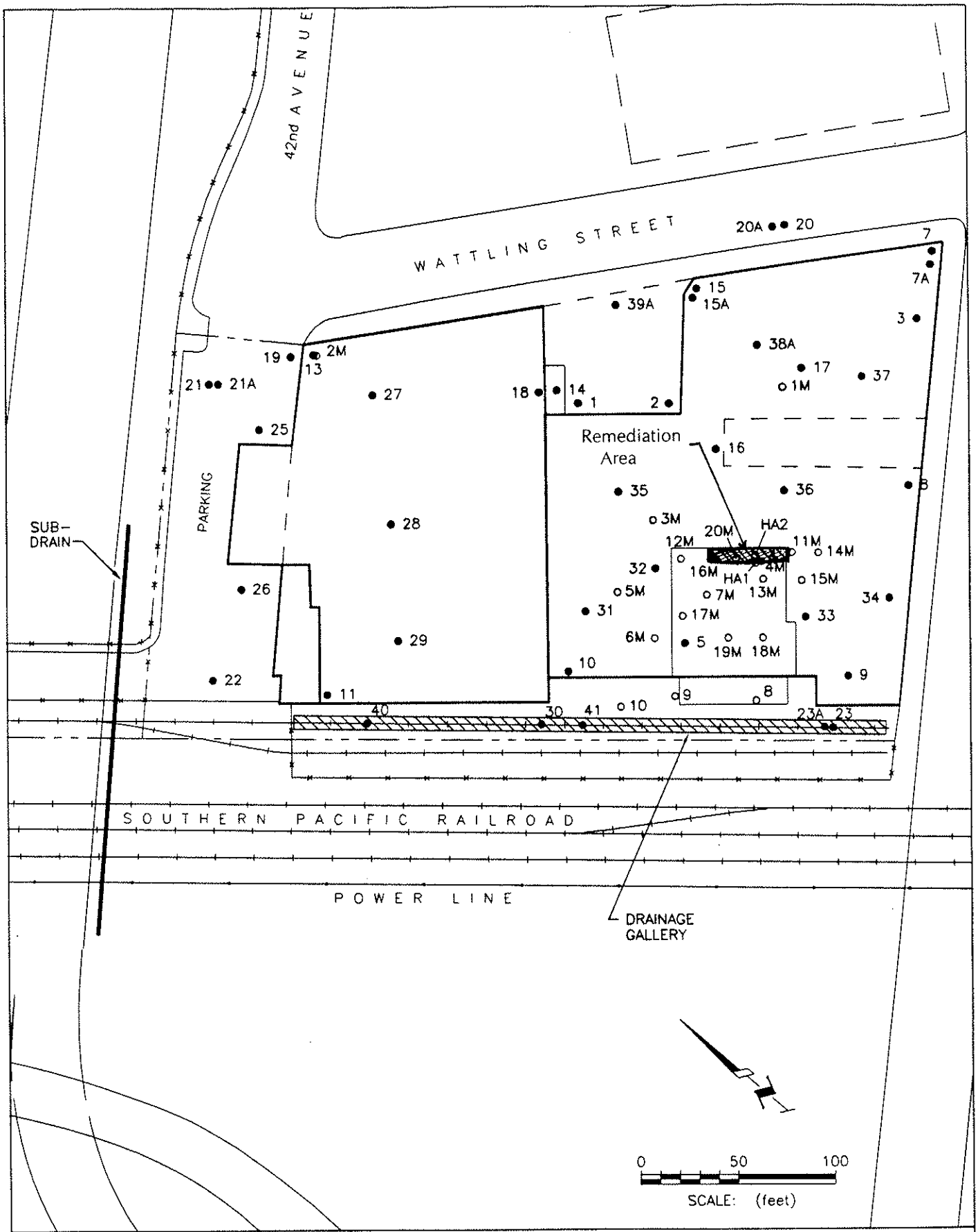
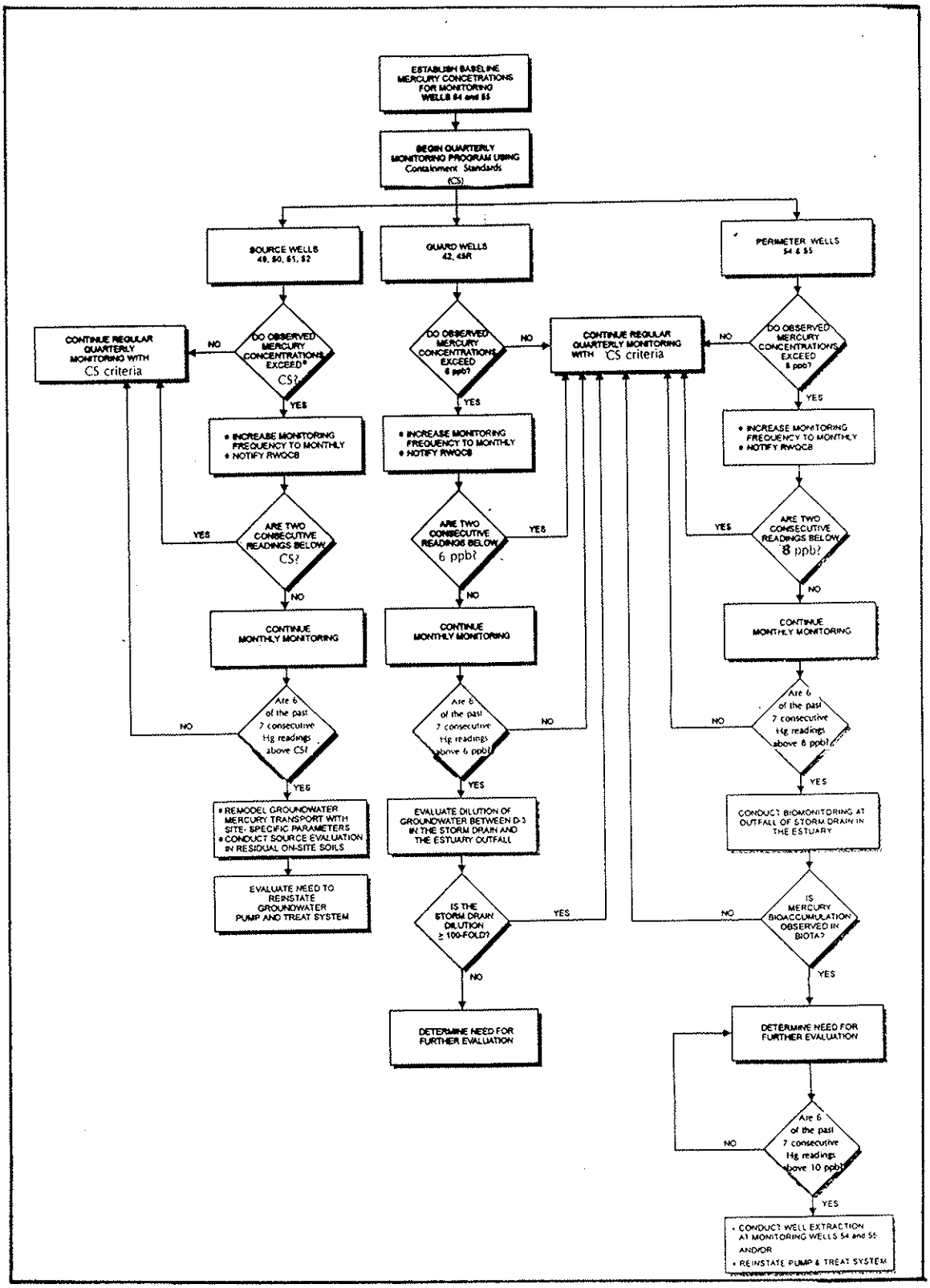


Figure 5
SITE MAP SHOWING
REMEDIATION AREA



* CS criteria based on statistical evaluation of baseline groundwater data post-remediation

Figure 6
GROUNDWATER
CONTINGENCY PLAN

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN FRANCISCO BAY REGION

SELF-MONITORING PROGRAM FOR:

THE CLOROX COMPANY

for the property located at

850 - 42nd AVENUE
OAKLAND
ALAMEDA COUNTY

1.**Authority and Purpose**: The Board requests the technical reports required in this Self-Monitoring Program pursuant to Water Code Sections 13267 and 13304. This Self-Monitoring Program is intended to document compliance with Board Order No. 95- (Site Cleanup Requirements).

2.**Monitoring**: The discharger shall measure groundwater elevations quarterly in all monitoring wells, and shall collect and analyze representative samples of groundwater according to the following table:

Well #	Sampling Frequency	Analyses*	Well #	Sampling Frequency	Analyses*
20	Biannually	Hg	51	Quarterly	Hg
21	Biannually	Hg	52	Quarterly	Hg
23R	Biannually	Hg	53	Quarterly	Hg
42	Quarterly	Hg	54	Quarterly	Hg
45R	Quarterly	Hg	55	Quarterly	Hg
46	Semi-annually	Hg	Gallery	Quarterly	Hg
49	Quarterly	Hg			
50	Quarterly	Hg			

* Using SW-846 method 7470 or 7471

The discharger shall sample any new monitoring or extraction wells quarterly and analyze groundwater samples for the same constituents as shown in the above table. The discharger may propose changes in the above table; any proposed changes are subject to Executive Officer approval.

3. **Quarterly Groundwater Monitoring Reports**: The discharger shall submit quarterly monitoring reports to the Board no later than 30 days following the end of the quarter (e.g. first quarter report for the year would be due April 30). The first quarterly monitoring report shall be due on April 30, 1996 . The reports shall include:

   a. Transmittal Letter: The transmittal letter shall discuss any violations during the reporting period and actions taken or planned to correct the problem. The letter shall be signed by the discharger's principal executive officer or his/her duly authorized representative, and shall include a statement by the official, under penalty of perjury, that the report is true and correct to the best of the official's knowledge.

   b. Groundwater Elevations: Groundwater elevation data shall be presented in tabular form, and a groundwater elevation map should be prepared for each monitored water-bearing zone. Historical groundwater elevations shall be included in the fourth quarterly report each year.

   c. Groundwater Analyses: Groundwater sampling data shall be presented in tabular form, and an isoconcentration map should be prepared for one or more key contaminants for each monitored water-bearing zone, as appropriate. The report shall indicate the analytical method used, detection limits obtained for each reported constituent, and a summary of QA/QC data. Historical groundwater sampling results shall be included in the fourth quarterly report each year. The report shall describe any significant increases in contaminant concentrations since the last report, and any measures proposed to address the increases. Supporting data, such as lab data sheets, need not be included.

   d. Groundwater Extraction: If applicable, the report shall include groundwater extraction results in tabular form, for each extraction well and for the Site as a whole, expressed in gallons per minute and total groundwater volume for the quarter. The report shall also include contaminant removal results from groundwater extraction wells and from other remediation systems, expressed in units of chemical mass per day and mass for the quarter. Historical mass removal results shall be included in the fourth quarterly report each year.

   e. Status Report: The quarterly report shall describe relevant work completed during the reporting period (e.g. site investigation, interim remedial measures)

and work planned for the following quarter.

4. **Violation Reports**: If the discharger violates requirements in the Site Cleanup Requirements, then the discharger shall notify the Board office by telephone as soon as practicable once the discharger has knowledge of the violation. Board staff may, depending on violation severity, require the discharger to submit a separate technical report on the violation within five working days of telephone notification.

5. **Other Reports**: The discharger shall notify the Board in writing prior to any site activities, such as construction or underground tank removal, which have the potential to cause further migration of contaminants or which would provide new opportunities for site investigation.

6. **Record Keeping**: The discharger or his/her agent shall retain data generated for the above reports, including lab results and QA/QC data, for a minimum of six years after origination and shall make them available to the Board upon request.

7. **SMP Revisions**: Revisions to the Self-Monitoring Program may be ordered by the Executive Officer, either on his/her own initiative or at the request of the discharger. Prior to making SMP revisions, the Executive Officer will consider the burden, including costs, of associated self-monitoring reports relative to the benefits to be obtained from these reports.

I, Loretta K. Barsamian, Executive officer, hereby certify that this Self-Monitoring Program was adopted by the Board on December 13, 1995.

Loretta K. Barsamian

Loretta K. Barsamian
Executive Officer