INTEGRATED
Environmental Services, Inc.

Phase 1 Groundwater Characterization Workplan

Boeing Realty Corporation
C-6 Facility, Parcel A
Los Angeles, California

October 1997

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Prepared by
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For
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1. INTRODUCTION

The Boeing Realty Corporation (BRC), an indirect subsidiary of The Boeing Company, is currently redeveloping Parcel A of its C-6 facility in Los Angeles, California. McDonnell Douglas Realty Company (MDRC) began the redevelopment in 1996. MDRC became an indirect subsidiary of The Boeing Company on August 1, 1997, and is now known as Boeing Realty Corporation. As part of the redevelopment effort, a review of historic and recent site environmental data was conducted. The results of that review indicate that certain constituents of concern (COCs) in groundwater originating upgradient of the BRC facility have migrated off-site and are now impacting groundwater beneath the BRC property. The BRC property shares a common boundary with the Lockheed Martin Corporation (LMC), International Light Metals (ILM) property and is hydraulically down gradient.

An investigation of groundwater beneath the western portion of the C-6 facility has been proposed jointly by BRC and LMC. This effort will be funded by LMC to characterize and delineate the groundwater plume containing COCs migrating from the LMC property.

The investigation will:

1. Provide information for use by LMC in fulfilling the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for groundwater conducted at the former ILM facility under the jurisdiction of the Department of Toxic Substances Control (DTSC), a matter with which BRC is not concerned.

2. Provide BRC, LMC and regulatory agencies with information on the lateral and vertical extent and concentration of ILM-derived COCs in the Bellflower aquiclude beneath the BRC facility.

This workplan has been developed to provide procedures for installing new temporary and permanent monitoring wells and for collecting and analyzing the first round of groundwater samples collected from the wells during the investigation. Subsequent sampling and investigative tasks will be covered as required by workplans developed specifically for those tasks.

1.1 BRC C-6 FACILITY HISTORY

The BRC C-6 property is located at 19503 South Normandie Avenue in Los Angeles, California, just south of the San Diego Freeway (I-405) and approximately one mile west of the Harbor (I-110) - San Diego Freeway interchange (Exhibit 1).

Aerial photographs indicate that the area was farmland prior to the 1940s. Industrial use of the property began in 1941 when the Defense Plant Corporation (Plancor) developed the site as part of an aluminum reduction plant. The Aluminum Company of America (ALCOA) operated the plant for the government to produce aluminum during World War II. Five "pot lines" were originally constructed at the plant, but only three were placed in operation. ALCOA operated the plant until it was closed in September 1944. The War Assets Administration then used the site for temporary storage during the following two years. In 1948, Columbia Steel Company purchased the property. No significant changes were made to the plant under Columbia Steel Company ownership (CDM 1991).

In March 1952, the US Navy purchased the property and established the Douglas Aircraft Company (DAC) as the contractor and operator of the facility for the manufacture of aircraft parts. DAC purchased the property from the Navy in 1970 and used the facility to manufacture components for various commercial and military aircraft until approximately 1992. DAC has used the C-6 facility for the storage and distribution of aircraft parts since cessation of manufacturing activities (K/J 1996a, b, c).

Boeing began a phased redevelopment of the 170-acre property in 1996 (phased both in terms of actual environmental activities and demolition). As shown in Exhibit 2, the property has been divided into three parcels (A, B, and C). Each parcel will undergo, as required, environmental investigation, assessment, and remediation prior to construction. Redevelopment of the northernmost portion of the property, Parcel A, began in 1996 and is ongoing. Historically, the westernmost portion of Parcel A has always been an employee parking lot – no manufacturing or machining operations have occurred in the area of Parcel A bordering the LMC property.

1.2 INTERNATIONAL LIGHT METALS FACILITY HISTORY

The LMC property, located at 19200 South Western Avenue, is adjacent to and west of the BRC property (Exhibit 1). Industrial development of the LMC property began in 1942 when Plancor constructed an aluminum extrusion facility on the property. The plant, known as Plancor 326, was operated by Bohn Aluminum & Brass Corporation on behalf of the United States government. Extrusion operations at the site began in late 1943 or early 1944 (HMC 1993).

The facility was shut down on August 15, 1945, following the end of World War II, and the property was transferred to the Reconstruction Finance Corporation and the War Assets Administration for disposition. A Reconstruction Finance Corporation drawing from 1946 (Exhibit 3) shows the Defense Plant Corporation properties in Los Angeles. The properties include the Bohn (LMC) and ALCOA properties (BRC). The western portion of what is now Parcel A of the BRC property is labeled "Office Parking" on the drawing (HMC 1993).

The Reconstruction Finance Corporation leased the Bohn property to the Harvey Company in October 1946. The Harvey Company moved munitions equipment from its Long Beach facility to the site in order to expand the extrusion capabilities of the plant to include brass and copper. The Harvey Company purchased the property in December 1948, and between 1950 and 1953 began to rapidly expand and improve operations at the newly created Harvey Aluminum facility. In 1956, Harvey Aluminum began a second major expansion of the facility and continued to increase production capabilities until the mid-1960s when expansion of the facility ceased. The later expansions gave Harvey Aluminum the ability to extrude brass, steel, titanium, and zirconium; ultimately, the company emerged as the leading producer of titanium and related products in the United States (HMC 1993).

Martin Marietta Corporation began acquiring interest in the Harvey Company, and in April 1972 changed the name of the facility to Martin Marietta Aluminum, Inc. Between 1972 and 1975, Martin Marietta Aluminum began to curtail some operations at the plant and focused on the core aluminum and titanium output (HMC 1993). The facility produced titanium and aluminum extrusions and forgings for the aerospace and automotive industries. Operations at the facility were divided into two divisions: Aluminum and Titanium. Operations occurring at the Aluminum Division included:

- Casthouse Operations, where pure and pedigree scrap aluminum were alloyed and prepared for the division's forge and extrusion operations. Wastes generated during casthouse operations included spent lubricating oil, clay used in absorbing oil spills, rags and filters from the maintenance of hydraulic equipment, and oil-contaminated wastewater (E&E 1986, K/J 1994).

- Forge Operations, where aluminum billets from the casthouse were placed into a furnace and forged by a hydraulic press. The forged metal was then etched and rinsed. Hexavalent chromium was occasionally used as an etchant. Wastes generated in forging operations included spent acidic and caustic solutions, tank bottom sludges containing metals, waste hydraulic oil, and steam-cleaning water contaminated with hydraulic fluid (E&E 1986, K/J 1994).

- Extrusion Operations, where aluminum billets were heated almost to the melting point of aluminum and then sent through the extrusion press. The types of wastes generated in extrusion operations were not provided in the referenced report (E&E 1986, K/J 1994).

The Titanium Division melted pure and scrap titanium into ingots. The ingots were then dry forged, extruded, or rolled into their final shapes. Processes that generated waste include grinding, metal cleaning, parts rinsing, hydraulic systems draining, and general plant maintenance. The types of wastes produced included spent sulfuric, nitric, and hydrofluoric acids, spent sodium hydroxide, waste TCA and petroleum solvents, waste oils, acid/caustic sludges, aluminum dross, and PCBs (K/J 1994).

In 1984, Martin Marietta Corporation set up a joint venture with Nippon Ko Kan (NKK), a Japanese steel and shipbuilding corporation with interests in aluminum, and the facility was renamed International Light Metals Corporation. NKK withdrew from the joint venture in 1991. Martin Marietta tried unsuccessfully to find a buyer for the property, and decided to close the facility in 1992. Aluminum extrusion production ended in April, 1992, followed by the cessation of titanium production in June, 1992, and aluminum forging in August, 1992 (HMC 1993). Structures at the site have been razed, and BRC has been informed that soils beneath the facility have been remediated to levels protective of human health and which should cause no additional impacts to groundwater at the site .

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1.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

The properties are situated within the West Coast Basin, a major groundwater basin which underlies approximately 160 square miles of the coastal plain in southwestern Los Angeles County. The facilities are located in an area where surface geology is characterized by Holocene Age sediments within the Torrance plain. The Torrance plain is defined as the area between Palos Verdes Hills to the south and the distinct belt of hills caused by folding and flexures along the Newport-Inglewood Uplift to the north. The Pacific Ocean forms the western boundary of the basin, while the San Pedro Bay and Dominguez Gap form the eastern boundary. The properties are underlain by Holocene and Pleistocene alluvium deposits that comprise the local hydrogeologic system described below (MW 1994).

Two geologic formations exist beneath the properties: the Lakewood and the San Pedro. The Lakewood formation extends to a depth of approximately 180 feet bgs and contains two major hydrogeologic and stratigraphic units known as the Bellflower aquiclude and the Gage aquifer (MW 1994).

In the vicinity of the properties, the Bellflower aquiclude is composed of low-permeability, late Pleistocene age sediments which lie above the Gage aquifer. The unit is composed predominantly of silty clays with thin, discontinuous sand lenses or gravelly clays. The Bellflower aquiclude extends to a depth of approximately 100 feet bgs (MW 1994, K/J 1996d).

The Gage aquifer underlies the Bellflower aquiclude and extends over the entire West Coast basin. The Gage is composed of water-bearing, fine-medium to coarse sand with variable amounts of coarse gravels and thin beds of silt and clay in the vicinity of the subject properties. The Gage aquifer is thought to have an approximate thickness of 30 to 40 feet and is encountered at approximately 150 feet bgs (MW 1994).

The San Pedro formation, which underlies the Lakewood formation, consists of lower Pleistocene deposits of marine origin and contains the Lynwood and Silverado aquifers. The San Pedro formation extends to a depth of approximately 1,000 feet bgs (K/J 1996d). The Lynwood aquifer has an approximate thickness of 90 feet and is encountered at a depth of about 310 feet beneath the properties. The Silverado aquifer is encountered at a depth of approximately 520 feet bgs. The Silverado is considered a source of drinking water (K/J 1996d) and is the primary water

source for the basin due to its high specific yield through the coarser sediments and its good water quality. The Silverado is continuous and merges with the Lynwood aquifer at the base of the El Segundo Sand Hills to the west (MW 1994).

Data collected from monitoring wells installed on the BRC and LMC properties indicate that groundwater flow in the region is generally to the southeast. The LMC data indicate that groundwater beneath the site is unconfined with a local hydraulic gradient of 0.0055 feet/foot. Groundwater beneath the LMC property generally occurs at depths ranging from 65 to 70 feet bgs and flow is generally to the east and southeast (G&M 1996a). Groundwater occurrence beneath the BRC property also occurs at approximately 65 feet bgs at the western property boundary, with flow generally to the southeast, bending to the south (K/J 1996a, b, c).

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2. DATA QUALITY OBJECTIVES

The objective of this groundwater investigation is to develop sufficient information to make informed decisions on the nature and extent of groundwater impacts associated with ILM-derived COCs unto the BRC property. The users of the data generated as a result of this program include the Regional Water Quality Control Board (RWQCB) and Department of Toxic Substance Control (DTSC) of the California Environmental Protection Agency (Cal/EPA), BRC, and LMC. To accomplish the objective of this program, BRC and LMC have developed three data quality objectives (DQOs):

1. Determine the lateral and vertical extent of groundwater contamination in the Bellflower aquiclude that has migrated from the LMC property to BRC.
2. Characterize ILM-derived COCs.
3. Develop sufficient data resources to develop and evaluate remedial alternative(s) in accordance with regulatory agency requirements.

Several of these DQOs are interrelated, and data collection efforts can serve to meet more than one objective. Specific tasks have been developed to enable this study to meet each specific objective.

Groundwater impacts at the ILM site are believed to be well documented. BRC has been informed that the source of these impacts has been established and addressed during a RCRA Corrective Action Program conducted under the direction of DTSC. However, little groundwater data has been collected on the lateral and vertical extent of ILM-derived groundwater impacts on the BRC property. Previous site investigation activities were performed by LMC and were limited to the ILM property. For this investigation, groundwater samples will be collected from existing wells in the study area, and additional monitoring wells that will be installed into the Bellflower Aquiclude system. The purpose for installing the additional wells is to investigate the horizontal extent of contamination, to quantify the volume of contamination, and assist with the screening of remedial alternatives. Vertical extent of contamination in the Bellflower Aquiclude will be evaluated during well installation and may require that wells be advanced below initial

specifications. Samples collected during the investigation will be analyzed for VOCs, TPH, and total and hexavalent chromium.

3. SAMPLING RATIONALE

In the preparation of the RFI for the LMC site, the investigative tasks were divided between soils and groundwater. The Soil RFI, completed in 1995, provided detailed information on the vertical and lateral extent of constituents in soil. A preliminary assessment was also conducted as part of the Soil RFI to determine if further investigation of the groundwater beneath the LMC property was needed. The Groundwater RFI was begun at the LMC property in late 1995 and was designed to acquire, analyze and interpret data to accomplish the following:

- Determine whether releases to soils have created a release to groundwater
- Collect groundwater data necessary to identify the type and concentration of hazardous waste and constituents released
- Evaluate the on-site extent of groundwater impacted by contaminant releases; and
- Evaluate the potential for downward migration of impacted groundwater from the first encountered groundwater to the underlying aquifers (G&M 1996b)

Exhibit 4 presents the wells and HydroPunch locations used in the Soil and Groundwater RFIs for the assessment of groundwater contamination. As part of the groundwater RFI, quarterly monitoring has been conducted since the initial sampling in late 1995.

Groundwater sampling results indicate that the quality of the Bellflower Aquiclude beneath the LMC property is relatively poor. The water is slightly saline and is very hard. The groundwater has also been impacted by TPH, VOC, SVOCs, dioxins and furans, and metals. TCE is the most frequently detected VOC contaminant in groundwater at the site and is detected at the highest concentrations along the southern half of the eastern property boundary. Other frequently detected VOCs in groundwater include 1,1-DCE, cis-1,2-DCE, 1,1,1-TCA, PCE, chloroform, benzene and toluene. Metals have also been detected in groundwater samples collected at the LMC property. Metals detected at concentrations exceeding primary Maximum Contaminant Levels (MCLs) include aluminum, arsenic, barium, chromium, cadmium, and nickel (G&M 1996a).

3.1 GROUNDWATER CONTAMINATION SOURCE

Migration of constituents of concern (COCs) to the BRC property from the adjacent LMC property are well documented. These COCs were identified in the Resource Conservation and Recovery Act (RCRA) Facility Investigation Report completed for LMC property by Geraghty & Miller in 1996 (G&M 1996a). The following is a discussion of the results of field and laboratory analyses of groundwater samples collected during the RFI that pertain to ILM-derived COCs to be analyzed in this study. Findings are divided into subsections addressing TPH, VOCs, and total and hexavalent chromium. These findings have been supplement with the most recent quarterly groundwater monitoring results when available.

3.1.1 Total Petroleum Hydrocarbons

Thirty groundwater samples were analyzed for TPH content during the RFI. Of the 30 groundwater samples analyzed for TPH, TPH-d was the most frequently detected compound (13 of 30). The highest TPH concentrations, with the exception of detects in well P-2 (Exhibit 5), were located along the northern half of the eastern property boundary (G&M 1996a).

Quarterly groundwater monitoring conducted by LMC in July 1997 identified a sheen of petroleum product in the north-east corner of the LMC property.

Based on these findings and the close proximity to the BRC property boundaries, this compound is believed to have migrated onto the north-west corner of the BRC property.

3.1.2 Volatile Organic Compounds

Twenty nine groundwater samples were collected and submitted for volatile organic compound (VOC) analysis. Sixteen different VOCs were detected in these samples. TCE was the predominate VOC occurring in shallow groundwater detected in 27 of the 30 samples. TCE was found at a maximum concentration of 23,000 μg/L in well P-1 adjacent to the LMC/BRC property boundary (G&M 1996a). A review of BRC quarterly groundwater monitoring results shows a TCE concentration of 15,000 μg/L in DAC-P1 directly down gradient of the LMC well P-1 (K/J 1997). Additional VOCs were identified in the RFI investigation, however not of this magnitude.

Based on these findings and the close proximity to the BRC property boundary, numerous VOCs are believed to have migrated onto the western portion of the BRC property.

3.1.3 Total and Hexavalent Chromium

Total and hexavalent chromium (Cr^{+6}) have been detected in groundwater beneath the LMC property (Exhibit 6). A potential source of chromium contamination exists on the LMC property near wells P-1 and P-14. Well P-1 is located directly across the property boundary from the BRC well DAC P-1. Well P-14 is located north of P-1 approximately 180 feet from the LMC/BRC property boundary. Concentrations of Cr^{+6} measured in P-1 and P-14 in September 1996 were 1,100 µg/L and 1,590 µg/L, respectively. An extensive Cr^{+6} plume covers the eastern portion of the LMC property and is shown to clearly extend beyond the LMC property boundary. Plume concentrations at the eastern LMC boundary are in excess of 1,000 µg/L Total chromium exceeded MCLs in 10 of 19 sample locations and was present above MCLs in border wells P-1 and P-5. (G&M 1996b).

Based on these findings and the close proximity to the BRC property boundary, total and hexavalent chromium are believed to have migrated onto the western portion of the BRC property.

3.2 DAC-P1 Monitoring Results Summary

Monitoring well DAC-P1 on the BRC property was installed by BRC in an effort to confirm potential off-site migration from the LMC property. The well is located on the eastern boundary of the BRC property, an area historically used by BRC for an employee parking lot, and down gradient of LCM well P-1. Throughout the monitoring history of DAC-P1, contaminant concentrations have been closely correlated with constituents found in LMC's well P-1. This includes type and concentration of groundwater contaminants.

3.3 Proposed Monitoring Well Locations

The locations and depths of BRC wells adjacent to the LMC property have been reviewed, in conjunction with the available data on localized hydrogeology, the potential source areas of

groundwater contamination, and the estimated nature and extent of the contamination. A determination was made that additional wells are needed to supplement the existing wells. Prior to the installation of permanent monitoring wells, temporary test wells will used to delineate the horizontal extent of the solvent and hydrocarbon plumes.

The eleven proposed temporary test well locations (nine proposed wells and two contingency wells) are shown in Exhibit 7, and are labeled BP-01 through BP-11. Four vectors have been used in the design of the temporary monitoring well locations to minimize the number of wells necessary for the delineation of contaminates in the aquifer. Three of the vectors (A, B, and C) originate from DAC-P1, an existing BRC monitoring well that shows high concentrations of chlorinated VOCs and can be useful in identifying any other contaminants migrating onto the BRC property. The fourth vector (D) originates approximately 375 feet south of the north-west corner of the BRC property boundary. This vector is down gradient of a known TPH source and will be used to identify the extent of the TPH plume.

Vector selection and geometry has been carefully orchestrated to provide basic information for the delineation of groundwater contamination. Vector B is in close correlation to the reported groundwater flow direction in the area. BP-01 and BP-02 will be located 150 and 450 feet from DAC-P1 along vector B, respectively. These wells will be used to evaluate the down gradient extent of contamination. BP-03 on vector B, located 1050 feet down gradient from DAC-P1, is a contingency well proposed only in the event that contamination is found in BP-02.

Vector A is due south and parallels the fence line between the LMC and BRC properties. Wells BP-07, BP-08, and BP-09 will be placed 150, 450, 1050 feet from DAC-P1 along Vector A, respectively. The spatial distribution of these wells compliments the LMC wells P-6 and P-7. The data collected from these wells will be used in conjunction with the findings of LMC wells P-6 and P-7 to assess the southerly extent of contamination migrating onto the BRC property.

Vector C is offset 235 degrees from Vector A in a north-easterly direction. BP-04 and BP-05 will be located 150 and 450 feet from DAC-P1 along vector C, respectively. These wells will be used to evaluate the northern lateral edge contamination identified in DAC-P1 and the down gradient TPH contamination from vector D. BP-06 on vector C, located 1050 feet cross-gradient from DAC-P1, is a contingency well proposed only in the event that contamination is found in BP-05 or BP-11.

Vector D originates from approximately 375 feet south of the north-west corner of the BRC property boundary. Vector D is offset 45 degrees from south in a south-easterly direction and is perpendicular to vector C. The predominate groundwater flow direction is reportedly to be south-east. BP-10 and BP-11 will be located 150 and 450 feet down gradient of the suspected TPH contamination, respectively. These wells in conjunction with BP-05 will determine the down gradient extent of TPH contamination.

Based on the findings of the proposed temporary wells, permanent monitoring well locations will be established and developed. The permanent wells will be developed to provide groundwater monitoring data necessary to meet all data quality objectives specified in Section 2. Temporary wells will be abandon by over-drilling to a depth of 12 feet and pressure grouting the remaining well casing.

3.4 Well Design and Installation

During the study, both temporary and permanent monitoring wells will be installed to measure water levels, determine the presence or absence of chemical compounds, and/or to determine the nature and concentration of contamination, if detected. All temporary wells will be completed and sampled prior to the strategic location of permanent wells for long-term monitoring. The following sections describe the procedures to be used during the drilling, installation, and surveying of both temporary and permanent monitoring wells.

3.4.1 Monitoring Well Drilling and Installation

Drilling will proceed from ground surface to the first water bearing zone. Prior to drilling, the contractor will notify Underground Services Alliance (USA) and appropriate BRC personnel to confirm the presence or absence of underground utilities near the boring locations. In addition, each borehole will be hand-augered to a minimum of five feet to clear the location for unmarked lines or utilities.

Drilling will be accomplished using 8 and 12 inch, outside diameter, hollow-stem augers. All soil collected will be described in the field by the contractor's geologist, acting under the supervision of a California Registered Geologist. All field inspections and descriptions of soils will be

completed on a BRC soil boring log. The boring log will include lithologic descriptions in accordance with the Unified Soil Classification System (USCS), color according to the Munsell color chart, identification number, sample interval, blow counts, and other pertinent data for each borehole drilled.

Upon completion of the boring, monitoring wells may be installed. The monitoring wells will be constructed using threaded, 2-inch-diameter (temporary wells) or 4-inch-diameter (permanent wells), Schedule 40, flush-jointed, polyvinyl chloride (PVC) casing. Each groundwater monitoring well will be constructed with two slotted intervals. One slotted interval is to be from 10 feet above the saturated zone to 15 feet into the saturated zone. The other interval is to be extend from 20 feet to 40 feet below the saturated zone. The wells will be designed with provisions for sand pack and cement/bentonite casing seal above the screened interval to prevent infiltration of surface water. Slot size and sand filter pack will be based on location-specific grain size analysis. The blank and slotted casing will be assembled above ground and lowered into the borings through the center of the hollow-stem augers to the proper depth. Grease, oil and glue will not be used when joining the sections together. Clean silica sand (compatible with the slot size) will then be added as the augers are retracted from the borings. Depth soundings will be taken regularly in order to insure that heaving conditions or sand bridging are not occurring, and the level of the introduced sand pack remains just above the lower extent of the augers being removed from the borehole. This process will continue until the sand pack extends 2 to 4 feet above the top of the slotted casing.

Following placement of the sand filter pack, the well will be surged using the appropriate diameter surge block. This will facilitate additional settling of the sand filter pack. Surging will consist of lowering the surge block to the bottom of the well and then raising and lowering the surge block along the entire length of the saturated screened interval. During surging operations, depth soundings will be taken regularly to determine whether additional sand will be necessary. Once surging is complete, bentonite pellets, chips, or slurry, depending on site conditions, will be added to the annular space above the sand pack. Potable water will be used to hydrate the bentonite. The amount of water added will be noted on the boring log. The bentonite seal will be 2 feet thick at a minimum. The remaining annular space will be grouted to approximately one foot below the surface with a bentonite and/or cement grout.

The PVC casing in each well will be capped with a PVC slip cap. The well heads will be protected by a traffic-rated, watertight box installed approximately one-inch above ground surface. A earthen pad, sloped to encourage surface-water runoff away from the monitoring well will be constructed around the well box. Each well will be affixed with a permanent identification marker.

3.4.2 Monitoring Well Development

Monitoring wells will be developed no sooner than 48 hours after the well installation has been completed. Groundwater levels and the total depth of the wells will be measured prior to and after completion of development. Groundwater will be removed from the monitoring wells using a stainless steel bailer followed by a centrifugal pump. Each well will be developed by removing a minimum of 3 well casing volumes of water or, in the event of a well slotted in a low permeability zone, by bailing the well dry twice. If water is used during drilling, at least three times the volume of fluid injected into the formation during drilling shall be removed in addition to the standard three well casing volumes. Development water from each monitoring well installed during this study will be stored and sealed in DOT approved 55-gallon drums. All drums will be labeled appropriately and retained on site, pending analysis and subsequent treatment and/or disposal by the contractor.

Field measurements of pH, temperature, specific conductance and turbidity will be obtained at regular intervals (after each well volume at a minimum) throughout well development and will be recorded on a field data sheet. Best efforts will be made to develop the wells until groundwater becomes devoid of sediment, and pH and specific conductance measurements stabilize. These field parameters will be considered stabilized when two successive measurements of pH are within 0.1 units, temperature within 0.5 degree Celsius (C), specific conductance is $\pm$ 10 μmhos/cm for 0-800 range (+ 50 at 800-1000), and turbidity is $\leq$ 50 Nephalometric Turbidity Units (NTU). The pH, temperature-specific conductance, and turbidity meters will be calibrated and operated in accordance with their respective instrument manuals.

3.4.3 Survey

Newly installed temporary and permanent wells will be surveyed for location and elevation. A permanent mark on the north side of the PVC casing will be used as the reference point for water-level measurements. Surveyor reference marks will be located on both the well casing and outer protective casing. The northing/easting coordinates of the sample location will be surveyed by Tait & Associates to within ± 1.0 foot. Elevations will be surveyed to an accuracy of ± 0.01 foot. The elevation of each well will be surveyed relative to mean sea level. The reference points will be measured by a California-licensed surveyor. Survey information will be documented on survey forms, the master surveyed site plan and in a computer database format.

4. SAMPLING & ANALYSIS PLAN

This section describes the types of field measurements that will be made and presents the procedures to be followed by personnel performing field measurements and collecting groundwater samples. Quality assurance/quality control procedures, sample handling and custody requirements, laboratory custody procedures, and documentation requirements are also presented in this section.

4.1 FIELD ANALYSIS AND MEASUREMENTS

Field data will be collected during well installation and sampling activities. The types of field data to be collected at the site include:

- Water-level measurements
- Conductivity, temperature, pH, and turbidity measurements
- HNu photoionization detection

The following methods presented below are intended to ensure that field measurements are consistent and reproducible when performed by various individuals. Field personnel will record field measurements on standardized Daily Field Measurement Record as described in Section 4.5.2. In addition to properly recording data on the standardized forms, personnel will maintain field notebooks in which all data will be recorded.

4.1.1 Water Level Measurements

Water levels may be measured using a steel tape, electric probe, and/or pressure transducer. If a pump or other equipment is in the well, measurement devices will be lowered slowly to avoid entanglements. Water level measurements in completed wells will be made from a permanently marked reference point on the well casing. The elevation of this point will be established by survey in relation to a National Geodetic Vertical Datum (NGVD). Water levels measured in boreholes or wells during construction will be made relative to the ground surface.

Measurements will be made and recorded in the Daily Field Measurement Record to the nearest hundredth of a foot. In general, water level measurements to determine hydraulic gradients, and in some permeability or aquifer tests, will be made with an electric probe or transducer.

4.1.2 Conductivity, Temperature, pH, and Turbidity Measurements

Specific conductance, water temperature, pH, and turbidity measurements will be made in the field during purging, before and after each water sample collection, and during pumping tests. The water sample will be placed in a sample container solely for field testing. A field pH meter with a combination electrode or equivalent will be used for pH measurements. Temperature measurements will be performed using standard thermometers or equivalent temperature meters. Combination instruments capable of measuring two or all three parameters may also be used.

All instruments will be calibrated as described in their respective instrument manual. If conductivity standards or pH buffers are used in field calibration, their values will be recorded on the Daily Field Measurement Record. All probes will be thoroughly cleaned and rinsed with distilled water prior to conducting any measurements.

4.1.3 HNu Photoionization Detector

The HNu photoionization detector will be used for measuring gaseous levels of a variety of organic and inorganic compounds. The HNu is a portable, nonspecific, vapor/gas detector which will be calibrated using isobutylene. Isobutylene provides a mid-range response for most contaminants of interest, is relatively safe to use, and is readily available from the supplier. The HNu contains an ultraviolet light source within its sensor chamber. Ambient air is drawn into the chamber. If the ionization potential of any molecule present in the ambient air is equal to or lower than the energy of the ultraviolet light source, ionization will take place, causing a deflection in the meter. The HNu will be used to monitor soil cuttings during drilling operations. Cutting samples will be measured by holding the tip of the probe at the surface of the sample for 5 seconds. Response time is approximately 90 percent at 3 seconds. The measurements are reported in parts per million. The HNu will also be used to measure organic vapors in the headspace of monitoring wells after the cap has been removed and prior to sampling. All readings will be recorded in the Daily Field Measurement Record.

4.2 GROUNDWATER SAMPLING

Groundwater samples will be collected from each of the wells installed as part of the groundwater investigation and submitted to a state certified laboratory for analysis. The sample data returned from the laboratory will be used to determine the nature and extent of the contaminants in groundwater migrating from the LMC property. Samples collected from wells BP-01 through BP-09 will be analyzed for:

- VOCs using EPA Method 8260
- Filtered and non-filtered chromium using EPA Method 6010 (total) and 7196 (hexavalent)

Samples collected from wells BP-10 and BP-11 will be analyzed for:

- TPH-fuel fingerprint (TPH-ff) using modified EPA Method 8015
- VOCs using EPA Method 8260

The procedures that will be used for purging the monitoring wells prior to sampling and for collecting groundwater samples are as follows:

1. Remove the well cap and check for volatile organics in the headspace using an HNu PID. Record the reading in the Daily Field Measurement Record.
2. Measure the static water level and total depth of all wells as described in Section 4.1.1 prior to collecting groundwater samples. If more than 24 hours have elapsed since water levels were collected, recheck the static water level prior to purging for documentation purposes. Record the data and determine the purge volume using the following equation

$$V = C_f \pi r^2 h$$

where:

V	=	well volume (gallons)
r	=	well radius (ft)
h	=	column of water in the well (total depth - depth to water) (ft)
C_f	=	7.48 gallons/ft^3

3. Purge water from the well until conditions described in item 4 below have been met. Water may be removed from the well using a bailer, submersible pump, surficial suction pump, or bladder pump. Criteria for selecting the proper device for purging the well are presented below. The use of a pump is the preferred evacuation method; bailers will only be used if it is not possible to use a pump.

   a. Bailers are most applicable for sampling after purging and for purging small diameter, low yield wells. If a bailer is used, it should be dedicated to the well, i.e., used only for that well. Field decontamination of bailers is not permissible.

   b. Submersible pumps are most effective for wells that recharge quickly and where water levels are greater than 20 feet bgs. When a submersible pump is used, the pump will be slowly lowered into the well on a polypropylene safety line. Once the pump has been lowered to the desired level, the safety line will be secured. The submersible pump must be decontaminated between wells by washing the outside surfaces with tap water and a non-phosphate detergent, rinsing it with tap water, placing the pump in a container and pumping 20 gallons of potable water through it, and then rinsing again with distilled/deionized water. New drinking water grade polyethylene tubing will be used at each well where the submersible pump is employed for purging.

   c. The surficial suction pump can only be used if the water level in the well is not lower than 20 to 22 feet bgs. Dedicated intake tubing should be used for each well. New linear polyethylene tubing that conforms to the ASTM drinking water grade specifications will be used as the intake line. The intake line is discarded after every use.

   d. The bladder pump typically will purge the well at a rate of 1 to 2 gallons per minute. The pump can be used for any size well if the volume of water in the well will not require an excessively long pumping time. New drinking water grade polyethylene tubing should be used as the discharge line. The pump will be dismantled and decontaminated prior to each use.

4. Measure the pH, conductivity, temperature, and turbidity after each well volume has been purged to determine stabilization. Purging will be completed when five well volumes have been removed or when two successive measurements of specific conductance, pH, and temperature give values within the following ranges:

   a. Specific Conductance: $\pm$ 10 μmhos/cm for 0-800 range (+ 50 at 800-1000)

   b. pH: $\pm$ 0.1 pH units

   c. Temperature: $\pm$ 0.5°C

5. Record the stabilization results on the Daily Field Measurement Record. Wells that recover very slowly should be purged at a rate of less than one gallon per minute. If the well is purged to near dryness using this slow rate, allow it to recover before collecting a sample.

6. Collect a groundwater sample from the well within two hours of purging. Slow recharging wells are permitted to sit for no more than 12 hours prior to sampling.

   a. Samples will be collected using decontaminated, disposable, bottom-loading Teflon or polyethylene bailer. Clean polypropylene rope will be used to lower the bailer into the well. The field team will wear disposable gloves when handling the sampling equipment. New rope and disposable gloves will be used at each well. Care will be taken to ensure that bailers or rope do not come into contact with any contaminated surface.

   b. Samples will be carefully transferred into containers, avoiding agitation or turbulence, which can result in the loss of VOCs and/or excessive oxygenation of the samples. Care will be exercised to avoid breakage and to prevent contact of any foreign substance with the interior surface of the containers or caps. Caps will not be removed from the container until sampling actually occurs.

   c. A sample label will be affixed to each sample container indicating the well number, and sample collection date. This information will be entered into the Daily Analytical Sample Record as described in Section 4.5.3.

   d. Samples will be packed on blue ice in a cooler and the Analytical Sample Record and chain-of-custody form will be completely filled out. Samples will be shipped to the laboratory at the end of each day's sampling.

7. All nondisposable sampling equipment will be decontaminated. Decontamination of equipment will prevent or minimize cross-contamination, or the transfer of contamination from the equipment to the sample. This is important for preventing the introduction of error into sampling results and for protecting the health and safety of site personnel. Equipment will be cleaned before and after each use with Alconox in water followed by a double rinse in distilled water. Decontamination fluids collected during equipment cleaning will be stored in properly labeled 55-gallon drums and disposed of in accordance with applicable regulatory requirements

4.3 QUALITY ASSURANCE

Standard laboratory quality assurance/quality control procedures developed by the Department of Toxic Substances Control and the Regional Water Quality Control Board will be followed to insure the quality of the analytical results obtained from all samples. In addition, three types of quality control samples; trip blanks, equipment blanks, and rinsate blanks will be collected.

4.3.1 Trip Blanks

At least one trip blank will be prepared for each cooler used for storage and transport of samples. Trip blanks will be submitted to the laboratory for VOC analysis by EPA Method 8260. The trip blank will consist of a vial of laboratory supplied distilled, deionized water. The trip blank will accompany the empty sample containers to the field and will be placed in the cooler to be returned to the laboratory with the samples collected on that sampling day. A trip blank will not be opened until it is analyzed in the laboratory with the actual site samples.

4.3.2 Field Blanks

The field blank sample is obtained by replicating the sample collection process in the field using laboratory supplied distilled, deionized water. This process will be used to identify potential contamination of samples from surrounding contamination sources. Each sampling crew will collect one field blank for every 20 groundwater samples. Field blanks will accompany the samples collected on that day to be laboratory for analysis. The rinsate blank(s) will be analyzed for:

- TPH-ff by modified EPA Method 8015
- VOCs by EPA Method 8260
- Filtered and non-filtered chromium by EPA Method 6010 (total) and 7196 (hexavalent)

4.3.3 Rinsate Blanks

The rinsate blank is obtained by collecting laboratory supplied distilled, deionized water as it is poured through or over decontaminated sampling equipment. Each sampling crew will collect

one rinsate blank for every 20 groundwater samples. Rinsate blanks will accompany the samples collected on that day to the laboratory for analysis. The rinsate blank(s) will be analyzed for:

- TPH-ff by modified EPA Method 8015
- VOCs by EPA Method 8260
- Filtered and non-filtered chromium by EPA Method 6010 (total) and 7196 (hexavalent)

4.4 Sample Handling and Custody

To establish the documentation required to trace sample possession from the time of collection to the time of sample analysis and reporting, a chain-of-custody form will be used. The completed form will accompany every sample to the designated state-certified laboratory and also through the laboratory during sample analysis. The following information shall be completed on the chain-of-custody form:

- Project number
- Total samples shipped
- Date samples are relinquished
- Signature of sample collector
- Sample identification
- Date/time samples collected
- Sample type
- Container type
- Analyses requested
- Signature of person or persons involved in the chain of possession

4.4.1 Field Custody Procedures

The following chain-of-custody procedures will be implemented to maintain and document sample possession:

1. Samples will be collected as described in this workplan.

2. The Task Leader is personally responsible for the care and custody of the samples until they are properly transferred or dispatched to the analytical laboratory.

3. Labels will be completed for each sample and then affixed to the sample container as described in Section 4.2, item 7d.

4. If a sample label should become lost during shipment, a written statement shall be prepared detailing how the sample was collected and transferred to the laboratory. The statement should include all pertinent information, such as entries in field log books regarding the sample, whether the sample was in the sample collector's physical possession or in a locked compartment until hand-transported to the laboratory, etc.

4.4.2 Transfer of Custody and Shipment

The following procedures will be implemented when transferring custody of samples:

1. Samples will be accompanied by a chain-of-custody form. When transferring possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the form. This form documents sample custody and transfers from the sampler, often through another person, to the analyst in the laboratory.

2. Samples will be packaged properly for shipment and dispatched to the laboratory for analysis, with a separate custody form accompanying each shipment (i.e, one for samples shipped to the laboratory). Containers will be sealed with signed chain-of-custody seals for shipment to the laboratory.

3. Each shipment will be accompanied by the chain-of-custody form that identifies the contents of that shipment. The courier transporting the shipment will sign the chain-of-custody form. The original form will accompany the shipment and a copy will be retained by the Field Operations Leader for inclusion in project reports.

4. If sent by common courier or air freight, proper documentation will be maintained (i.e., FedEx airbill).

4.4.3 Laboratory Custody Procedures

The following procedures will be implemented when the samples arrive at the laboratory:

1. A designated custodian will take custody of all samples upon their arrival at the laboratory. When samples are delivered to the laboratory after hours or when the sample custodian is not present to accept the samples, the samples will be placed in a designated sample area in accordance with the procedures established by the laboratory.

2. The custodian will be responsible for inspecting all sample labels and chain-of-custody forms to ensure that the information on each corresponds and that all are completed properly. The custodian will then assign a unique laboratory number to each sample and then transfer the samples to secured storage areas. The custodian will enter the label data into the sample tracking system of the laboratory. This system will use the sample label and will ensure that all samples are transferred to the proper analyst or stored in the appropriate secure area.

4.5 Documentation and Photography

Each environmental crew leader is required to maintain daily activity logs on-site during field activities to provide a daily record of significant events, observations, and field operations. The crew leader will submit the daily activity log to management for review by 8:00 a.m. the following day. All entries on the daily activity log and the field data sheets will be made legibly in indelible ink, signed, and dated. The field entries will be factual, detailed, and objective. The daily activity log will consist of:

1. A Field Report

2. A Daily Field Measurement Record

3. A Daily Analytical Sample Record

4. A Daily Summary of Field Activities

A description of each component of the daily activity log is presented below.

BOE-C6-0025634

4.5.1 Field Report

The Field Report is used to document activities occurring at the site. It also updates management and other team members who may not be on the site on a daily basis on activities that are occurring at the site. The information contained in the Field Report will include, but is not limited to, the following:

- Date
- Project name and number
- Location
- Weather conditions at the site
- Names of environmental crew members present on-site and names of other organizations present on-site (such as construction crews)
- Detailed chronological record of activities at the site
- Name and signature of the individual completing the field report

In the detailed chronological record of activities it is important to record activities at the site on an hourly basis, at a minimum. It is also important to record equipment calibration data and information about any activities, extraneous to sampling activities, that may affect the integrity of the samples collected on that day (e.g., emissions from nearby operations).

4.5.2 Daily Field Measurement Record

The Daily Field Measurement Record will be used to record field measurements collected during sampling. The information contained in the record will consist of, but is not limited to, the following:

- Project name and number
- Date
- Well being for which data is being measured

- Time sample was collected
- Water level, conductivity, temperature, pH, and sample headspace reading

4.5.3 Daily Analytical Sample Record

The Daily Analytical Sample Record is intended to log groundwater samples collected at the site on a daily basis. The information included on the Daily Analytical Sample Record will include, but is not limited to, the following:

- Project name and number
- Date
- Well being sampled
- Time sample was collected
- Sample number assigned to the sample
- Comments about the sample

4.5.4 Daily Summary of Field Activities

The Daily Summary of Field Activities is intended to present concise summary of installation and sampling activities that occurred at the site on that day. In addition, the Daily Summary of Field Activities will include:

- Date
- Project name and number
- Location
- Names of contracting and environmental companies present on-site that day
- Listing of any site visitors on that day
- Name and signature of the individual completing the field report

In addition to the written documentation described above, representative photographs will also be taken of the well installation and sampling procedures. Photographs will logged by location.

4.5.5 Corrections to Documentation

If an error is made on any of the daily activity log entries, the individual who signed the document will make corrections by crossing out the error with a single line and then entering the correct information. The erroneous information should not be obliterated. All corrections will be initialed and dated.

4.5.6 Disposition of Documentation

Upon completion of the field effort at the facility, field documentation will be clearly labeled and placed in the project files of both BRC and LMC.

4.5.7 Laboratory Files

Laboratory files will be maintained for the groundwater monitoring. The file will contain all data and reports including raw data calculation sheets, chromatograms, and mass spectrums in both electronic and hard copy formats. All written and electronic records of laboratory handling and analysis will also be maintained as part of the permanent file.

5. REPORTING AND SCHEDULE

The anticipated task/reporting schedule for well installation and the initial sampling is presented in Table 5-1 below.

TABLE 5-1.
TASK AND REPORTING SCHEDULE

DATE	TASKS/REPORTS
October 20, 1977	Workplan preparation and delivered to agency for review and approval.
November 1, 1997	Temporary monitoring well installation begins.
November 10, 1997	Groundwater sampling of temporary wells.
December 10, 1997	Groundwater monitoring report preparation and agency review.
December 30, 1997	Install permanent wells.
January 10, 1998	Collect first round of permanent well samples.
February 10, 1998	Permanent well sampling report to agency for review.

All permanent groundwater wells will be sampled on a quarterly basis. This workplan does not cover sampling conducted after the first permanent well samples.

BOE-C6-0025638

6. REFERENCES

Camp Dresser McKee Inc. (CDM) 1991. Phase I Environmental Assessment of the Douglas Aircraft Company C-6 Facility, Parking Lot and Tool Storage Yard Los Angeles, California. Prepared for McDonnell Douglas Realty Company.

Geraghty & Miller (G&M) 1996a. RCRA Facility Investigation Report, Martin Marietta Technologies, Inc., International Light Metals Facility, Torrance, California. Prepared for Martin Marietta Technologies, Inc.

Geraghty & Miller (G&M) 1996b. Fourth Quarterly Monitoring Report (Third Quarter 1996), RCRA Facility Investigation, Lockheed Martin Corporation, International Light Metals Facility, Torrance, California. Prepared for Lockheed Martin Corporation.

Hammond Management Consulting (HMC) 1993. Martin Marietta Technologies, Inc. International Light Metals Division Historical Review Project Final Report. Prepared for Martin Marietta Technologies, Inc.

Kennedy/Jenks Consultants (K/J) 1994. Technical Memorandum - Draft Site Vicinity Environmental Evaluation Report. Prepared for McDonnell Douglas Corporation.

Kennedy/Jenks Consultants (K/J) 1996a. Phase 1 Environmental Assessment Parcel A. Prepared for McDonnell Douglas Realty Company.

Kennedy/Jenks Consultants (K/J) 1996b. Phase 1 Environmental Assessment Parcel B. Prepared for McDonnell Douglas Realty Company.

Kennedy/Jenks Consultants (K/J) 1996c. Phase 1 Environmental Assessment Parcel C. Prepared for McDonnell Douglas Realty Company.

Kennedy/Jenks Consultants (K/J) 1996d. Groundwater Monitoring Data Summary Report Third Quarter 1996, Douglas Aircraft Company C-6 Facility Torrance, California. Prepared for McDonnell Douglas Realty Company.

Montgomery Watson (MW) March 1994. Conceptual Design of Final Soil and Groundwater Remediation System at the Douglas Aircraft Company, C6 Facility. Prepared for McDonnell Douglas Corporation.

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Exhibit 1
Boeing Company C-6 Facility and Vicinity
Site Location Map

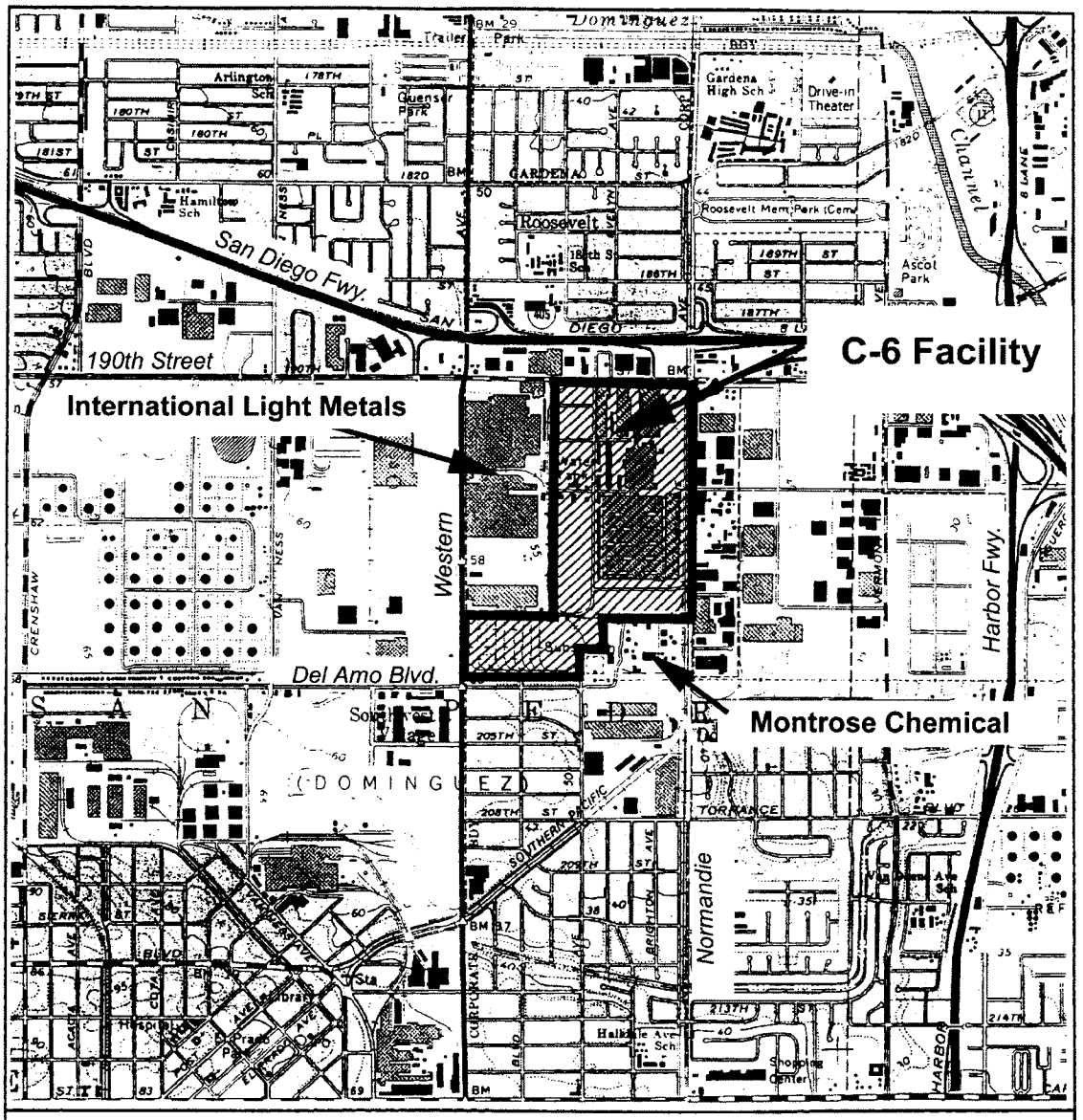
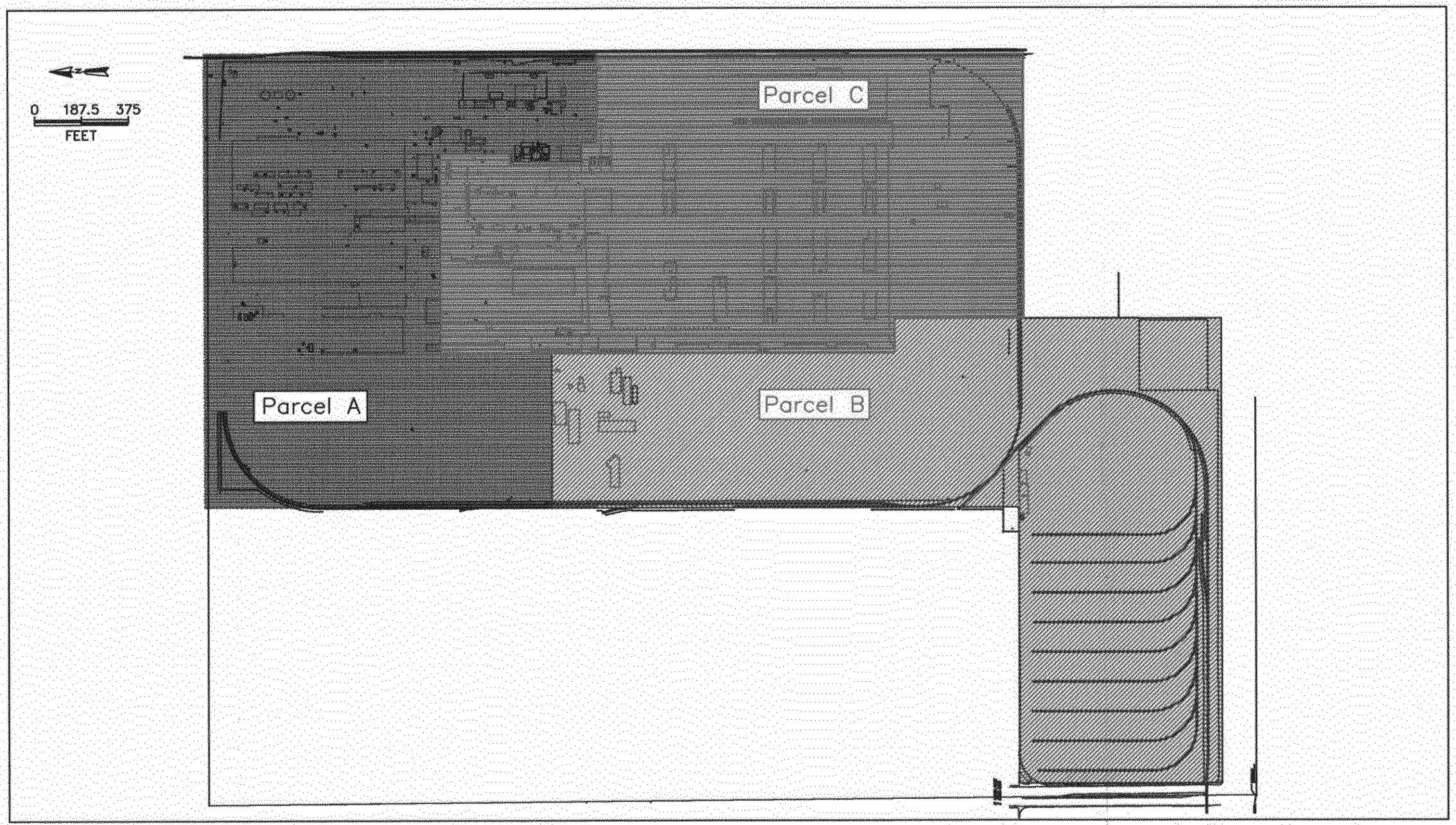


Exhibit 1
Site Location Map

Exhibit 2
Boeing Company C-6 Facility
With Parcels Defined



INTEGRATED
Environmental Services, Inc.
[illegible]
(714) [illegible]

TITLE:
Boeing Company C6 Facility
Parcels A, B, and C

DWN: JL	DES.: JL	PROJECT NO.: 2363
CHKD: CS	APPD: JH	FIGURE NO.: EXHIBIT 2
DATE: 8-18-97	REV.: 1	

F:\Projects\MDC6/C6-ILM GW Monitoring/Figs/Exhibit 2

Exhibit 3
1945 Plancor Properties Map
(HMC 1993)

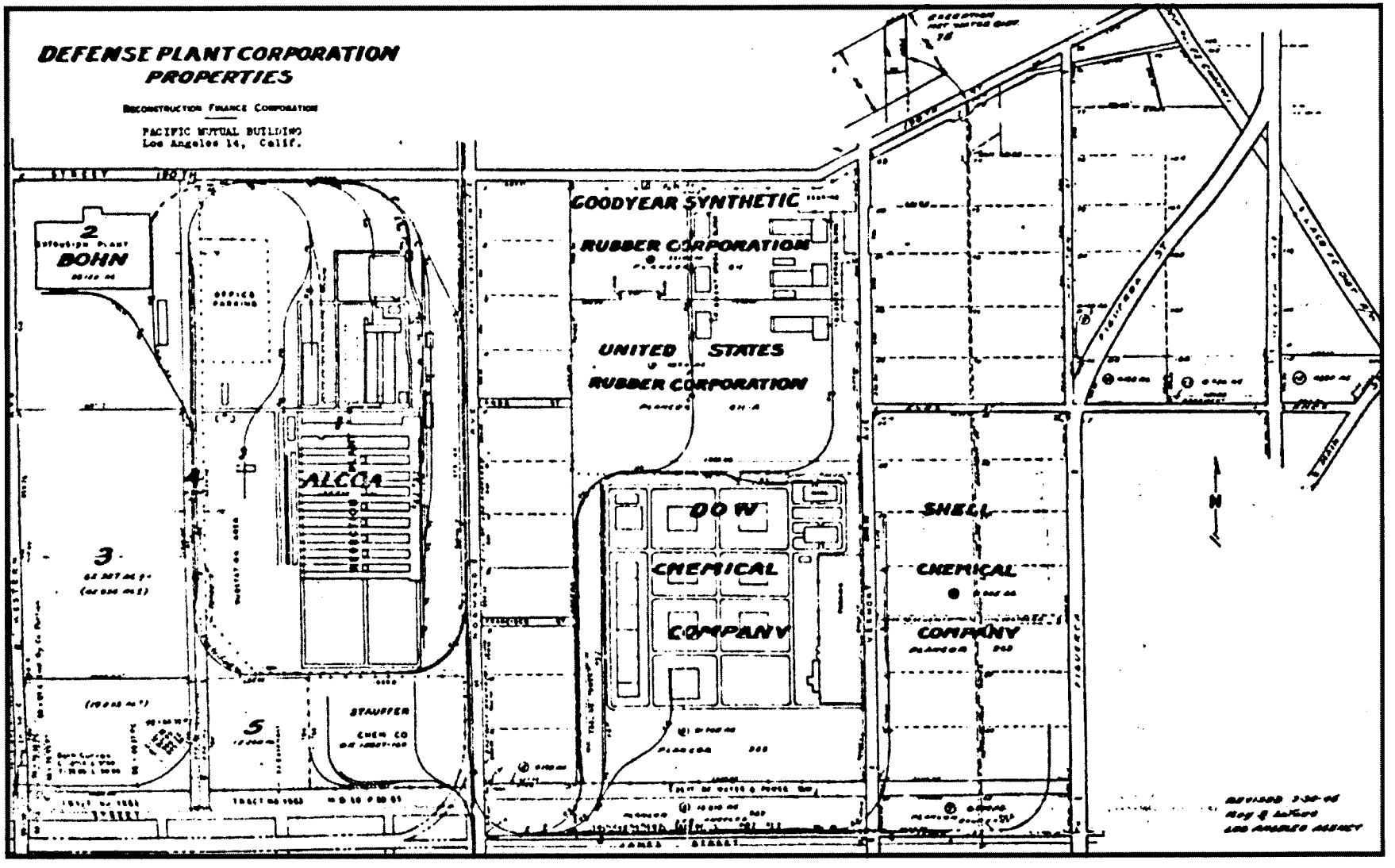


Exhibit 3
1945 Plancor Properties Map

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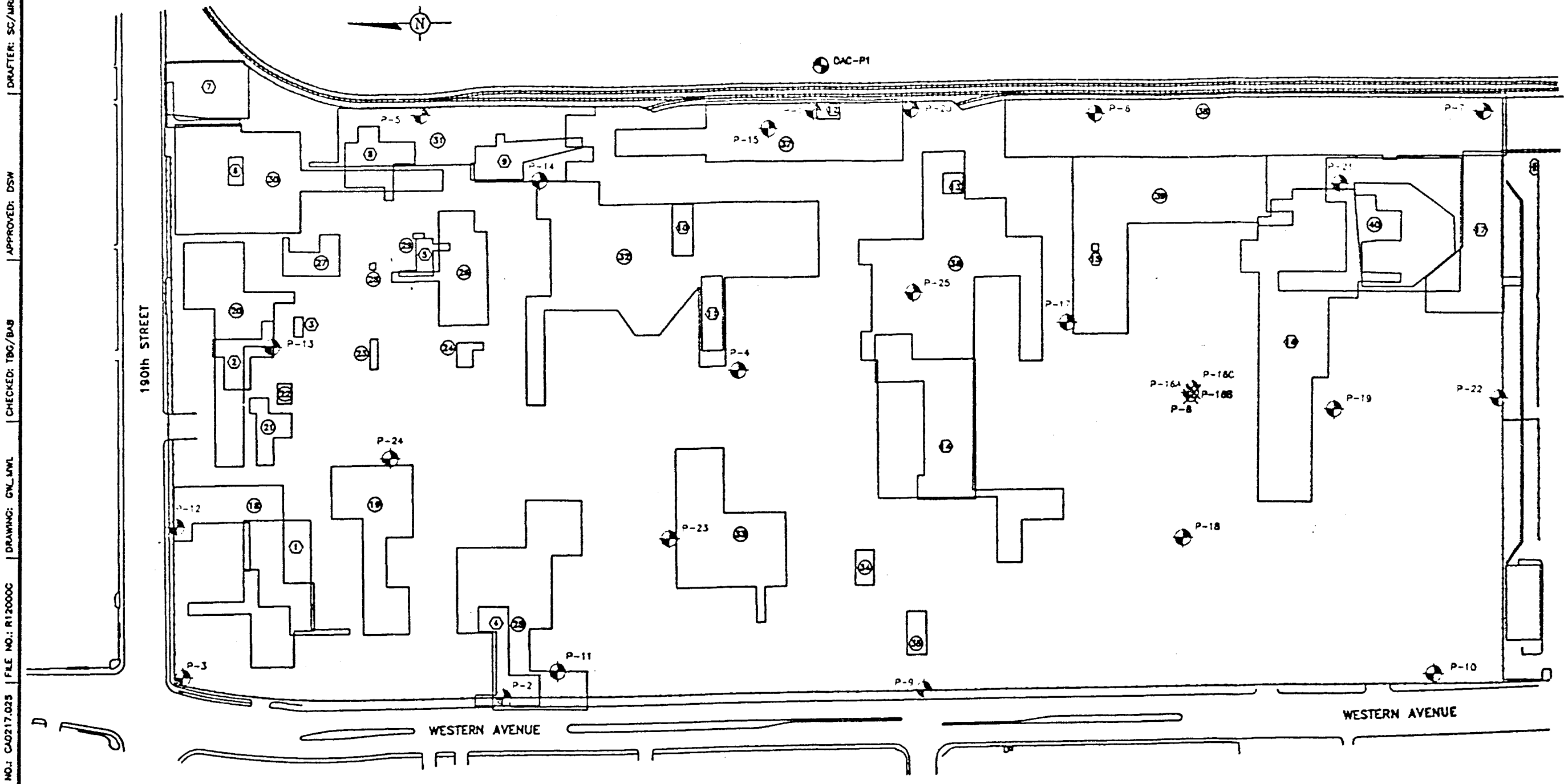
Exhibit 4
Groundwater Sampling and Monitoring Well Locations
(G&M 1996a,b)



LEGEND

- DAC-P1 McDONNELL DOUGLAS MONITORING WELL
- P-5 GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION
- P-8 ABANDONED MONITORING WELL LOCATION AND DESIGNATION
- ① ⑯ AREAS OF INVESTIGATION (AOIs)

GERAGHTY & MILLER, INC.
Environmental Services

0 200 FT

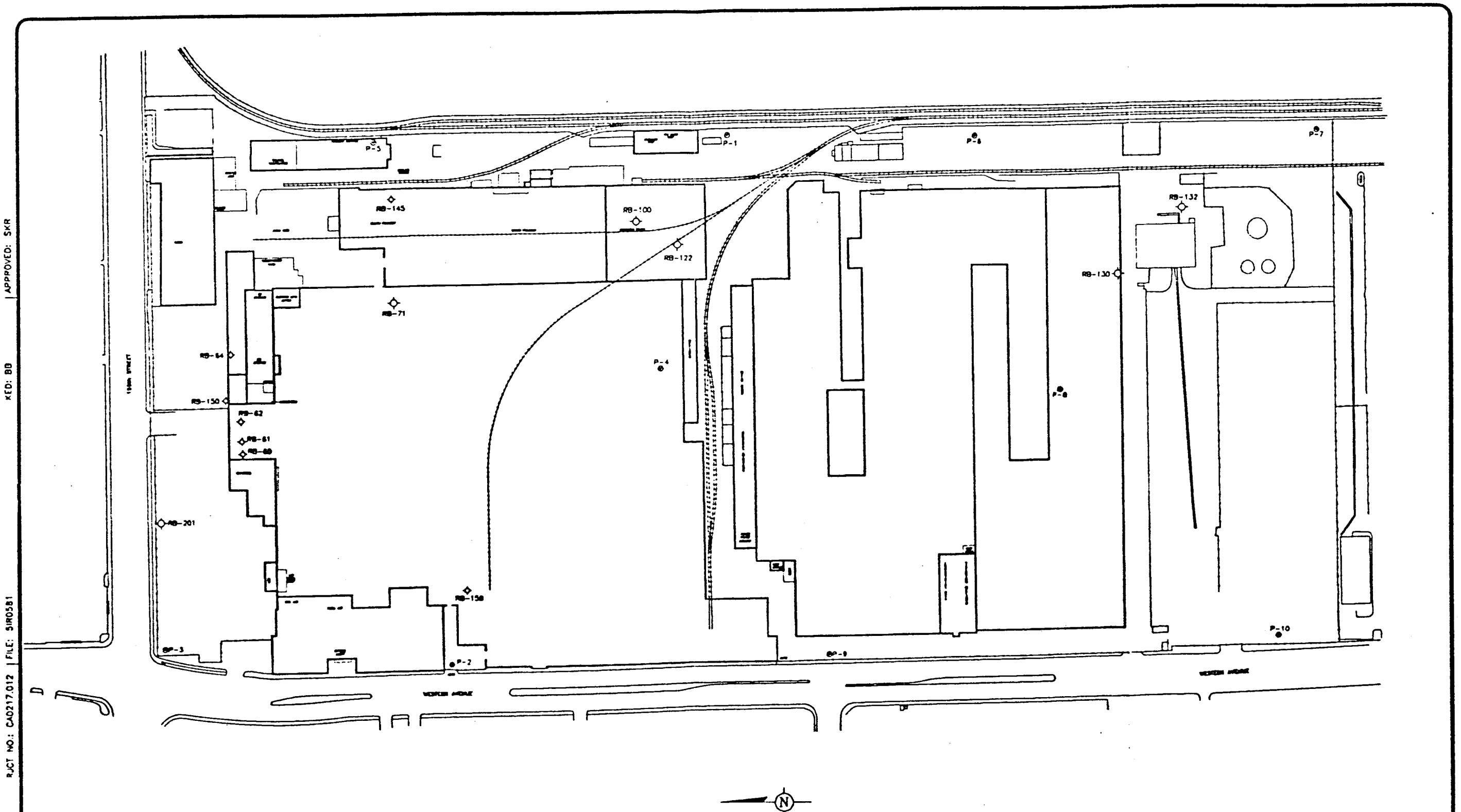
GROUNDWATER MONITORING WELL LOCATION MAP

LOCKHEED MARTIN CORP./INTERNATIONAL LIGHT METALS FACILITY
TORRANCE, CA

FIGURE 3-1

DRAFTER: SC/MRP/JOB | APPROVED: DSW | CHECKED: TBG/BAB | DRAWING: GW_MWL | FILE NO.: R12000C | PRJCT NO.: CA0217.025 | DWG DATE: 20 NOV 98

BOE-C6-0025647



LEGEND

P-1 ⊙ PIEZOMETER LOCATION AND DESIGNATION

RB-71 ⌖ HYDROPUNCH LOCATION AND DESIGNATION

GERAGHTY & MILLER, INC.
Environmental Services

0 100 200 FT

GROUNDWATER SAMPLING LOCATIONS

MARTIN MARIETTA TECHNOLOGIES, INC./INTERNATIONAL LIGHT METALS DIV.
TORRANCE, CA

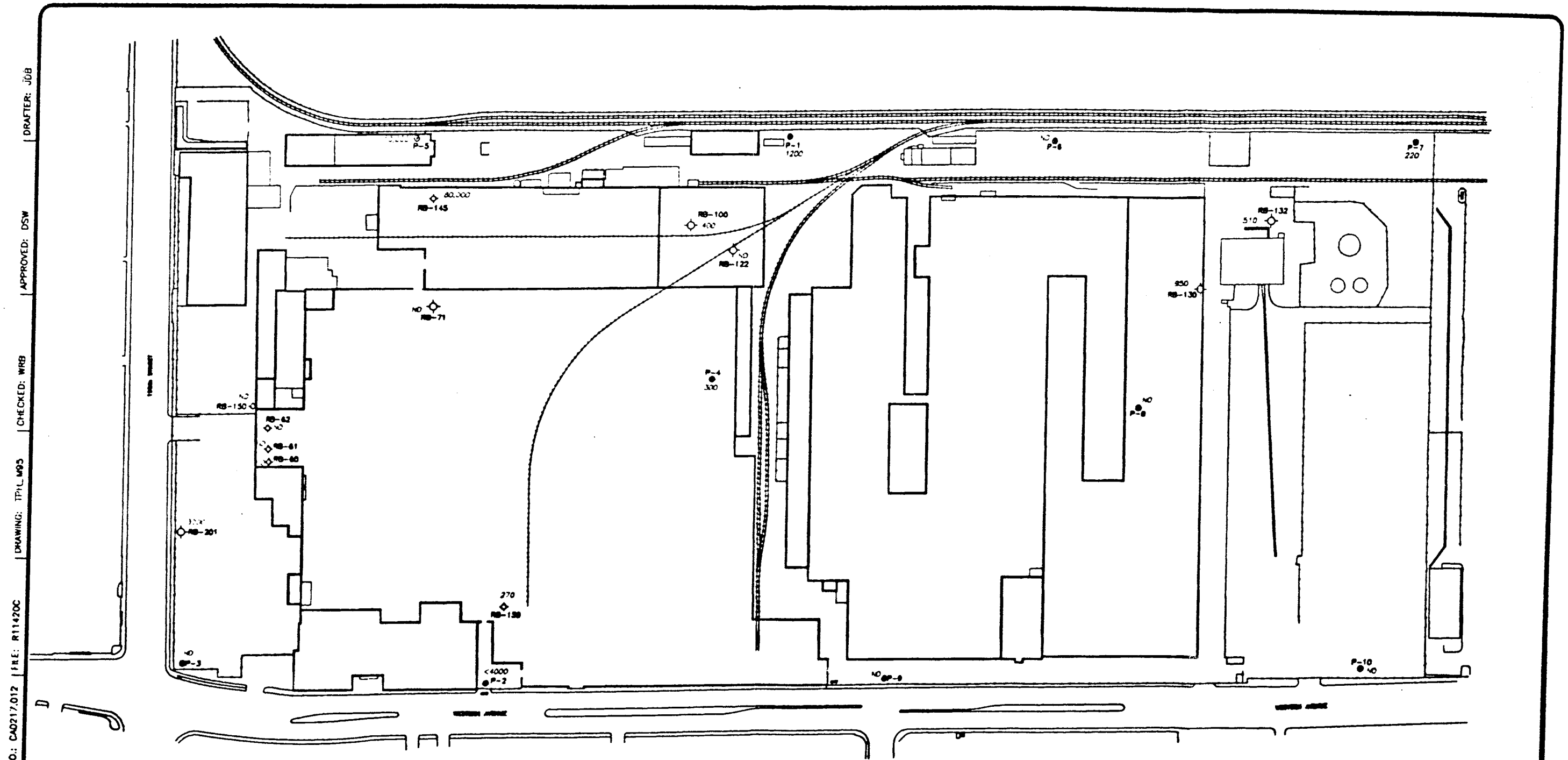
FIGURE
6-5

PROJECT NO.: CA0217.012 | FILE: 5IR0581 | KED: BB | APPROVED: SKR

GW-SAMPL/5-23-95

INTEGRATED
ENVIRONMENTAL SERVICES, INC.

Exhibit 5
TPH-Diesel Distribution in Shallow Groundwater
For February - March 1995
(G&M 1996a)



LEGEND

P-1 1200 ● GROUNDWATER MONITORING WELL LOCATION WITH TPH-Diesel CONCENTRATION IN MICROGRAMS PER LITER (ug/L)

RB-130 950 ◇ HYDROPUNCH/TEMPORARY WELL LOCATION WITH TPH-Diesel CONCENTRATION IN ug/L

<0 NOT DETECTED AT OR ABOVE DETECTION LIMIT OF 200 ug/L

GERAGHTY & MILLER, INC.
Environmental Services

0 200 FT

TPH-Diesel DISTRIBUTION IN SHALLOW GROUNDWATER FOR FEBRUARY-MARCH 1995

MARTIN MARIETTA TECHNOLOGIES, INC./INTERNATIONAL LIGHT METALS DIV.
TORRANCE, CA

FIGURE **6-8**

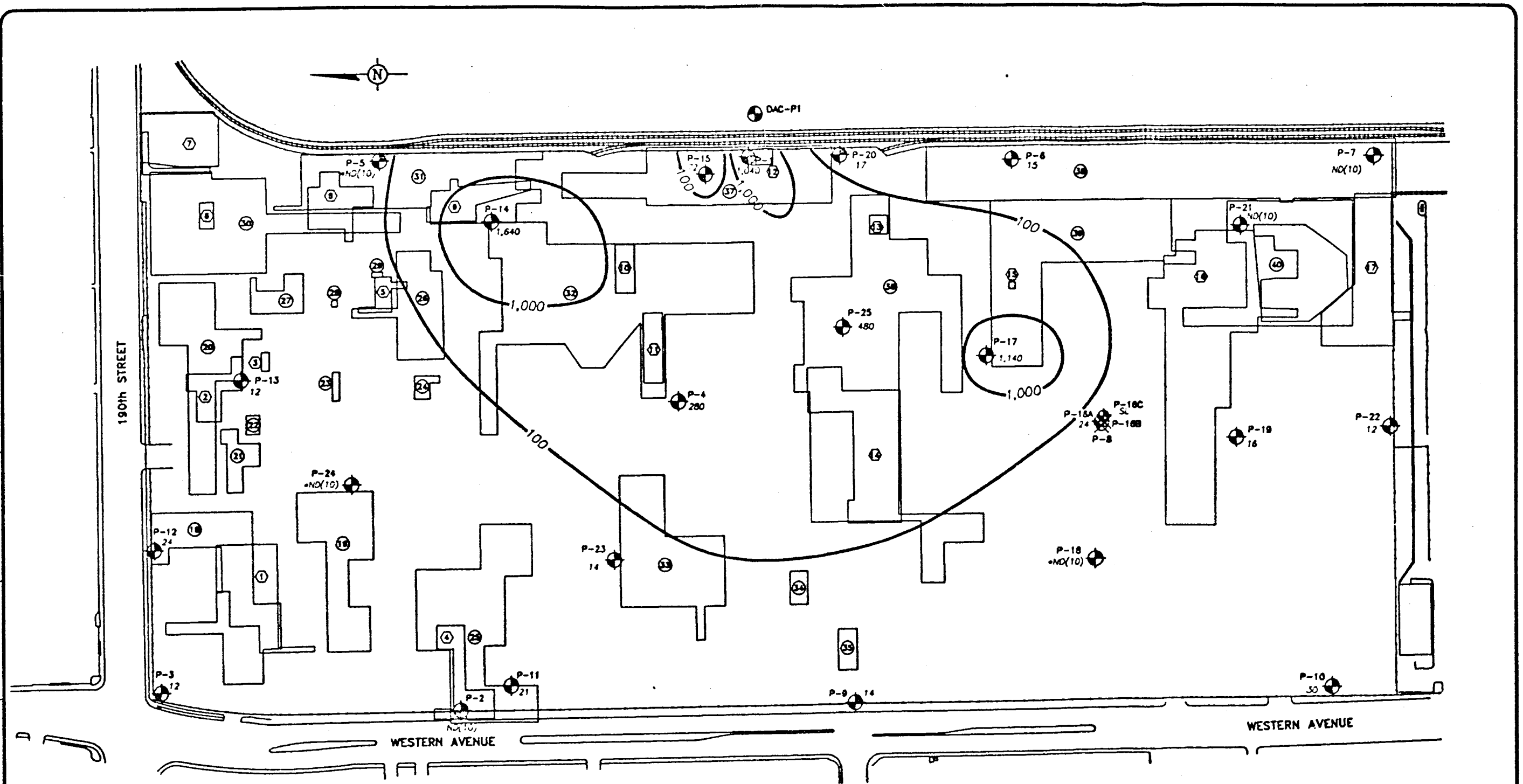
DRAWING: TPH_M95 | CHECKED: WRB | APPROVED: DSW | DRAFTER: JOB
DWG DATE: 20 JUNE 95 | PROJECT NO.: CA0217.012 | FILE: R11420C

TCE_M95/6-20-95

BOE-C6-00256550

INTEGRATED
ENVIRONMENTAL SERVICES, INC.

Exhibit 6
Dissolved Hexavalent Chromium in Groundwater - September 1996 (G&M 1996b)



LEGEND

DAC-P1	McDONNELL DOUGLAS MONITORING WELL
P-5	GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION
P-8	ABANDONED MONITORING WELL LOCATION AND DESIGNATION
480	CONCENTRATION OF HEXAVALENT CHROMIUM IN MICROGRAMS PER LITER (ug/L)
ND(10)	NOT DETECTED ABOVE PRACTICAL QUANTITATION LIMIT (PQL), IN PARENTHESES
*	DENOTES AVERAGE BETWEEN SAMPLE AND SAMPLE DUPLICATE. AVERAGES OF THE PQL FOR NON-DETECT SAMPLES SHOWN IN PARENTHESES.
SL	SLOTTED LOWER THEREFORE NOT UTILIZED IN ISOCONCENTRATION MAP
1,000	CONTOUR OF EQUAL HEXAVALENT CHROMIUM CONCENTRATION

GERAGHTY & MILLER, INC.
Environmental Services

0 200 FT

DISSOLVED HEXAVALENT CHROMIUM IN GROUNDWATER - SEPTEMBER 1996

LOCKHEED MARTIN CORP./INTERNATIONAL LIGHT METALS FACILITY
TORRANCE, CA

FIGURE
3-13

DRAFTER: MRP/JDB | APPROVED: DSW | CHECKED: BAB | DRAWING: GW_HEX4 | FILE NO.: R11949C | PRJCT NO.: CA0217.025 | DWG DATE: 20 NOV 96

BOE-C6-0025652

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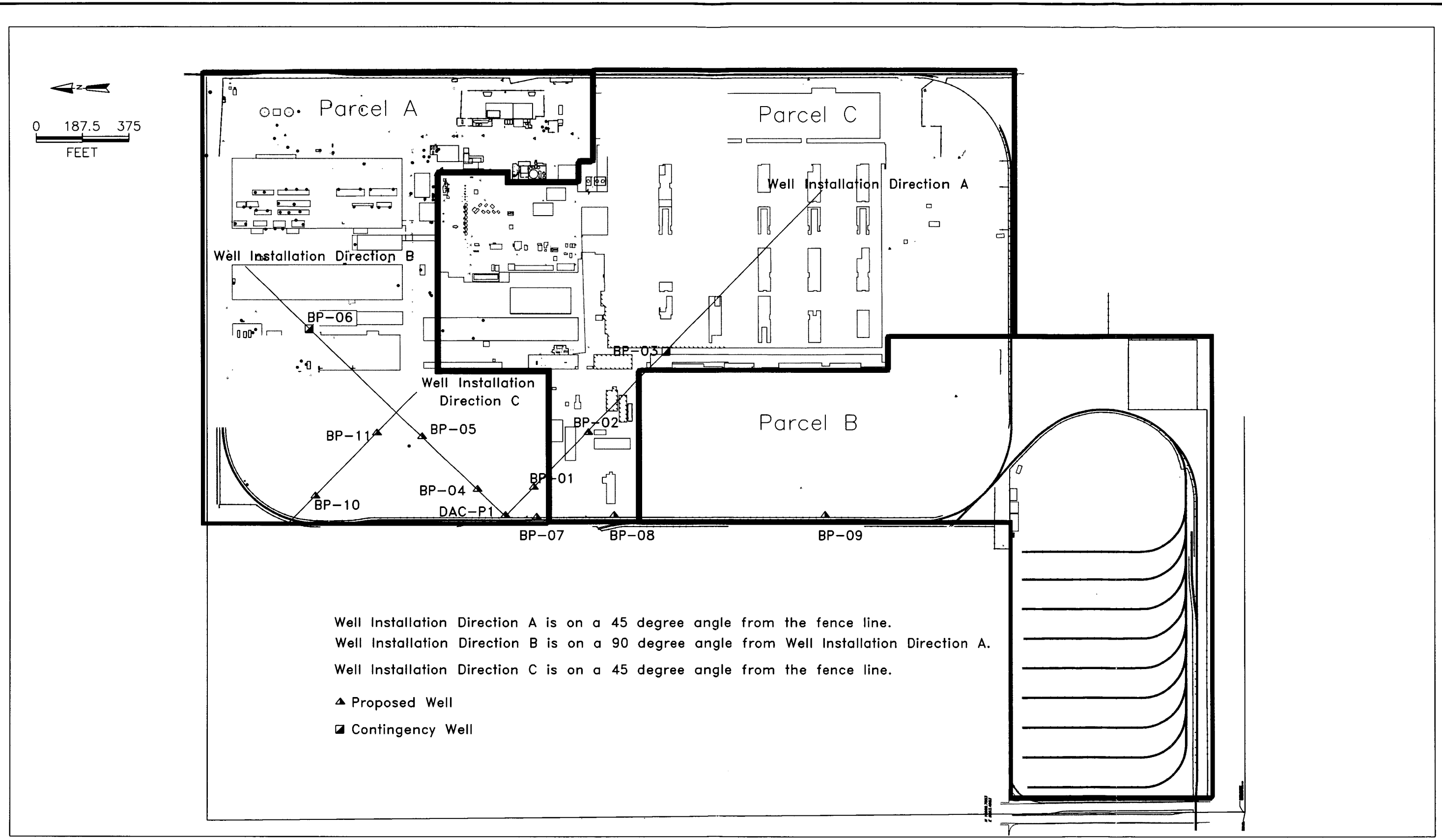
ENVIRONMENTAL SERVICES, INC.

Exhibit 7
Boeing Company C-6 Facility Layout
Proposed and Contingency Monitoring Well Locations



INTEGRATED
Environmental Services, Inc.
3390 Westerly Place, Suite 210
Newport Beach, CA 92660 (714) 852-9050

TITLE:
Boeing Company C6 Facility Layout
Proposed and Contingency Monitoring Well Locations

DWN: JL	DES.: JL	PROJECT NO.: 2363
CHKD: CS	APPD: JH	FIGURE NO.: EXHIBIT-7
DATE: 8-18-97	REV.: 2	

F:PROJECTS\MDC6\PRGDOCS\C6-ILM_GWMONITORING/FIGS

BOE-C6-0025654

COPY

January 29, 1998

Cal/EPA

Department of Toxic Substances Control

1011 N. Grandview Ave. Glendale, CA 91201

Carol A. Yuge
Deputy Director
Lockheed Martin Corporation
Environment, Safety &Health
Burbank Program Office
2550 N. Hollywood Way, 3rd Floor
Burbank, CA 91505-1055

Pete Wilson
Governor

Peter M. Rooney
Secretary
for Environmental Protection

Dear Ms Yuge:

WORK PLAN FOR INVESTIGATION OF OFF-SITE CONTAMINATION: LOCKHEED MARTIN CORPORATION, TORRANCE, CALIFORNIA (EPA ID. NO. CAD030398622)

The Department of Toxic Substances Control (DTSC) reviewed the work plan submitted by Lockheed Martin Corporation (LMC) for an approval. The work plan was prepared for investigating the offsite groundwater contamination originated from LMC. The work plan is entitled "Phase I Groundwater Characterization Work Plan, Boeing Realty Corporation C-6, Parcel A, Los Angeles, California."

Attached is a copy of the DTSC's comments on the work plan. Please revise the work plan according to the comments and submit to DTSC for an approval by March 16, 1998. Should you have any question regarding this letter, please contact Ms. Chia-Rin Yen at (818) 551-2182.

Sincerely,

Yolanda M. Garza
Unit Chief
Southern California Permitting Branch

enclosure

B. P. O.
DATE REC'D. 2/2/98
WBS # 22
COPIES TO: Jensen, Johnson, Yuge, Reg Log

cc: Mr. Jim Ross
Regional Water Quality Control Board
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Monterey Park, California 91754-2156

Mr. Hadar Plafkin
Department of Planning
City of Los Angeles
220 N. Figueroa Street
Los Angeles, California 90012

Mr. Jeff Dhont
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

John R. Johnsen
Lockheed Martin Corporation
Environment, Safety &Health
Burbank Program Office
2550 N. Hollywood Way, 3rd Floor
Burbank, CA 91505-1055

M E M O R A N D U M

Cal/EPA

Department of Toxic Substances Control

1011 N. Grandview Ave.
Glendale, CA 91201

Pete Wilson
Governor

Peter M. Rooney
Secretary
for Environmental
Protection

TO: Chia-Rin Yen
Permitting Branch

FROM: Alfredo Zanoria, R.G.
Geological Services Unit

DATE: January 13, 1998

SUBJECT: Phase I Groundwater Characterization Workplan, Boeing Realty Corporation

---

The Geological Services Unit (GSU) has reviewed the document Phase I Groundwater Characterization Workplan, Boeing Realty Corporation C-6, Parcel A Los Angeles California, dated October 1997 (the Workplan). The workplan was prepared by Integrated Environmental Services Inc. per agreement between Lockheed Martin Inc. and Boeing Realty Corp. to investigate the offsite extent of groundwater contamination originating from the Lockheed Martin property (Formerly International Light Metals Facility) into the Boeing facility. The report was prepared in cooperation with Geraghty & Miller, Inc., consultant to Lockheed Martin.

The following are GSU's comments:

1. This reviewer is unfamiliar with past and present conditions within the Boeing facility that might have a bearing on the current investigations, specifically the potential for commingling of plumes from the two facilities. The Workplan should provide a <u>brief</u> discussion about the results of groundwater investigation within the Boeing property, including the chemicals of concern and the extent of contamination. Please provide a map of the contaminant plumes. } LM site as well

2. The Workplan should revise its strategy for placement of new monitoring wells. The concept of arranging wells according to "vector directions" is not standard practice in groundwater investigations, and does not offer any apparent advantage to the conventional methods. Instead of using groundwater flowpath as the main consideration, the proposal restricts well placement along "vector" lines that are defined by the orientation of the fence, with subsidiary lines projecting at 45°. As a result, some areas are covered by wells spaced too close together

(e.g., DAC-P1, BP-04, BP-07 and BP-01; BP-11 and BP-05), while leaving large gaps in other areas (e.g., between BP-10 and BP-04; BP-05 and BP-02). The conventional method is still preferable, which relies on "eyeballing" to achieve optimum coverage of the downgradient area, using the minimum of wells but strategically placed to yield the maximum data value. The wells may be arranged in a pattern of concentric half-rings, or an orthogonal grid, or some combination of both.

3. Page 3-4: "Prior to the installation of permanent monitoring wells, temporary test wells will used (sic) to delineate the horizontal extent of...plumes."

Page 3-6, 2nd par.: "The monitoring wells will be constructed using threaded, 2-inch-diameter (temporary wells) or 4-inch-diameter (permanent wells),...(PVC) casing."

The Workplan is unclear about the nature of these temporary wells and the determination process involved in converting temporary wells to permanent. Does the temporary well consist simply of the assembled well casing lowered into an open borehole and then sampled? Or would a filter pack be built around the screen interval of the "temporary well"? If the objective is to achieve quick characterization with minimum compromise on water quality, a better alternative is to use a hydropunch sampler driven ahead of the borehole. With this method, several depth-discrete samples can be collected from the saturated zone, which can then be used for determining screen placement of depth-discrete wells.

Unless this area of the Boeing facility is already well defined stratigraphically, continuous coring should be conducted in selected wells. However, all wells should be continuously cored as the saturated zone is reached.

already done reference BPCS 2 BB report

The Workplan should also specify whether an on-site laboratory will be used, or a fixed laboratory with quick turnaround time to allow timely decision-making.

4. Page 3-6, 2nd par.: "Each...well will be constructed with two slotted intervals. One...is to be from ten feet above...to 15 feet into the saturated zone. The other...is from 20 to 40 feet below the saturated zone."

   This well design is not acceptable. If the purpose is acquire characterization of the plume from different levels of the formation, such data is compromised by the mixing of groundwater within the well casing. A separate well should be targeted for each depth interval. Several well casings may be installed within the same borehole (nested well system) as long as complete hydraulic separation between each screen interval is ensured. A preferred alternative is to have separate boreholes for each depth-discrete well (clustered well system). } agree

5. The proposed method of well development only describes using a bailer and centrifugal pump. The experience of this GSU staff is that a combination of pumping and surging would be required to properly develop the well, given the type of soils at this site. Unless this proposal is based on actual experience at the Boeing facility, please revise this proposal appropriately. Also, take note that DTSC standards require that wells be developed until turbidity stabilizes at around 5 NTUs or less (not 50 NTUs as proposed). } Target Only can do

6. The Sampling and Analysis Plan does not include a provision for sampling and analysis of soils from well boreholes. These borings provide an opportunity to collect soil data that can be used to eliminate the possibility of other sources for groundwater contamination. Soil samples should be collected where there are obvious indications of contamination (staining, odors, PID detections) and from pre-established intervals. Samples should be analyzed for all constituents of concern present in both ILM and Boeing facilities. } Soil not needed already done 2BB

7. For the initial set of groundwater samples, the GSU recommends that each well be analyzed for all the known groundwater constituents present in both ILM and Boeing facilities. This is to establish a

broad information baseline that can be used to assess potential commingling of plumes, and from which a more focused sampling plan can be designed for subsequent monitoring.

8. Please provide details about the procedure and equipment for the collection of filtered and unfiltered metal samples.

9. All geologic reports and workplans should be signed by a California Registered Geologist or Professional Civil Engineer.

The GSU also reviewed comments prepared by the Los Angeles Regional Water Quality Control Board (see attachment). The GSU endorses the Water Board's memo and requires a response for all listed comments, except where the issue is already covered by the GSU's comments above. The Workplan should address the following bullet items in the Water Board memo: 3, 4, 5, 6, 10, 11, 12, and 14.

CONCLUSION

The GSU finds the subject Workplan inadequate for approval. Boeing/Lockheed Martin should address all the abovelisted comments and revise the Workplan accordingly.

If you have any questions or comments, please do not hesitate to call me at 562-590-5538.

cc: Karen T. Baker
CRWQCB-LA

State of California

Environmental Protection Agency

Memorandum

To : Ms. Karen Baker, Unit Chief
Southern California Permitting Branch
Department of Toxic substance Control
245 West Broadway, Suite 425
Long Beach, California 90808

Date: January 12, 1998

File : 100.315

From : CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—LOS ANGELES REGION
101 Centre Plaza Drive, Monterey Park, CA 91754-2156
Telephone: (213) 266-7500

Subject :

PHASE I GROUNDWATER CHARACTERIZATION WORKPLAN - BOEING REALTY CORPORATION C-6 FACILITY, PARCEL A

We have received and reviewed the Phase I groundwater Characterization Workplan for the Boeing Reality Corporation C-6 Facility, Parcel A, dated October 17, 1997. Our comments, a draft of which was forwarded to you, for discussion, on November 4, 1997, are as follows:

1. Please note, we plan to charge our oversight costs for this review and subsequent field work to the BRC PCA number currently in use. We will segregate charges made to ILM and BRC.

2. Workplans and reports submitted for this Board's approval must be signed by a California Registered Geologist, Engineer, or Certified Engineering Geologist. Please include a signature page for the document.

3. Page 1-1 states that this investigation will provide information on the vertical extent and concentration of the chemicals of concern (COC). This workplan addresses the lateral extent of COCs in the shallow Bellflower aquitard only. The COC at this site have the potential to impact aquifers below the Bellflower aquitard. The workplan should be modified to address the deeper aquifers or, at a minimum, defer investigation of the deeper units to a subsequent phase. defer deeper aquifer investigation

4. Section 1.3 notes that the Bellflower aquitard extends to 100 feet bgs and the Gage aquifer is encountered at 150 feet bgs. Please address the missing section. discontinuous strata not so specific

5. Bullet 4 on page 3-1 states that an evaluation of the "...potential for the downward migration of impacted groundwater from the first encountered groundwater to the underlying aquifers..." was conducted in 1996. Please provide us with the results of the evaluation. LMS to provide language

6. Add hexavalent chromium to the COCs listed in paragraph 1, on page 3-4. ok

Ms. Karen Baker, Unit Chief
Page 2

7. There is no correlation between the vectors shown in Exhibit-7 and the narrative on page 3-4. Please modify either Exhibit-7 or the text.

8. The location of sampling point BP-03, located 1,050 feet downgradient from DAC-P1, should be reevaluated. Propose a location that will provide data pertinent to both the lateral extent of COCs, and co-mingling of groundwater plumes, if any. Same as DTSC# 2

9. Please state the purpose of the dual screen intervals proposed on page 3-6. Clarify if the intent is to separate the Bellflower aquitard into shallow and deep zones. If so, identify whether packers will be used to separate the screened intervals. Same as DTSC # 4

10. The proposed monitoring wells will penetrate the entire thickness of the Bellflower aquitard, according to the unit thicknesses presented on page 1-5. Identify what precautions, if any, will be in place to prevent screened intervals from creating hydraulic connections, and resulting cross-contamination, between the Bellflower aquitard and underlying units. depth of well field set protocol to be stated ranges of depth in report

11. Paragraph 2 on page 1-6 should state that a groundwater flow on the BRC property appears to be controlled, or influenced by a persistent trough or depression along the eastern boundary. cite previous reports summary

12. Define SOP Section 4.2 should include a sequence for purging and sampling the proposed monitoring wells.

DTSC# 7 / 13. BRL-5 COCs Include all COCs in the initial phase of this investigation. The list of COCs may be revised during subsequent phases as appropriate.

14. Briefly discuss the proposed contents of the monitoring and sampling reports identified on page 5-1. The contents should include isoconcentration maps for each COC, note trends identified, discuss significant changes noted, and provide recommendations for future work, if necessary. Standard report format

Should you have any questions regarding the above comments, please contact Hugh Marley at (213) 266-7669.

Keith I Ellroy for

J.E. ROSS, Unit Chief
Site Cleanup Unit