REMEDIAL INVESTIGATION/REMEDIAL ACTION PLAN INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA

January 15, 1990

A Report Prepared for:

Industrial Asphalt
53 El Charro Road
P.O. Box 636
Pleasanton, California 94566

REMEDIAL INVESTIGATION WORKPLAN/REMEDIAL ACTION PLAN, INDUSTRIAL ASPHALT, PLEASANTON, CALIFORNIA

Kleinfelder Job No. 10-1682-05

by

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Date 8 Febr. 90

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Copies 1

To Mr. Gil Wistar

Alameda County Dept. of Health Services

Hazardous Materials Division

80 Swan Way, Room 200

Oakland CA 94621

Subject RI/RAP Report, Ind. Asphalt

We are sending ☑ Attached ☐ Under separate cover

The following: Attached please find corrected Table 2 (page 19). This page should replace appropriate page in our report "Remedial Investigation / Remedial Action Plan, Industrial Asphalt, Pleasanton, California" dated 15 January 1990.

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Remarks We apology for any inconvenience this may create. Please call us if you have any questions.

By Krys Jesierek

TABLE 2

SUMMARY OF ANALYTICAL RESULTS
SOIL SAMPLES
INDUSTRIAL ASPHALT

Date	Boring No.	Depth (feet)	TPH-D (mg/kg)	PCBs (µg/kg)
3-25-87	B-1	17	170	ND
3-25-87	B-2	5/25[1] 45	ND 4,600	ND 30
3-25-87	B-3	15	ND	ND
3-25-87	B-5	5/20[2] 45	ND 1,800	ND ND
3-25-87	B-6	5/20[2] 45	ND 1,000	ND 73
3-25-87	B-7	5/20[2] 45	ND ND	ND ND
7-30-87	PT-1	[3]	300	140
9-20-87	S-1[4]	15	29,000	510
9-20-87	S-2[5]	14	2,000	ND
9-20-87	S-3[5]	15	26	ND
9-20-87	S-4[5]	14	1,500	ND
9-20-87	S-5[5]	15	ND	ND
9-20-87	S-6[5]	14	2,300	ND
9-20-87	S-7[5]	15	ND	ND
9-20-87	S-8[5]	20	150,000	ND
9-20-87	S-9[4]	12	ND	ND
9-20-87	S-10[4]	17	ND	ND
9-20-87	S-11[4]	15	ND	ND
9-20-87	S-12[4]	16	ND	ND
9-20-87	S-13	[6]	9,000	ND
7-7-89	MW-11	65/70[7] 75	21 50	NT NT
7-11-89	MW-9	70	90[8]	NT
7-13-89	MW-10	75	120[8]	NT

1. INTRODUCTION

This Remediation Investigation (RI) work plan and Remedial Action Plan (RAP) have been prepared by Kleinfelder, Inc., on behalf of Industrial Asphalt, Inc., as part of their remedial activities of the site located at 52 El Charro Road in Pleasanton, California. This report was prepared to be consistent with the October 1988 Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) - Ref. 1.

The planned work consists of the following major tasks:

- Collect and review data necessary to assess soil and ground water quality
- Assess the nature and extent of affected soil and ground water at the site
- Evaluate the potential hazards and risks to public health and the environment that may result from constituents of concern at the site
- Conduct field investigations to collect site specific data necessary to meet the overall RI objectives
- Identify the applicable remediation criteria and provide a quantitative basis for selection of an effective Remedial Action Plan (RAP)
- Utilize the results of the RI to ensure that remedial alternatives are identified, developed, screened, and evaluated in a systematic manner
- Develop and evaluate the remedial action alternatives with respect to public health, technical, environmental, institutional, and cost considerations

- Provide an analysis that will support the selection of the remedial alternatives which are technically feasible and which will provide the necessary cost-effective protection of public health and the environment

- Provide a description of the activities required to design, install, and operate systems for soil and ground water remediation.

The work plan presented in this document incorporates tasks, required by the EPA RI/FS process, which are applicable to the Industrial Asphalt site. These tasks address general requirements for project plans, RI/RAP reports, and technical requirements for both the remedial investigation and the remedial action plan.

2. INITIAL SITE EVALUATION

2.1 SITE DESCRIPTION

Industrial Asphalt, Inc., is an asphalt manufacturing company located at 52 El Charro Road, Pleasanton, California. A regional locality map is presented as Plate 1. The site location is presented on Plate 2.

Industrial Asphalt is a California based company currently employing 6 employees at its Pleasanton facility. The company has been at the site since 1963. The product manufactured, at the 53 El Charro Road facility, includes asphalt for industrial, commercial and residential purposes.

The manufacture of asphalt at the facility involves the combination of approximately 5682 pounds of rock material with approximately 318 pounds of heavy hydrocarbon oil per 6000 pound batch of asphalt product. Diesel oil is compatible with this process when used in controlled amounts.

At the present time, no underground storage tanks containing hazardous materials are reported onsite or in the immediate vicinity of the Industrial Asphalt site.

2.2 SITE HISTORY

Industrial Asphalt maintained six underground asphalt and two underground diesel storage tanks at the facility (Plate 3). The diesel product purchased during 1983 and 1984 was used as a burner fuel in its batch plant. Following 1984, the plant began utilizing natural gas due to its lower cost. In 1985, a leaking fill pipe serving the diesel tanks was identified and repaired.

Upon removal of these two diesel tanks (6,700 and 4,920 gallon capacities) in February 1987, diesel product was observed in the bottom of the excavation. Subsequent chemical analysis of the product indicated the presence of total petroleum hydrocarbons as diesel (TPH-D) at a concentration of 340,000 mg/kg and polychlorinated biphenyls (PCBs) at a concentration of 12 mg/kg. Approximately 5,000 gallons of a mixture of diesel product and water was removed and disposed of at Class I disposal facility. At this same time, two adjacent asphalt tanks were also excavated and removed (Ref. 2).

In March 1987, seven soil borings were drilled by Kleinfelder, Inc., at the locations around the tank farm (Plate 3). Several soil samples were collected to a depth of 45 feet excepting areas where free product was encountered. Selected samples were analyzed for the presence of TPH-D and PCBs. Diesel product was identified in several borings at a depth of 45 feet. The diesel concentrations ranged from 170 mg/kg to 4,600 mg/kg of TPH. PCBs concentrations in two borings ranged from .030 mg/kg to .073 mg/kg (Ref. 2).

Three ground water monitoring wells, namely MW-1, MW-2, and MW-3, were installed, developed and sampled in June 1987. At the same time, one soil sample of the backfill gravel was obtained. Plate 4 shows approximate locations of the three wells and the soil sample. Chemical analyses for TPH-D and PCBs on the three water samples and one soil sample revealed that the contaminants of concern have migrated to the ground water table, and have contaminated ground water. The PCBs analysis on the free product sample collected from well MW-2 indicated 18 mg/l as Aroclor 1260 (Ref. 3).

In September 1987, the four remaining underground tanks used for asphalt storage and contaminated backfill were excavated . TPH-D in samples of soil and backfill excavated during the tank removal ranged from 1,500 mg/kg to 150,000 mg/kg. Closure samples (Plate 5) representative of the soil remaining in the excavated area had 26 mg/kg TPH-D or had no-detectable concentrations. PCBs were detected at concentration of .51 mg/kg in one sample only. Disposal of excavated soils containing TPH-D in concentration in excess of 1,000 mg/kg was by onsite recycling. Typically, TPH-D concentrations in the ground water samples were less than 100 mg/l, with PCBs concentrations less than .0057 mg/l (Ref. 4).

A soil gas vapor survey was conducted to aid in plume definition in June 1988. Collected data from the survey were used to identify the locations of five additional ground water monitoring wells installed at the site. A sample of free product collected from well MW-2 on 15 July 1988 indicated that the gross composition of the free product is comparable to a diesel standard. Analysis for PCBs indicated a concentration of 25 mg/kg, comparable to analytical results for a sample analyzed on 7 August 1987, which indicated 18 mg/kg of PCBs in the free product (Ref. 5).

The review of the Status Report No. 4 (Ref. 6) by the ACDEH staff prompted a letter from their organization (Ref. 7) requesting more subsurface investigation at the Industrial Asphalt site.

Two ground water monitoring wells and one observation well were installed in July 1989 at the project site (Plate 6) in accordance with our work plan dated 9 June 1989 (Ref. 8). In addition, a staff gauge was installed in the gravel pit located north of the site to monitor elevation of surface water. All the existing wells sampled for benzene, toluene, xylenes and ethylbenzene (BTXE) indicated the absence of these compounds in the analyzed samples.(Ref. 9).

Monitoring of the free product thickness and depth to ground water as well as the onsite ground water monitoring well sampling and sample testing for TPH-D and PCBs concentrations have been performed on an approximate monthly basis since well installation. Collected data show a consistent decreasing trend in the ground water table elevation and free product thickness.

In October 1989, ACDEH reviewed the Industrial Asphalt file and consulted with the San Francisco Bay California Regional Water Quality Control Board (CRWQCB) in order to develop guidelines for further characterization and remediation at the site as presented in Reference 10.

2.3 ENVIRONMENTAL SETTING

2.3.1 Physical Setting

The Industrial Asphalt facility is in the Amador Subbasin of the Amador Valley, approximately 35 miles southeast of San Francisco. As such, it is a portion of the Alameda Creek watershed which is completely surrounded by hills of the Diablo Range. Most of the subbasin is used for agriculture and gravel extraction. The site is bordered on the north by a gravel pit and El Charro Road on the east. Neighboring facilities and structures include Jamison Co. to the south and west.

2.3.2 Topography and Drainage

Topographic relief across the 53 El Charro Road site is minor and ground surface elevations range from approximate elevation 380 feet above mean sea level (AMSL) to approximate elevation 376 feet AMSL, northeast to southwest across the Industrial Asphalt's property, a distance of about 700 feet (0.5%).

There are no drainage facilities at the site. Storm water infiltrates into the ground, flows with the surface gradient, or creates ponds on the ground surface.

The area not covered by structures is not paved and is heavily used for traffic, storage and automobile parking.

2.3.3 Geology and Hydrology

2.3.3.1 Regional Geology and Hydrology

The Industrial Asphalt site is located in the northern part of the Alameda County. The oldest water-bearing formation in the area is the Tassajara Formation. This formation is of Pliocene age and occurs north of Livermore-Amador Valley and also beneath the central portion of the valley at depths ranging from 200 feet to 750 feet. Postdepositional deformation has folded and tilted the beds of the Tassajara Formation into a number of northwest-southeast trending anticlines and syclines. These beds are composed of sandstone, siltstone, shale, conglomerate, and limestone. Wells tapping the Tassajara Formation yield only sufficient water for domestic, stock or limited irrigation purposes.

Ground water contained in this formation is of sodium bicarbonate character of moderately good quality (Ref. 11).

The next youngest geologic unit in Livermore-Amador Valley is the Livermore Formation, which is of Plio-Pleistocene age. The formation occurs generally as beds of clayey gravel in a sandy clay matrix. To the south of Livermore-Amador Valley these beds dip toward the north. They are nearly flat under the valley, and they dip gently to the south along the north edge of the valley where they lap onto the Tassajara Formation. This formation is a significant water-bearing formation in the valley area. Yields to wells are adequate for most irrigation, industrial, or municipal purposes. Like the underlying Tassajara Formation, ground water in the Livermore Formation is of sodium bicarbonate character and of good quality (Ref. 11).

The surficial valley-fill materials overlie the Tassajara and Livermore Formations and range in thickness from a few feet to nearly 400 feet. These alluvial materials are composed of unconsolidated sand, gravel, silt, and clay, all of Holocene age. Wells located in these materials yield both confined and unconfined ground water. These materials generally produce an excellent quality sodium, calcium, and magnesium bicarbonate water. Exceptions are local areas containing significant quantities of chloride and nitrate ions (Ref. 11).

The Amador Subbasin is bounded on the east by the middle zone of the Livermore Fault and on the west by the Pleasanton Fault. The north boundary, east of Santa Rita Road, is formed by a permeability barrier which has been formed by the interfingering of alluvial deposits. West of Santa Rita Road, the northern boundary is formed by the Parks Fault. The south boundary of the subbasin is formed partly by the contact of the water-bearing Livermore Formation with non-water bearing rocks (Ref. 11).

Amador Subbasin is drained by Arroyo Valle and Arroyo Mocho, the two principal streams of Livermore-Amador Valley. Minor streams such as Tassajara Creek, Cottonwood Creek, and Arroyo las Positas also cross the subbasin. All streams drain in a generally westward direction.

Much of the ground water produced in the Amador Subbasin is derived from thick water-bearing zones in the valley-fill material. These aquifers are composed of sandy gravel and sandy clayey gravel that are up to 150 feet in thickness. Separating the aquifers are confining beds of silty clay that are up to 50 feet in thickness (Ref. 11).

Regional ground water movement in the valley is generally in a northwesterly and westerly direction. However, locally, ground water flow direction is in the general direction of the gravel pits (Ref. 12, 13). The gravel operations pump large quantities of water from the pits to facilitate gravel mining, thus creating a large artificial depression in the valley ground water system. The gravel pit operators also back fill some of the pits with silt and clay to minimize further recharge and ground water movement in the area.

In most of the valley, vertical flow is minimal because of the many clay layers that tend to separate parts of the permeable aquifer material. The clay layers are not continuous, however, and some vertical flow does occur. In much of the southern parts of the Amador and Mocho II subbasins, the clay layers are less extensive and vertical flow is more apparent from water-quality measurements (Ref. 12).

Until 1962, most of the water used in the Livermore-Amador Valley was provided by ground water, with small quantities supplied by local streams. This almost total dependence on ground water caused a serious overdraft in the valley, with water levels dropping 100 feet or more in some areas. In order to correct this overdraft situation, water has been provided from the South Bay aqueduct since 1962. The South Bay aqueduct water is treated for domestic and industrial uses. Also, water from the aqueduct is released to Arroyo Mocho and Arroyo Valle for ground water recharge (Ref. 12).

Available data indicate that the yield of the production wells in the Amador Subbasin ranges from approximately 40 to 2,800 gallons per minute. The specific capacity ranges from 1.1 gallons per minute per foot of drawdown for a well drilled in the Livermore Formation to 217 gallons per minute per foot of drawdown for a well drilled in the valley-fill (alluvial) materials. This corresponds to transmissivities in the range of 75,000 to 375,000 gallons per day (Ref. 11).

2.3.3.2 Local Geology and Hydrology

Materials, which directly underlie the Industrial Asphalt site, consist primarily of fine to coarse-grained sediments, chiefly sand, gravel, silt and clay. Plates 12 and 13 in Reference 2 present geologic cross sections which show the soil conditions within the tank backfill and soil stratigraphy adjacent to the tank backfill area. Three cross sections, which illustrate lithology of the deeper local subsurface are presented on Plates 5 and 6 in Reference 6.

Material encountered in the borings was fairly continuous and correlates well between the boreholes. Relatively fine grained sediment, consisting of silty clays and silt, were encountered at a depth of approximately 25 feet below grade. Underlying these fine grained sediments, coarse materials consisting of sandy gravels and gravelly sands were encountered the total depth of deep borings (110 feet). Some silty clayey sands and gravels were also observed. The sand was primarily fine to coarse grained and rather poorly graded. The gravels encountered were typically subrounded to rounded and ranged from 1/2 to 2 inches in diameter. However, cobbles to 5 inches maximum diameter were also encountered in the borings.

Local geologic and hydrologic conditions are very consistent with the regional geology and hydrology. Materials encountered at the site are of alluvial origin. The upper 25 feet of deposits seems to be continuous and of rather low permeability. Also, there is an apparently less permeable layer at an approximate depth of 60-70 feet. However, coarse sand and gravel beneath both layers are of moderate to high permeability.

Ground water level measured at the site has fluctuated considerably since well installation and ranged from approximately 76 feet in 1987 to approximately 95 feet below surface in 1989. Table 1 presents depth to water data obtained from the site monitoring wells. Ground water levels hydrographs for monitoring wells MW-1 through MW-11 are presented on Plates 7 through 17, respectively.

TABLE 1
MONITORING PARAMETERS
INDUSTRIAL ASPHALT

Well	Date	Depth to Water[1] (ft)	Ground Water Elevation[2] (ft)	Product Thickness (ft)	TPH as Diesel (mg/l)	TPH as Waste Oil (mg/l)	PCBs (μg/l)
MW-1	06-11-87	75.0	304.41	NE	NT	NT	NT
	07-09-87	75.9	303.51	<0.1	NT	NT	NT
	08-06-87	79.1	300.31	3.2	350	NT	5.7
	09-29-87	79.3	300.11	1.84	510[3]	NT	22[3]
	10-30-87	78.23	301.18	0.95	780(3)	NT	22[3]
	11-30-87	77.68	301.73	1.10	1800[3]	NT	56[3]
	12-21-87	79.53	299.88	2.52	55	NT	1
	01-25-88	77.88	301.53	1.63	96	NT	ND
	02-25-88	79.46	299.95	2.49	120	NT	ND
	03-18-88	81.61	297.80	2.93	3.6	NT	ND
	04-27-88	81.10	298.31	2.26	23	NT	ND
	05-20-88	82.97	296.44	2.29	NT[6]	NT	NT[6]
	06-22-88	83.48	295.93	0.93	NT	NT	NT
	07-26-88	85.78	293.63	0.99	NT	NT	NT
	08-11-88[5]	84.55	294.86	0.05	NT	NT	NT
	08-15-88[5]	87.90	291.51	0.05	NT	NT	NT
	08-26-88	84.80	294.61	0.05	NT	NT	NT
	10-04-88	84.84	294.57	0.11	NT	NT	NT
	10-28-88	84.94	294.47	0.04	NT	NT	NT
	12-22-88	84.92	294.49	TRACE	NT	NT	NT
	01-26-89	DRY	NA	NE	NT	NT	NT
	03-02-89	84.74	294.67	NE	NT	NT	NT
	04-07-89	DRY	NA	NE	NT	NT	NT
	05-08-89	DRY	NA	NE	NT	NT	NT
	06-01-89	DRY	NA	NE	NT	NT	NT
	07-05-89	DRY	NA	NE	NT	NT	NT
	08-15-89	DRY	NA	NE	NT	NT	NT
	09-25-89	68.56	310.85	0.04	130	37	1.6
	10-17-89	DRY	NA	NE	NT	NT	NT
	11-28-89	DRY	NA	NE	NT	NT	NT
	12-27-89	DRY	NA	NE	NT	NT	NT

TABLE 1 (continued)
MONITORING PARAMETERS
INDUSTRIAL ASPHALT

Well	Date	Depth to Water[1] (ft)	Ground Water Elevation[2] (ft)	Product Thickness (ft)	TPH as Diesel (mg/l)	TPH as Waste Oil (mg/l)	PCBs (μg/l)
MW-2	08-06-87	NE	NA	14.0	NT	NT	NT
	09-29-87	NE	NA	12.05	NT	NT	NT
	10-30-87	82.67	297.04	5.34	1100[3]	NT	14[3]
	11-30-87	84.12	295.68	7.79	1100[3]	NT	33[3]
	12-21-87	84.28	295.52	7.31	27	NT	2
	01-25-88	84.26	295.54	8.07	150	NT	ND
	02-25-88	84.21	295.59	7.28	15	NT	ND
	03-18-88	86.18	293.62	7.56	3.6	NT	ND
	04-27-88	85.57	294.23	5.64	6.1	NT	ND
	05-20-88	88.48	291.32	6.93	NT[6]	NT	NT[6]
	06-22-88	87.30	292.50	4.52	NT	NT	NT
	07-26-88	NE	NA	5.02[4]	NT	NT	NT
	08-11-88[5]	88.70	291.10	1.40	NT	NT	NT
	08-15-88[5]	88.05	291.75	0.35	NT	NT	NT
	08-26-88	88.35	291.45	0.10	NT	NT	NT
	10-04-88	89.46	290.34	0.03	NT	NT	NT
	11-28-88	NE	NA	NE	NT	NT	NT
	12-22-88	89.10	290.70	NE	NT	NT	NT
	01-26-89	87.83	291.97	SHEEN	NT	NT	NT
	03-02-89	87.55	292.25	0.02	NT	NT	NT
	04-07-89	86.68	293.12	0.01	NT	NT	NT
	05-08-89	DRY	NA	NE	NT	NT	NT
	06-01-89	DRY	NA	NE	NT	NT	NT
	07-05-89	DRY	NA	NE	NT	NT	NT
	08-15-89	DRY	NA	NE	NT	NT	NT
	09-25-89	71.39	308.41	SHEEN	100	43	3.5
	10-17-89	DRY	NA	NE	NT	NT	NT
	11-28-89	DRY	NA	NE	NT	NT	NT
	12-27-89	DRY	NA	NE	NT	NT	NT

TABLE 1 (continued)
MONITORING PARAMETERS
INDUSTRIAL ASPHALT

Well	Date	Depth to Water[1] (ft)	Ground Water Elevation[2] (ft)	Product Thickness (ft)	TPH as Diesel (mg/l)	TPH as Waste Oil (mg/l)	PCBs (μg/l)
MW-3	08-06-87	75.00	303.54	NE	0.6	NT	ND
	09-29-87	78.77	299.77	1.84	7.6	NT	2.7
	10-30-87	78.44	300.10	2.11	1100[3]	NT	24[3]
	11-30-87	77.76	300.78	2.22	340[3]	NT	62[3]
	12-21-87	77.88	300.66	1.68	46	NT	2
	01-25-88	76.88	301.66	1.21	27	NT	ND
	02-25-88	77.80	300.74	1.60	6	NT	ND
	03-18-88	80.50	298.04	2.59	3.8	NT	ND
	04-27-88	79.40	299.14	1.32	4.5	NT	ND
	05-20-88	81.48	297.06	1.73	14	NT	4.7
	06-22-88	82.14	296.40	0.53	44	NT	4.3
	07-26-88	84.36	294.18	0.54	NT[6]	NT	NT[6]
	08-11-88[5]	86.45	292.09	0.50	NT	NT	NT
	08-15-88[5]	86.74	291.80	0.44	NT	NT	NT
	08-26-88	87.18	291.36	0.28	NT	NT	NT
	10-04-88	88.72	289.82	0.30	NT	NT	NT
	10-28-88	89.49	289.05	0.29	NT	NT	NT
	12-22-88	84.74	293.80	0.02	NT	NT	NT
	01-26-89	86.57	291.97	SHEEN	NT	NT	NT
	03-02-89	86.26	292.28	0.02	NT	NT	NT
	04-07-89	85.31	293.23	SHEEN	NT	NT	NT
	05-08-89	88.35	290.19	SHEEN	NT	NT	NT
	06-01-89	89.67	288.87	SHEEN	NT	NT	NT
	07-05-89	89.52	289.02	SHEEN	NT	NT	NT
	08-15-89	DRY	NA	NE	NT	NT	NT
	09-25-89	70.30	307.24	SHEEN	120	58	3.6
	10-17-89	DRY	NA	NE	NT	NT	NT
	11-28-89	DRY	NA	NE	NT	NT	NT
	12-27-89	DRY	NA	NE	NT	NT	NT

TABLE 1 (continued)
MONITORING PARAMETERS
INDUSTRIAL ASPHALT

Well	Date	Depth to Water[1] (ft)	Ground Water Elevation[2] (ft)	Product Thickness (ft)	TPH as Diesel (mg/l)	TPH as Waste Oil (mg/l)	PCBs (μg/l)
MW-4	04-08-88	76.59	299.67	NE	ND	NT	ND
	04-27-88	75.96	300.30	NE	NT	NT	NT
	05-20-88	77.71	298.55	NE	ND	NT	NT
	06-22-88	79.41	296.85	NE	ND	NT	ND
	07-26-88	81.74	294.52	NE	ND	NT	ND
	08-11-88[5]	83.80	292.46	NE	NT	NT	NT
	08-15-88[5]	84.06	292.20	NE	NT	NT	NT
	08-26-88	84.62	291.64	NE	ND	NT	ND
	10-04-88	86.16	290.10	NE	ND	NT	ND
	10-28-88	87.02	289.24	NE	0.46	NT	ND
	12-22-88	85.42	290.84	NE	0.6	NT	ND
	01-26-89	84.20	292.06	NE	ND	NT	ND
	03-02-89	84.06	292.20	NE	ND	ND	ND
	04-07-89	83.22	293.04	NE	ND	ND	ND
	05-08-89	86.18	290.08	NE	NT	NT	NT
	06-01-89	87.78	288.48	NE	ND	ND	ND
	07-05-89	89.86	286.40	NE	ND	ND	ND
	08-15-89	90.68	285.58	NE	ND	ND	ND
	09-25-89	69.68	306.58	NE	2.7	ND	ND
	10-17-89	89.69	286.57	NE	ND	0.7	ND
	11-28-89	92.01	284.25	NE	ND	ND	ND
	12-27-89	93.50	282.76	NE	ND	ND	ND
MW-5	04-08-88	86.76	295.79	NE	ND	NT	ND
	04-27-88	82.34	300.21	NE	NT	NT	NT
	05-20-88	84.38	298.17	NE	ND	NT	ND
	07-26-88	88.84	293.71	NE	ND	NT	ND
	08-11-88[5]	91.70	290.85	NE	NT	NT	NT
	08-15-88[5]	91.94	290.61	NE	NT	NT	NT
	08-26-88	92.88	289.67	NE	ND	NT	ND
	10-04-88	95.65	286.90	NE	ND	NT	ND
	10-28-88	97.32	285.23	NE	ND	NT	ND
	12-22-88	90.64	291.91	NE	ND	NT	ND
	01-26-89	91.29	291.26	NE	ND	NT	ND
	03-02-89	88.58	293.97	NE	ND	ND	ND
	04-07-89	87.95	294.60	NE	ND	ND	ND
	05-08-89	91.56	290.99	NE	NT	NT	NT
	06-01-89	94.85	287.70	NE	ND	ND	ND
	07-05-89	96.91	285.64	NE	ND	ND	ND
	08-15-89	98.93	283.62	NE	ND	ND	ND
	09-25-89	66.51	316.04	NE	0.7[7]	ND	ND
	10-17-89	98.83	283.72	NE	ND	ND	ND
	11-28-89	98.09	284.46	NE	ND	ND	ND
	12-27-89	>100	<282.55	NE	ND	ND	ND

TABLE 1 (continued)
MONITORING PARAMETERS
INDUSTRIAL ASPHALT

Well	Date	Depth to Water[1] (ft)	Ground Water Elevation[2] (ft)	Product Thickness (ft)	TPH as Diesel (mg/l)	TPH as Waste Oil (mg/l)	PCBs (μg/l)
MW-6	06-22-88	82.11	297.04	NE	17	NT	ND
	07-01-88	82.38	296.77	SHEEN	ND	NT	ND
	07-26-88	84.37	294.78	SHEEN	ND	NT	ND
	08-11-88[5]	86.46	292.69	SHEEN	NT	NT	NT
	08-15-88[5]	86.78	292.37	SHEEN	NT	NT	NT
	08-26-88	87.35	291.80	SHEEN	ND	NT	ND
	10-04-88	88.90	290.25	NE	ND	NT	ND
	10-28-88	89.72	289.43	NE	ND	NT	ND
	12-22-88	87.94	291.21	NE	9.3	NT	ND
	01-26-89	86.95	292.20	NE	ND	NT	ND
	03-02-89	85.91	293.24	NE	ND	ND	ND
	04-07-89	85.57	293.58	NE	ND	ND	ND
	05-08-89	88.60	290.55	NE	NT	NT	NT
	06-01-89	90.30	288.85	NE	ND	ND	ND
	07-05-89	92.35	286.80	NE	ND	ND	ND
	08-15-89	93.28	285.87	NE	ND	ND	ND
	09-25-89	70.24	308.91	NE	ND	0.6	ND
	10-17-89	91.98	287.17	NE	ND	ND	ND
	11-28-89	94.22	284.93	NE	ND	ND	ND
	12-27-89	95.90	283.25	NE	ND	ND	ND
MW-7	06-22-88	82.20	296.74	NE	140	NT	ND
	07-01-88	82.60	296.34	SHEEN	17	NT	ND
	07-26-88	84.65	294.29	SHEEN	ND	NT	ND
	08-11-88[5]	86.94	292.00	SHEEN	NT	NT	NT
	08-15-88[5]	87.27	291.67	NE	NT	NT	NT
	08-26-88	88.02	290.92	SHEEN	ND	NT	ND
	10-04-88	84.80	294.14	NE	ND	NT	ND
	10-28-88	90.76	288.18	NE	1.4	NT	ND
	12-22-88	88.05	290.89	NE	1.0	NT	ND
	01-26-89	87.21	291.73	NE	ND	NT	ND
	03-02-89	86.49	292.45	NE	22	9	ND
	04-07-89	84.97	293.97	NE	4	ND	ND
	05-08-89	88.39	290.55	NE	NT	NT	NT
	06-01-89	91.56	287.38	NE	ND	ND	ND
	07-05-89	92.75	286.19	NE	1.6	ND	ND
	08-15-89	94.28	284.66	NE	0.5	ND	ND
	09-25-89	67.40	311.54	SHEEN	2	0.9	ND
	10-17-89	93.40	285.54	NE	1.2	ND	ND
	11-28-89	94.90	284.04	NE	0.6	ND	ND
	12-27-89	98.42	280.52	NE	ND	ND	ND

TABLE 1 (continued)
MONITORING PARAMETERS
INDUSTRIAL ASPHALT

Well	Date	Depth to Water[1] (ft)	Ground Water Elevation[2] (ft)	Product Thickness (ft)	TPH as Diesel (mg/l)	TPH as Waste Oil (mg/l)	PCBs (μg/l)
MW-8	06-22-88	81.70	296.86	NE	NT	NT	NT
	07-01-88	82.00	296.56	SHEEN	ND	NT	ND
	07-26-88	86.19	292.37	2.44	87	NT	ND
	08-11-88[5]	87.22	291.34	1.27	NT	NT	NT
	08-15-88[5]	87.02	291.54	2.12	NT	NT	NT
	08-26-88	87.40	291.16	0.75	ND	NT	1.2
	10-04-88	88.93	289.63	0.43	NT[6]	NT	NT[6]
	10-28-88	89.71	288.85	0.37	NT	NT	NT
	12-22-88	87.70	290.86	0.13	NT	NT	NT
	01-26-89	86.52	292.04	SHEEN	NT	NT	NT
	03-02-89	86.30	292.26	0.01	NT	NT	NT
	04-07-89	86.41	292.15	0.01	NT	NT	NT
	05-08-89	88.45	290.11	0.01	NT	NT	NT
	06-01-89	90.29	288.27	0.02	81	ND	5
	07-05-89	92.22	286.34	0.03	8.8	4.2	ND
	08-15-89	93.08	285.48	SHEEN	12	6	0.9
	09-25-89	84.18[8]	294.38[8]	SHEEN	3.3	2	ND
	10-17-90	92.04	286.52	SHEEN	17	6.7	0.7
	11-28-89	94.40	284.16	NE	ND	ND	ND
	12-27-89	95.97	282.59	NE	0.4	ND	ND
MW-9[6]	08-15-89	92.95	284.45	NE	ND	ND	ND
	09-25-89	64.12	313.28	SHEEN	0.3[7]	ND	ND
	10-17-89	92.72	284.68	NE	NT	NT	NT
	11-28-89	NC	NA	NT	NT	NT	NT
	12-27-89	97.17	280.23	NE	ND	ND	ND
MW-10[7]	08-15-89	92.40	285.64	NE	ND	ND	ND
	09-25-89	70.62	307.42	NE	ND	ND	ND
	10-17-89	91.14	286.90	NE	ND	ND	ND
	11-28-89	93.35	284.69	NE	ND	ND	ND
	12-27-89	94.70	283.34	NE	ND	ND	ND
MW-11[8]	08-15-89	DRY	NA	NE	NT	NT	NT
	09-25-89	71.35	307.67	SHEEN	5.8	ND	ND
	10-17-89	DRY	NA	NE	NT	NT	NT
	11-28-89	DRY	NA	NE	NT	NT	NT
	12-27-89	DRY	NA	NE	NT	NT	NT

TABLE 1 (continued)

MONITORING PARAMETERS
INDUSTRIAL ASPHALT

Well	Date	Depth to Water[1] (ft)	Ground Water Elevation[2] (ft)	Product Thickness (ft)	TPH as Diesel (mg/l)	TPH as Waste Oil (mg/l)	PCBs (μg/l)
SG	09-25-89	1.10[9]	301.10[10]	NA	NA	NA	NA
	10-17-89	0.40[9]	300.40[10]	NA	NA	NA	NA
	11-28-89	1.50[9]	301.50[10]	NA	NA	NA	NA
	12-27-89	1.60[9]	310.60[10]	NA	NA	NA	NA

NOTES:

(1) Below top of casing
(2) Feet Above Mean Sea level (USGS Datum)
(3) These samples may have been contaminated; analytical results may therefore be suspect.
(4) Minimum thickness of product based on no water encountered within total depth of well.
(5) Pre- and post- well skimming demonstration; approximately two gallons of product skimmed from wells MW-2 and MW-8 on 08-11-88
(6) Sampling of ground water in wells MW-1, MW-2, MW-3, and MW-8 terminated due to the presence of free product in these wells
(7) "Weathered diesel" (includes higher molecular weight hydrocarbons that those typically contained in a diesel fuel)
(8) Measurement taken on September 18, 1989
(9) Reading on the staff gauge
(10) Surface water elevation in the pit (USGS Datum)

TPH Total Petroleum Hydrocarbons
PCBs Polychlorinated Biphenyls (as Aroclor 1260)
NE Not Encountered
ND Not Detected at or above laboratory detection limits
NA Not Applicable
SG Staff Gauge
NC Not Accessible

As indicated by the hydrographs, ground water table elevations at the site appear to be declining. However, within the overall pattern of decline, water elevations appear to fluctuate from month to month. These fluctuations do not appear to correlate with the rainy or dry seasons. It is possible that ground water levels in the area are affected by water pumping in gravel pits or by nearby high yield irrigation/industrial water wells.

However, as indicated by the data, ground water elevation rose significantly in September 1989. It is our understanding that ground water surface elevations in the wells were influenced by the artificial recharge from Arroyo Mocho (Ref. 14).

2.3.3.3 Hydraulic Properties

Since no pump test was performed on any of the Industrial Asphalt site wells, hydraulic conductivity and transmissivity or specific yield values for the alluvial aquifer beneath the site are not known at this time.

Potentiometric contour maps were developed and are presented in several our reports (e. g., Ref. 8, 9). Interpretation of the data indicates that ground water flowed in almost every possible direction since the measurements were obtained, i.e., since 1987. However, it seems that the predominant directions of ground water flow are towards northwest and northeast. Also, the water level measurements indicate that the hydraulic gradient changes, apparently affected by water pumping in the nearby gravel pits, at nearby high yield irrigation/industrial water wells or recharge from the Arroyo Mocho.

Ground water flow velocity can be calculated by using Darcy's Law. Assuming an effective porosity of 30%, a hydraulic conductivity of .001 m/s (.003 ft/s, Ref. 15), and a hydraulic gradient of .01, the effective velocity of ground water in the aquifer would be approximately 3 m/day (10 ft/day).

2.3.3.4 Local Ground Water Use

As discussed in Reference 6, a limited well canvass was performed by Kleinfelder, Inc., in January 1988. Of the forty one wells, which were discovered at that time and were located within a one mile radius of the site, there were fourteen listed as active wells. Of these fourteen active wells, five were water supply wells, four were monitoring wells, one was a domestic well, two were irrigation wells and two were industrial wells. Two wells, which were located closest to the Industrial Asphalt site, are water supply/industrial wells with screen intervals 135-160, 160-205 and 150-300, 350-500.

2.4 SITE CHEMICAL CHARACTERIZATION

2.4.1 Potential Primary Sources

Potential sources have been located onsite during investigations at the former sites of two diesel and six asphalt underground storage tanks. However, as discussed above, all the tanks were removed in 1987.

2.4.2 Soils

Soil samples collected during the tank removal and drilling programs were analyzed for total petroleum hydrocarbons as diesel (TPH-D) and polychlorinated biphenyls (PCBs). A summary of the soil analytical data is presented in Table 2. Sampling locations are shown on Plates 3, 4, and 5.

TABLE 2

SUMMARY OF ANALYTICAL RESULTS
SOIL SAMPLES
INDUSTRIAL ASPHALT

Date	Boring No.	Depth (feet)	TPH-D (mg/kg)	PCBs (g/kg)
3-25-87	B-1	17	170	ND
3-25-87	B-2	5/25(1) 45	ND 4,600	ND 30
3-25-87	B-3	15	ND	ND
3-25-87	B-5	5/20(2) 45	ND 1,800	ND ND
3-25-87	B-6	5/20(2) 45	ND 1,000	ND 73
3-25-87	B-7	5/20(2) 45	ND ND	ND ND
7-30-87	PT-1	(3)	300	140
9-20-87	S-1(4)	15	29,000	510
9-20-87	S-2(5)	14	2,000	ND
9-20-87	S-3(5)	15	26	ND
9-20-87	S-4(5)	14	1,500	ND
9-20-87	S-5(5)	15	ND	ND
9-20-87	S-6(5)	14	2,300	ND
9-20-87	S-7(5)	15	ND	ND
9-20-87	S-8(5)	20	150,000	ND
9-20-87	S-9(4)	12	ND	ND
9-20-87	S-10(4)	17	ND	ND
9-20-87	S-11(4)	15	ND	ND
9-20-87	S-12(4)	16	ND	ND
9-20-87	S-13	(6)	9,000	ND
7-7-89	MW-11	65/70(7) 75	21 50	NT NT
7-11-89	MW-9	70	90(8)	NT
7-13-89	MW-10	75	120(8)	NT

NOTES:

(1) Composite sample from depths of 5, 10, 15, 20, and 25 feet.
(2) Composite sample from depths 5, 10, 15, and 20 feet.
(3) Bulk sample of the tank backfill gravel.
(4) Closure sample from excavation sidewall.
(5) Closure sample from excavation floor.
(6) Composite sample of four of the stockpiled backfill.
(7) Composite sample from depths of 65 and 70 feet.
(8) Reported as waste oil.

As indicated by the data, elevated concentrations of TPH-D and PCBs were found at approximate depths of 45 feet in borings B-2, B-5, and B-6. In addition, high concentrations of these two compounds were found in samples PT-1 and S-1. TPH-D was found in the sidewall closure sample S-1 and excavation floor samples S-2, S-3, S-4, S-6, and S-8. However, contaminated soils were subsequently removed to the extent feasible to expose soils with low levels of contamination (Ref. 4).

Analyses on a composite soil sample of the stockpiled backfill indicated the presence of TPH-D at concentrations of 9,000 mg/kg. Hydrocarbon contaminated backfill was recycled onsite through the asphalt and batch plants (Ref. 4).

Chemical analyses on selected soil samples taken during drilling of bore holes MW-9, MW-10, and MW-11 indicate that hydrocarbon contaminated soils exists at those locations (Ref. 9).

A soil gas vapor survey was conducted to aid in plume definition. Analyses were conducted for total hydrocarbons, benzene, toluene, total xylenes, and carbon dioxide and methane which are natural biodegradation products of the diesel contaminant. Results of the soil gas survey are presented in Reference 5 (Table 5-1).

2.4.3 Free Product

Table 1 presents free product (FP) thickness levels over time. The data are graphically shown as FP hydrographs on Plates 7 through 17. It is evident that FP thickness in the existing monitoring wells onsite shows a consistent decreasing trend.

Maximum FP thickness at the site was 14 feet in monitoring well MW-2 on 6 August 1987, following that wells installation. Maximum FP thicknesses in monitoring wells MW-1 and MW-3 of 3.2 and 2.59 feet, respectively, were measured on 6 August 1987 and 18 March 1988, respectively. Maximum FP thickness in well MW-8 was 2.44 feet measured on 26 July 1988.

No FP has ever been found in the remaining monitoring wells MW-4, MW-5, MW-6, MW-7, MW-9, MW-10, and MW-11. However, there has been sheen detected in several wells including MW-6, MW-7, MW-9, and MW-11. Notwithstanding, sheen has been absent in these wells during the last three monthly sampling events.

As we hypothesized in the past (Ref. 6), it is possible that as water levels have dropped beneath the site, FP has been trapped in the interstices of the subsurface, spreading into the unsaturated zone. (Diesel's relatively high viscosity may aid in the retention of FP in the vadose zone.)

Two samples of FP were obtained from monitoring well MW-2 on 7 August 1987 and 15 July 1988. In both instances, hydrocarbon characterization analysis indicated that the gross composition of the FP is comparable to a diesel standard. Analysis for PCBs using EPA Method 8080 indicated concentrations of 18 mg/kg and 25 mg/kg, respectively.

2.4.4 Ground Water

Ground water quality monitoring by Industrial Asphalt on El Charro Road site has been conducted since 1987. The monitoring program has been developed gradually, with wells being added as required, based on the results of previous investigations. Since the monitoring program commencement, all collected ground water samples were analyzed for TPH-D and PCBs by a State certified analytical laboratory. Additionally, water samples from all wells were analyzed once for benzene, toluene, xylenes and ethylbenzene (BTXE).

Analytical data are presented in Table 1 and graphically on Plates 18 through 28. Laboratory results for BTXE are not shown in this table; however, the analyses on water samples indicated no presence of the subject compounds in the samples.

In general, concentrations of the target compounds including TPH-D, TPH-Waste Oil (TPH-WO), and PCBs have declined as ground water surface elevation beneath the site dropped. This fact can support our hypothesis of the released FP being trapped in the unsaturated zone and, possibly, moving slowly downwards.

2.4.4.1 TPH-D

According to the data in Table 1, concentrations of TPH-D in ground water samples obtained from well MW-1 ranged from 1,800 mg/l on 30 November 1987 to 3.6 mg/l on 18 March 1988. The data also indicate that TPH-D concentrations in samples from wells MW-2 and MW-3 ranged from 1,100 mg/l in both wells to 3.6 mg/l on 18 March 1987 and .6 mg/l on 6 August, respectively. However, these wells, located next to the tank pit excavation, have not been sampled since 20 May 1988, with one exception, i.e., 25 September 1989.

The wells were not sampled due to the presence of FP in the wells or an insufficient volume of water in the wells to obtain a representative sample. Water samples were collected on 25 September 1989 since ground water level rose, likely as a result of an artificial recharge from Arroyo Mocho, as discussed in Section 2.3.3.2. Additionally, due to the FP presence in the wells, it has been suspected (Ref. 4) that water samples may have been contaminated and, therefore, analytical results may be ambiguous.

TPH-D was detected in well MW-4 at concentrations of .46 mg/l, .6 mg/l, and 2.7 mg/l during the October 1988, November 1988 and September 1989 sampling rounds, respectively. Dissolved diesel (TPH-D) was found only once in well MW-5 at concentration .7 mg/l on 25 September 1989. Similarly, TPH-D was detected in well MW-6 only twice at concentrations 17 mg/l and 9.3 mg/l on 22 June 1988 and 22 December 1988, respectively.

In monitoring well MW-7, TPH-D concentrations have decreased from a high of 140 mg/l on 22 June 1988, to .6 mg/l on 28 November 1989. However, the concentration of TPH-D in this well was reported to be 22 mg/l on 2 March 1988. TPH-D concentration value was detected in well MW-8 as high as 87 mg/l on 27 July 1988 to a non-detectable level in November 1989.

Ground water samples taken from wells MW-9 and MW-11 on 25 September 1989, contained TPH-D at concentrations 0.3 mg/l and 5.8 mg/l, respectively. Dissolved petroleum hydrocarbons as diesel (TPH-D) have never been detected in the monitoring well MW-10.

2.4.4.2 TPH-WO

The contract analytical laboratory has reported concentrations of total petroleum hydrocarbons as waste oil (TPH-WO) since March 1989. There are not enough data to draw any final conclusions. However, water samples obtained from wells MW-1, MW-2, and MW-3 contained TPH-WO at concentrations of 37 mg/l, 43 mg/l, and 58 mg/l, respectively.

TPH-WO concentrations in wells MW-4 and MW-6 were found once in each well on 17 October 1989 (.7 mg/l) and 25 September 1989 (.6 mg/l), respectively. TPH-WO was found twice in well MW-7 at concentrations of 9 mg/l (2 March 1989) and .9 mg/l (25 September 1989).

In monitoring well MW-8, TPH-WO concentrations have fluctuated from 2 mg/l on 25 September 1989 to 6.7 mg/l on 17 October 1989 and to no detectable levels in November 1989.

No detectable levels of TPH-WO have ever been measured in the ground water samples collected from monitoring wells MW-5, MW-9, MW-10, and MW-11.

2.4.4.3 PCBs

No detectable levels of PCBs have ever been detected in wells MW-4, MW-6, MW-7, MW-9, MW-10, and MW-11. However, concentrations of PCBs were found as high as 56 ug/l in well MW-1, 33 ug/l in well MW-2, and 62 ug/l in well MW-3 on 30 November 1987. The highest concentration of PCBs in well MW-8 was found to be 5 ug/l in the water sample taken on 1 June 1989.

3. CONCEPTUAL MIGRATION MODEL

Chemical constituents in the soil and ground water at Industrial Asphalt have the potential to migrate off site and to impact human and environmental receptors.

Migration of constituents presently located on site could occur primarily through unsaturated soils in the vadose zone toward ground water and via ground water. A potential also exists for release to the atmosphere of volatile soil and ground water constituents. Physical and chemical processes control the movements of constituents in environmental media. Potential mobility and environmental fate and persistence of the chemical compounds identified at Industrial Asphalt are of importance in determining the exposure concentrations at potential receptor points. A conceptual site migration model flow chart is presented on Figure 1.

3.1 SOURCES

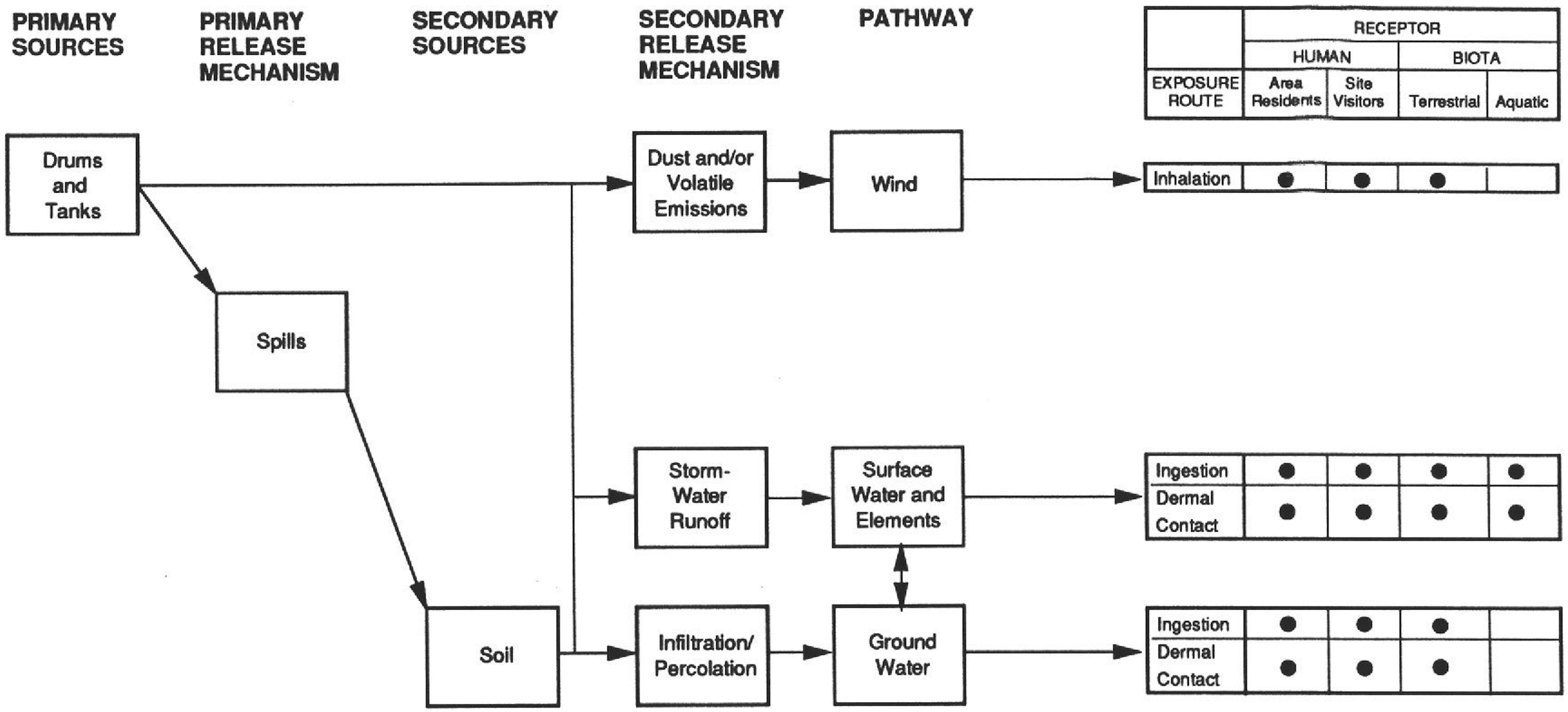
Potential primary sources that have been determined to date are summarized in Section 2.4.1. In addition to primary sources which have already been removed, contaminated soil is a suspected secondary source onsite.

3.2 TRANSPORT MEDIA

3.2.1 Air

The behavior of chemical constituents in air is controlled primarily by four chemical/physical processes: emission (including volatilization, erosion, and mechanical disturbance), dispersion and transportation, reaction and decomposition, and removal.

Figure 1. Conceptual Site Migration Model



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Significant concentrations of the target constituents were found in near surface soils at the site during the tank and pit gravel removal. It is expected that significantly contaminated soils, in the vicinity of the former tank farm, have been removed. Although all contaminated soils at the site may not be identified to date, it is expected that the potential for exposure via air is insignificant due to the depth of the contaminated soil and ground water.

3.2.2 Soil

The potential environmental fate and migration of chemicals in soil is affected by a variety of processes that include volatilization, adsorption, desorption, leaching, hydrolysis, oxidation, biological decomposition and uptake by plants.

Soils at Industrial Asphalt are affected at deeper soil levels. Chemical compounds in deeper soils in the vadose zone migrate primarily to ground water.

3.2.3 Surface and Ground Waters

Since the surface water elevation in the gravel pit is generally higher than the ground water elevation beneath the site, and since chemical constituents occur deep in soils, the potential for migration of chemicals in surface water as suspended load or as dissolved constituents in negligible. However, if the ground water surface rises and its elevation becomes higher as compared to the pit surface water, the potential for migration of trapped chemicals (in soils) is likely to increase. In that case, the potential for exposure via surface water will be reevaluated.

Transport by ground water presents the major potential pathway by which constituents may migrate from the Industrial Asphalt site. Solute migration in ground water is controlled by advection, dispersion, interphase transport (water/air), adsorption, and biodegradation.

Ground water quality has been assessed at various locations on the Industrial Asphalt property. The highest concentrations of dissolved compounds of concern have been detected in three monitoring wells located next to the former underground storage tank farm in 1987. However, wells MW-1 and MW-2 have not been sampled since 20 May 1988, and well MW-3 since 26 July 1988 (Section 2.4.4 and Table 1).

Ground water generally flows northeastward and northwestward in the first aquifer (90-100 feet) under the Industrial Asphalt facility. Constituents migrating in this direction may be expected to reach some of the existing ground water supply/irrigation or industrial wells. Additionally, as ground water is pumped by other wells or from the gravel pits located in the area, there exists a potential for constituents from the site to be captured and discharged.

3.3 POTENTIAL RECEPTORS

Chemical constituents identified at Industrial Asphalt have the potential to migrate from the property. This migration may lead to exposures affecting human and environmental receptors. The potential human and environmental receptors of chemical constituents originating at Industrial Asphalt depends upon solute and free product migration to the exposure locations.

Potentially impacted populations include people working on the site, people using affected ground water, people and biota at potential ground to surface water discharge points downgradient from the site. The classical approach to defining a potentially exposed population is to assume that individuals may be exposed to chemical constituents under a wide variety of conditions.

Direct contact with the chemical constituents is the primary means of potential exposure for the personnel working at the site. If the most contaminated soils have been removed and there are not any more unidentified areas of concern, such exposure should be unlikely. This evaluation does not include contact during the manufacturing process.

Potential exposure to local working and residential populations could occur by eventual degradation of the public or private water supply. Although there is a number of water supply wells located in the site vicinity, these wells are most likely to be used for non-drinking purposes. Public supply degradation could occur if constituents migrate to deeper aquifers and are captured by water supply wells. However, the public water supply wells, located downgradient of the site, may be screened at deeper aquifers.

The potential health risks to receptors have not been evaluated at this time. Section 6 presents a methodology for evaluating the probability of adverse effects to humans and the environment resulting from the release and migration of chemical compounds detected at the Industrial Asphalt facility.

4. REMEDIAL INVESTIGATION DATA REQUIREMENTS AND RATIONALE

This section briefly reviews the current monitoring program at Industrial Asphalt and identifies data requirements and rationale for further investigations of the nature and extent of chemical constituents toward the development and evaluation of remedial alternatives. A proposed site remediation task flow diagram is presented on Figure 2.

4.1 MONITORING PROGRAM

4.1.1 Ground Water Quality Assessment Program

Following construction, all wells were sampled on an approximately monthly basis to establish a database for water quality trend analysis. All samples were analyzed for selected constituents of concern including TPH-D,.TPH-WO, and PCBs. In addition, samples from all wells were once analyzed for BTXE.

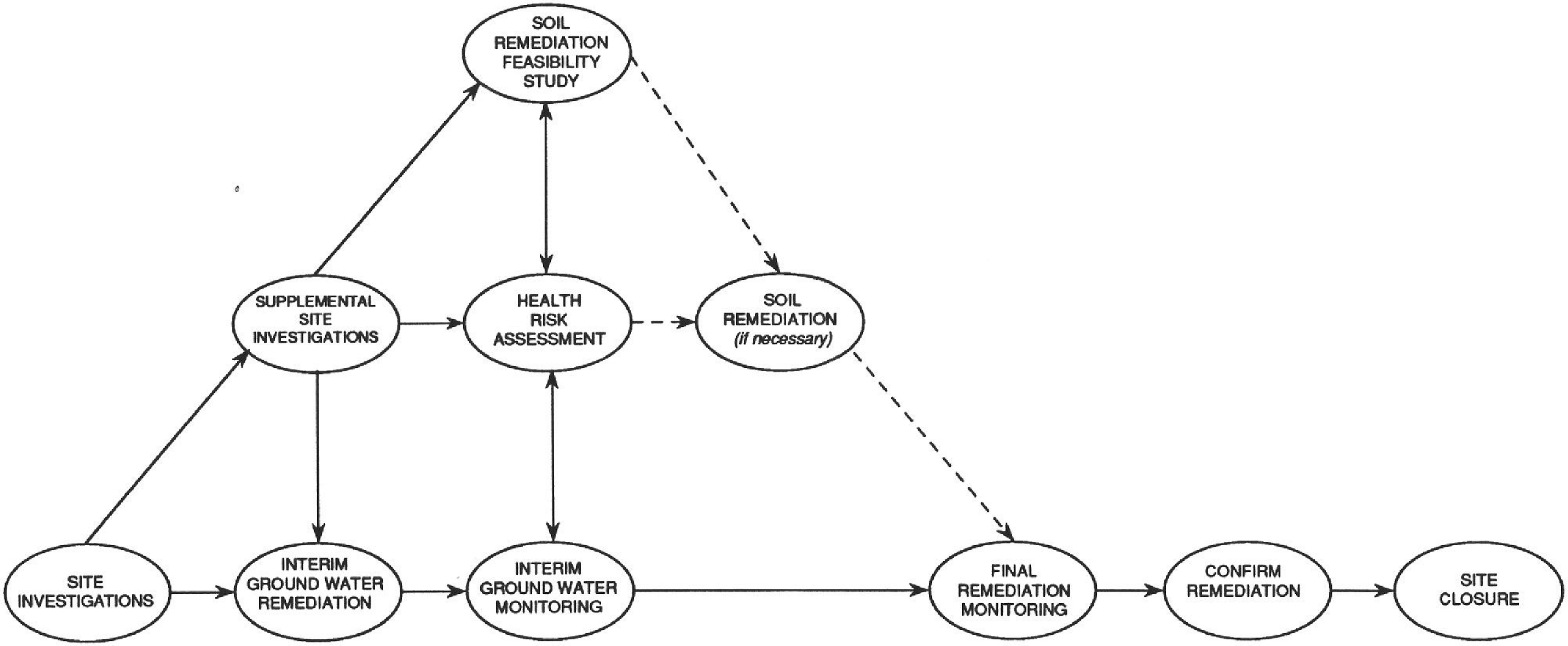
4.1.2 Ground Water Surface Elevation Monitoring Program

Monthly ground water surface elevation measurements in wells have been made since 1987 to evaluate horizontal gradient and develop database for trend analysis. Additionally, FP thickness measurements were taken.

4.2 IDENTIFICATION OF DATA REQUIREMENTS

Data requirements for Industrial Asphalt are identified using the guidelines described in the National Contingency Plan (Ref. 16) and EPA's Guidance Document (Ref. 1). The general data requirements described in these documents are presented in Appendix A. Additional site investigation requirements are determined by review of the general requirements versus work completed on the site through November 1989 and by specific requirements for selection and implementation of soil and ground water remediation.

Figure 2. Site Remediation Task Flow Diagram



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4.3 DATA DEFICIENCIES AND RATIONALE

Based on the information presented in Chapter 2, data requested by the ACDEH (Ref. 10), and the NCP and EPA guidelines, data deficiencies appear to remain in the following general areas:

- Source Characterization
  Waste Characteristics: types, quantities, chemical and physical properties, and concentrations

- Hydrogeologic Information
  Hydraulic Aspects: hydraulic conductivity, transmissivity, storage coefficient, porosity, dispersivity
  Ground Water Use Aspects

- Chemical Constituent Distribution in Soils and Ground Water

- Potential Receptor Populations and

- Ecological Information
  Water Use Characteristics.

4.3.1 Source Characterization

Information required for adequate design of the remedial system includes a definition of the contaminant of concern at the site. Although, as discussed in Section 2.4.3, FP has been analyzed twice and defined most likely as diesel, additional analysis should be performed on the FP samples using GC/MS equipment. These analyses should determine the components of the released product.

4.3.2 Hydrogeologic Information

Vadose zone information includes physical and chemical characteristics of soils. Definition of the soil and vadose zone properties of the site have been limited to the identification of soil types during logging and analyses for chemical constituents in the characterization of soils as sources.

The current understanding of site hydrogeology has identified the general characteristics of the water bearing unit beneath the site. In general, ground water occurs in silty/sandy/gravelly sediments which are unconfined or semiconfined. The ground water gradient has been evaluated utilizing some of the site monitoring wells.

Near site use of ground water has not been fully identified. It is known that several water supply wells exist within a one mile radius of the site. Water use from these wells has not been fully quantified, nor have the aquifers been characterized.

DATA DEFICIENCIES/DATA NEEDS

While the vertical lithology at each borehole is well defined, the lateral extent of units has not been delineated. Regional characterization has determined that alluvial materials are laterally discontinuous.

Soil below a depth of about 45 feet in the area of the former tank farm has not been fully described. Also, ground water immediately beneath the area of the former tanks have not been sampled for a long time due to wells MW-1, MW-2 and MW-3 being too shallow to provide consistent information, given the fluctuating water levels. Therefore, deeper wells are needed in this area.

Pertinent hydraulic parameters including hydraulic conductivity, transmissivity and storage coefficient have not been identified. These data are necessary to estimate ground water velocity, to depict the extent of the capture zone and to design the remedial system.

Information on beneficial uses of ground water in the area have not been updated since January 1988. Additionally, the effect that spreading contaminants could have on drinking water, agricultural and industrial water supplies, or recreational uses of water have not been evaluated.

Recharge and discharge areas in the alluvium have not been characterized. Possible recharge phenomena include infiltration from precipitation as well as recharge from streams and gravel pits. Discharge downgradient from the site may include pumping wells, discharge to gravel pits or subsurface discharge to a deeper aquifer, if one exists. Discharge locations are of particular interest because discharge points will define potential receptors and hence potential exposures.

INVESTIGATION RATIONALE

The proposed hydrogeologic investigation for the Industrial Asphalt site will include a review of regional data, the installation of the total of five additional monitoring and recovery wells on the Industrial Asphalt facility, continuous monitoring program implementation, and a pump test.

An update of well inventory will be conducted to identify the locations and well completion data for wells within a one mile radius of the site. However, the location of the closest municipal water supply wells will be also described. The type of information to be obtained for the wells, as available, includes well depth, geologic logs, the depth and length of the perforated interval(s), other well construction details, estimates of well production, the most recent results of chemical analyses performed on water samples from a particular well, and the intended use of water. Also, if available, elevations of surface water in the surrounding gravel pits will be collected. The attempt will be made to describe the hydrologic regime in a watershed (water balance).

Five additional wells to be installed at the site will include two extraction wells and three ground water monitoring wells. The two recovery wells will replace dry wells MW-1 and MW-2 for monitoring functions and will be used to pump water from the aquifer to create a capture zone, if necessary. The third well will be installed between the pond and the new recovery well (next to MW-2) to monitor ground water flow and quality during the remedial action and the pump test. The fourth well will replaced another dry monitoring well MW-3 and will be located approximately next to it. The fifth well will be located between wells MW-1 and MW-9.

Therefore, the proposed additional wells will aid in the evaluation of site hydrogeologic conditions as well as ground water quality. The locations of the proposed additional monitoring wells are shown on Plate 29.

Ground water conditions can be estimated by monitoring water levels in the extended monitoring network. Seasonal variations in ground water conditions can be evaluated by monthly/quarterly monitoring. Datalogging equipment will be installed in the wells and the gravel pit to record changes in water level, electrical conductivity, and temperature on a continuous basis for a period of one to two months. The equipment will be installed to observe changes that cannot be detected with periodic sampling, e.g., ground water pumping, salinity fluctuation, etc. It also should aid in better understanding of the local water flow direction(s).

Two aquifer pump tests will be performed on the two new extraction wells in order to obtain aquifer parameters including hydraulic conductivity, transmissivity and storage coefficient. In addition, the test can provide an estimate of possible hydraulic connection between the wells, and observations on boundary phenomena (horizontal limits of water bearing zones).

4.3.3 Distribution of Chemical Constituents

4.3.3.1 Soils

The full extent of soils impacted by the target constituents of concern including TPH-D, TPH-WO and PCBs remains unknown. Definition of residual wastes in soils on site has been limited to the analysis of soil samples collected from few boreholes for monitoring well installation and limited subsurface investigations next to the tank farm.

Therefore, for the subsurface conditions at Industrial Asphalt, additional ten soil borings will be drilled and soil samples collected for chemical analyses and lithologic description. Additionally, soil samples will be obtained from each new well (monitoring and recovery) borehole.

Soil samples will generally be collected at five foot intervals. However, only samples at ten foot intervals, starting at depth of approximately 20-25 feet, will be analyzed in the contract laboratory. Additional soil samples may be analyzed if justified by the visual or olfactory characteristics of the sample. The borings will be drilled to depths of first encountered ground water. In proposed soil borings SB-1, SB-3, and SB-4, continuous samples will be obtained and preserved for later analyses as dictated by requirements for selected soil remediation.

Approximate locations of the ten boreholes are shown on Plate 29.

4.3.3.2 Ground Water

The horizontal extent of ground water contamination at the site is not known. Plate 26 in Reference 9 illustrate inferred outline of the hydrocarbon contamination plume. However, since the ground water level has been continuously decreasing, the contamination plume boundary is currently unknown. Additional monitoring wells will be installed in order to more fully identify the extent of the plume. Wells to be constructed on site include the aforementioned two recovery and three ground water monitoring wells.

The results of this monitoring event may indicate the need for further hydrogeologic investigations. If no data are available on water quality in the adjacent high production wells or the gravel pit, water samples may be taken and analyses performed for target compounds.

5. REMEDIAL INVESTIGATION SCOPE OF WORK

This section describes the initial phase of activities for the Remedial Investigation (RI). The scope of work described herein is consistent with the ACDEH (Ref. 10) and the EPA (Ref. 1), as applicable to the site, requirements. Field sampling will be done in accordance with procedures described in Reference 17. The scope of work includes:

- Interim Remedial Measures (IRM)
- Site/Study Area Survey
- Characterization of Sources
- Study Area Ground Water Characterization
- Solute Transport Pathways Evaluation and Health Risk Assessment
- Remedial Investigation Report Preparation

The following sections describe the tasks listed above.

5.1 INTERIM REMEDIAL MEASURES

IRM currently being implemented at the site include: 1) monthly ground water and FP thickness monitoring in wells and in the pit, 2) monthly ground water sampling and analyses, 3) quarterly progress report summarizing ground water data and remedial operations to date, and 4) FP extraction using a specific gravity skimmer.

Monthly monitoring and ground water sampling programs are being carried out to develop a significant data base from which long term trends can be evaluated for assessing remedial alternatives.

5.2 SITE/STUDY AREA SURVEY

A canvass of wells at adjacent properties will be carried out to determine location, construction details and use of nearby wells. Data will be collected regarding water elevations and quality in the adjacent gravel pits. Finally, as new wells are installed, an elevation survey will be conducted to establish elevations of reference points on new wells

5.3 CHARACTERIZATION OF SOURCES

Based on the existing data, the primary source of contamination has likely been identified. It appears to have been leakage from the pipe lines and underground storage tanks. However, since the tanks have been removed, the primary source is gone. Therefore, the existing potential secondary source at the site are contaminants trapped in soils beneath the site.

5.3.1 Soil Sampling

Subsurface soil sampling will be conducted to evaluate the extent of petroleum hydrocarbons and PCBs in the subsurface. The sampling will be performed in five well and additional ten bore holes. The boreholes will be drilled to depths of approximately 95-100 feet to collect samples for chemical analyses and physical description. The bore holes will be logged every five feet. However, samples will be obtained at approximately ten foot intervals or from any other depth, if soil sample odor or visual characteristics indicate the presence of hydrocarbons. Continuous sampling is planned on soil borings SB-1, SB-3, and SB-4. This soil sampling will be carried out to allow evaluation of the presence of chemicals of concern in soils.

Soil chemical samples will be analyzed at a State certified analytical laboratory for performance of analysis of TPH-D, TPH-WO, and PCBs. Three or four soil samples taken from soil/monitoring well boreholes will be analyzed using GC/MS instruments to evaluate what type of hydrocarbons are contained in the released product and to evaluate proportions (by weight or by volume) of particular hydrocarbons in the product.

The locations of soil borings are shown on Plate 29.

5.4 STUDY AREA GROUND WATER CHARACTERIZATION

As summarized in Section 2, previous investigations by Industrial Asphalt have not identified all the aquifer parameters necessary to evaluate local hydrogeologic conditions and to provide aquifer parameters which are necessary to design a ground water remedial system.

To satisfy these needs the work to be performed includes: drilling, construction of wells, ground water sampling, monitoring of water elevations, and aquifer testing. The following subtasks describe these activities.

5.4.1 Drilling, Construction of Wells, and Sampling

Drilling and well construction will be carried out in the first aquifer. Plate 29 shows the locations of proposed wells.

Three monitoring wells will be constructed using 4-inch PVC casing to an approximate depth of 120 feet. The wells will be screened from 80 to 120 feet. The wells will be constructed using a rig equipped with a drive shoe using the dual tube percussion method of drilling which provides an open casing. Soils will be logged continuously during drilling.

Two extraction/monitoring wells will be constructed using 6-inch mild steel casing. Anticipated well depth is 140 feet with the screen interval from 80 to 140 feet. Minimum borehole diameter will be 10 inch. At this time, it is anticipated that this same drilling technique will be used as the one proposed for the construction of the monitoring wells.

Upon completion, each well will be covered with a locking cover and a Christy box. Well reference points will be surveyed to the common datum. Finally, the wells will be developed by pumping and surging, allowed to rest, then purged and sampled. Ground water samples will be analyzed at a State certified laboratory for TPH-D, TPH-WO, and PCBs per EPA Methods 8015, 8015 and 8080, respectively. However, water samples obtained from the new wells during the first sampling round only will be analyzed for BTXE as well. These analyses will be included in the sampling program if any of the compounds is found. Otherwise, this will be a single sampling round addition to the program.

5.4.2 Aquifer Testing

Aquifer testing will be performed as appropriate for the purpose of evaluating hydraulic properties of the aquifer and designing long term remedial action system. Following the installation and sampling of the additional monitoring and extraction wells, the review of additional data collected to date, and an initial screening of remedial alternatives, a plan will be prepared for aquifer testing and evaluation.

5.4.3 Ground Water Assessment Program

Ground water assessment will consists of monthly water level and FP thickness measurements, monthly sampling and analyses, and quarterly analysis of collected data as requested by the ACDEH (Ref. 10).

5.5 SOLUTE TRANSPORT PATHWAYS EVALUATION AND HEALTH RISK ASSESSMENT

An evaluation will be completed to assess risks to various potential receptors. The evaluation will include activities to both established baseline risks and to set preliminary performance goals. Potential surface and subsurface pathways for potential exposure will be evaluated using the physical and chemical data generated in previous tasks. An endangerment assessment with regard to both human and environmental receptors will be completed for selected chemical constituents over representative time intervals. A Baseline Health Risk Assessment Plan is presented in Chapter 6.

5.6 RI REPORT PREPARATION

A RI report will be completed following completion of all tasks outlined above. The report will include summaries of data collection procedures and protocols, field activities and observations, analytical results, and conclusions. Additionally, the report will contain appropriate maps and graphical representation and laboratory documentation.

6. BASELINE HEALTH RISK ASSESSMENT PLAN

This section presents an outline of the methodology used to evaluate the potential magnitude and probability of adverse health effects to humans and the environment resulting from the release and migration of chemical compounds detected at the Industrial Asphalt site. The methodology most currently available and acceptable to regulatory agencies for evaluating potential health impacts to human and environmental receptors is health risk assessment (HRA). The HRA for the Industrial Asphalt facility will utilize appropriate elements included in References 1, 18, 19 and 20. However, at this time, it is anticipated that only a Baseline Health Risk Assessment (BHRA) will be prepared. The BHRA evaluates the potential threat to human health and the environment in the absence of remedial action only.

6.1 CONTAMINATION ASSESSMENT

For the purpose of conducting a BHRA for the Industrial Asphalt site, the environmental data obtained from soil and water samples from both the previously completed investigations and the proposed RI sampling activities will be reviewed. The data will be evaluated in the following categories: soil concentrations at varying depths (surface, upper vadose zone, lower vadose zone), ground water concentrations upgradient and downgradient of potential onsite sources. Toxicity and environmental fate profiles will be prepared for all of the compounds detected at the site.

6.2 ENVIRONMENTAL FATE AND TRANSPORT MECHANISMS

This task will evaluate the potential for the chemical compounds detected in the sampled environmental media (water, soil) to undergo transport migration from the site in the baseline scenario. Therefore, this task will include an assessment of: 1) the potential for soil bound chemicals to be transported in via volatilization or fugitive dust emissions or 2) the potential for water migration downward through the vadose (unsaturated) zone to eventually impact ground water. In addition, the potential for ground water contaminants to impact the potential receptor points via transport mechanisms other than ground water migration will be addressed.

Kleinfelder's preliminary assessment of the sampling data obtained up to this time suggests that the depth to ground water is far enough below grade so that potential transport to the surface via volatilization would not be an exposure pathway of concern; however, towards offsite wells that may be used for drinking water in the future is an essential point of concern. The potential for migration is actually a chemical-specific process and will require analysis for each compound detected at the Industrial Asphalt site.

6.3 DOSE-RESPONSE ASSESSMENT AND IDENTIFICATION OF ARARs

This task will provide a detailed compilation of the existing health criteria and the Applicable or Relevant and Appropriate Requirements (ARARs) for the target compounds.

Dose-response assessment provides the quantitative toxicological information derived by a variety of regulatory agencies that indicates the inherent degree of toxicity risk per unit of chemical dose. These numerical estimates are commonly called cancer potency factors (CPFs). The currently accepted noncarcinogenic health criteria are called Reference Doses (RFDs). These values were formally called Accepted Daily Intake (ADI) by several EPA program offices prior to approximately 1987.

Using the dose-response methodology specified by the U.S. EPA, Kleinfelder will identify the currently published health criteria for all of potentially carcinogenic and noncarcinogenic compounds detected at the site. Several data sources will be utilized including two U.S. EPA toxicological database: the Integrated Risk Information System (IRIS) and the Public Health Risk Evaluation Database (PHRED).

The applicable ARARs published by either Federal, State and/or local governmental agencies for the target chemicals will be obtained from a wide variety of sources. The best source of ARARs for potential drinking water sources are Maximum Contaminants Levels (MCL) published by EPA and Department of Health Services (DHS). Additionally, the ACDEH requirements (Ref. 10) that hydrocarbons and PCBs levels in ground water must be reduced to "ND" levels, will be evaluated.

6.4 EXPOSURE ASSESSMENT

The primary objectives of exposure assessment are to identify the site specific exposure pathways and estimate the daily exposures to the potential human and environmental receptors. Based on the specific chemical compounds detected at the site and their respective environmental media, several potential exposure pathways have been identified. The primary pathways of concern are identified below:

- Ground water transport towards wells within the study area that are currently used for drinking water

- Ground water transport towards wells that are not currently used for drinking water, but may be used for this purpose in the future

- Ground water transport towards surface water ponds used for recreational uses

- Ground water transport towards industrial/irrigation wells within the study area

- Direct contact with existing soil at the site leading to soil ingestion and dermal adsorption.

6.5 IDENTIFICATION OF POPULATIONS AT RISK

The objective of this task is to provide site-specific information regarding the potential populations at risk who may come in contact with the detected onsite chemical compounds. Exposure assessments generally assume that human populations may come in contact with chemicals by either direct contact (ingestion or dermal absorption) or indirect contact via inhalation. The population at risk via direct contact is the population that has direct access to site , and individuals who would be consuming ground water. The areas of the site presently affected by detected soil contamination are generally the deeper soils. While this scenario suggests that direct contact with the surface soil contamination presently onsite is highly unlikely, the additional soil samples to be collected at the site will provide further evidence as to the significance of this exposure pathway.

In addition, the present usage of ground water that may be impacted by the site contaminants is limited. However, there are a series of wells located less than one mile from the site that may be used for drinking water purposes during nonoperational periods of the existing water supply system.

In keeping consistent with the requirements of an RI BHRA, the exposure assessment will estimate ground water concentrations at the nearest potential downgradient receptor living offsite. For health risk assessments, this potential exposure point is generally considered to be facilities or residences located nearest to the downgradient property line. Making the assumption that the owner of this nearest downgradient property may place a drinking water well at the boundary in the future, provides a maximum impact point for potential exposures and potential health risks that may occur in the future. A hypothetical individual either residing or living at this nearest point is called the Maximum Exposed Individual (MEI).

6.6 RISK CHARACTERIZATION

The final step of a BHRA is a quantitative estimate of the potential degree of health risk posed by the chemical contaminants originating at the Industrial Asphalt site. Since the chemicals detected at the site to date are assumed to produce both potential carcinogenic and noncarcinogenic health effects in humans, the potential for producing both of these endpoints will be evaluated. Health risks will be derived for the hypothetical MEI, the Maximum Exposed Residence (MER) and an Average Exposed Individual (AEI) living within the study area.

7. REMEDIAL ACTION PLAN

7.1 DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

7.1.1 Introduction

In development of the workplan for interim remedial measures, Kleinfelder has sought to formulate a program which will respond to the need for prompt action to clean up ground water at the Industrial Asphalt site. We propose a program that will attack both the source of further ground water degradation and limit the migration of chemical constituents already in the ground water.

Balanced with site specific and long term considerations, the interim remedial scheme will be formulated with the expectation of evolving into a final remedial scheme with limited modifications, or possibly none at all. Thus, the interim remedial plan establishes the ground work for final remediation. A preliminary analysis will be performed of the most likely changes to occur in the site conditions. The analysis will provide the basis for anticipating changes that may arise during program implementation producing a program with flexibility, allowing for adaptations as new data emerges.

The selection of remediation technology and the sequence of remedial actions will be based on site specific parameters. Important parameters which will be considered include the characteristics of the gravelly/sandy soil; the most likely path of contaminant migration; the proximity to a large quantity of surface water; the physical, toxicity, and other contaminant characteristics; and the need for continuous operation of the Industrial Asphalt facility.

7.1.2 Development of Ground Water Treatment Alternatives

Kleinfelder will first evaluate process technology for ground water treatment. The extraction and treatment processes will be suitably designed to function over a range of flow rates and variations in ground water depth. (Flow rates will be estimated from existing data and data that will be obtained during the remedial investigation). The treatment process alternatives must be evaluated for efficiency of contaminant removal and for process times to achieve regulatory acceptable concentrations. What impacts the processes may have on the environment and on public health also will be assessed; for example the impact of secondary air emissions from the process.

The primary requirements for process equipment selection will be availability, sizing, and reliability. The equipment must be readily available in a size that is appropriate for the task, but also in a system that readily adapts to changes in conditions and can work with any chosen soil remediation technique. Additionally, a review will be conducted of equipment performance under similar conditions at other locations to assess performance reliability.

Process and equipment selection must also conform to requirements set forth for regulatory acceptance. Communication with the lead regulatory agency during development of remedial alternatives will facilitate the required agency approval for implementation.

Finally, a conceptual cost analysis will be prepared for the various treatment alternatives which are developed. Review of the comparative costs will aid in selection of both equipment and processes.

7.1.2.1 Ground Water Remedial Technology Alternatives

Perhaps the most cost effective and implementable system for treating ground water may be extraction and treatment at the ground surface with subsequent disposal. For this reason, background information is provided on potential treatment systems.

<u>Extraction</u>

Ground water extraction would be performed by pumping out ground water through extraction wells. Typically, extraction wells are of large diameter (6 to 10 inch diameter) with a large screen interval and coarse gravel pack which allows for a large flow of water. The wells will need to be installed in a configuration that adequately captures the contaminated ground water under estimated flow conditions and that accounts for seasonal fluctuations in depth and gradient. Emphasis would be placed on locating the wells such that the Industrial Asphalt operations are unimpeded during well installation and use.

Treatment

Although several technologies are available for surface-located ground water treatment systems, the most appropriate technologies for Industrial Asphalt appear to be activated carbon and biological treatment.

Activated carbon in a fixed bed system involves the flow of ground water through a bed of activated carbon. volatile organic compounds such as petroleum hydrocarbons and PCBs adsorb onto the carbon surfaces and are removed from the water. Generally, two or more beds are used in series or on a rotational basis. As the activated carbon becomes exhausted, the bed is run through a regeneration cycle using steam to strip the organic compounds from the carbon. Subsequently, the contaminated steam is cooled in a condenser and the water and hydrocarbon sections are partitioned.

In general, biological treatment involves the establishment of specific, commercially available microbial communities in a fluid medium. Contaminated ground water is directed into treatment vessels containing microbial cultures which are designed to consume contaminants such as petroleum hydrocarbons and to cometabolize other such as PCBs. In this way, the water is treated through biodegration of contaminants.

Other treatment options for Industrial Asphalt include combining the above treatment systems; activated carbon and biological treatment in the same reactor vessel, of the use of oxidation with hydrogen peroxide and or UV light. A distinct advantage to this option is the ability of the system to be modified to accept effluent from in situ soil treatment.

Disposal

Several disposal options will be pursued for treated ground water. Evaluation of treatment options will include water quality and cost considerations. One possibility is the return of treated water to the aquifer through injection wells. Disposal by reinjection must consider regulatory constraints, hydrogeological conditions, and ground water flow patterns as well as the potential dispersal of residual constituents in the subsurface. An advantage to this option is the return of water to ground storage for potential future uses. Potential impacts of the system on other existing or proposed extraction wells in the vicinity is considered in the design of an extraction and reinjection system. Design for the quantity and configuration of wells will include calculations of the influence by injected water on the capture and extraction of contaminated ground water such that the effect will be as advantageous as possible. The potential will be developed for coupling the injection system to soil remediation, thus serving a dual purpose with little additional cost.

A second disposal option is discharge of treated ground water into existing surface waters, such as in local gravel pits or the nearby creek. Discharge of treated water in surface waters must comply with state and local water quality standards and regulations.

A third disposal option is the removal of treated ground water through the local sanitation district sewer system. Discharge of treated water into the sewer system involves meeting local water quality standards and requirements for industrial effluent.

Other disposal requirements for consideration depend upon the system selection. By using activated carbon with steam regeneration for example, extracted petroleum hydrocarbons in liquid form are produced and require disposal. Disposal possibilities include incineration, incorporation of the product into the asphalt production onsite, and disposal to a designated hazardous waste repository. It may be possible to utilize the asphalt production process onsite to incinerate the liquid product. Strict adherence to regulations governing PCBs content and a strict quality control program for incineration are paramount.

Onsite Use of Recovered Hydrocarbons

The original products leaking from the underground storage tanks were diesel and possibly asphalt. For this reason, the liquid product extracted from the activated carbon system will be an admixture of compounds found in diesel and asphalt as well as an undetermined amount of PCBs. One possibility for the disposal of the admixture is reuse. By adding the product into the asphalt production, the product may be disposed of in a beneficial way. This disposal method appears relatively inexpensive. The reuse option will require an assessment of exposure level versus estimated PCBs concentrations in the product.

Strict adherence to PCBs limits set by governing regulatory agencies will provide the foundation for successful use or partial use of this alternative and will avoid potential liabilities otherwise present.

7.1.3 Criteria for Evaluation and Screening of Ground Water Treatment Alternatives

Evaluation and screening of ground water treatment alternatives will be accomplished separately and in advance of soil treatment alternatives. Keeping the screening processes separated will enable immediate installation and operation of an approved ground water treatment system without delays which might detain approval of a soil treatment system.

7.1.3.1 Site Specific Criteria

Action must be taken that is suitable for the location, the volumes of soil and ground water, and suitable for the contaminant species and concentrations. Moreover, smooth, uninterrupted operation of the Industrial Asphalt facility will be an essential criterion for actions appropriate for the conditions. Consideration will be made for the possibility of integrating remedial actions with existing process systems at the site.

7.1.3.2 Regulatory Criteria

Treatment alternatives will be evaluated with respect to public health, environmental, and cost criteria. Remedial objectives for soil and ground water will incorporate allowable exposure limits based on Applicable or Relevant and Appropriate Requirements (ARARs). Adjustments to the soil remediation program will also develop in response to findings presented in the Health Risk Assessment.

In meeting the requirements of the California Department of Health Services (DHS) and EPA, the following criteria will be used:

- Short-term effectiveness
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume through treatment
- Implementability
- Cost
- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements.

Regulatory requirements, policy and water use objectives will be discussed and used in the development of cleanup standards for the site. Accordingly, technology options will be reviewed for compliance with one of the following categories:

- Alternatives that attain applicable or relevant and appropriate Federal public health and environmental requirements.

- Alternatives that attain applicable or relevant and appropriate State public health and environmental requirements if more stringent than Federal requirements,

- Alternatives that do not meet applicable or relevant and appropriate Federal or State public health and environmental requirements, but will provide significant protection to the environment.

- An alternative of no action.

7.1.3.3 Categories of General Response Alternatives

Initially, general response actions will be categorized broadly into the following divisions:

TABLE 3.
CATEGORIES OF GENERAL RESPONSE ALTERNATIVES
FOR GROUND WATER REMEDIATION

CATEGORY	GENERAL RESPONSE ACTION
No action	Continue monitoring the ground water, collecting and analyzing samples
Hydrodynamic control of waste migration	Install pumping wells and injection wells
Ground water treatment	Ground water would be removed through extraction wells, treated onsite, with disposal into an environmentally acceptable location

Technology options which will be relevant to these general action categories will be screened to eliminate technologies that will not be appropriate or could not be implemented at Industrial Asphalt. A block flow diagram shown in Figure 3 illustrates the steps taken in the screening process. Site specific conditions may suggest the elimination of some general response actions which will not be appropriate based on the criteria of public health, environment, or cost. For example, the no action alternative may not appear appropriate based on the presence of active wells within a one-half mile radius of the site.

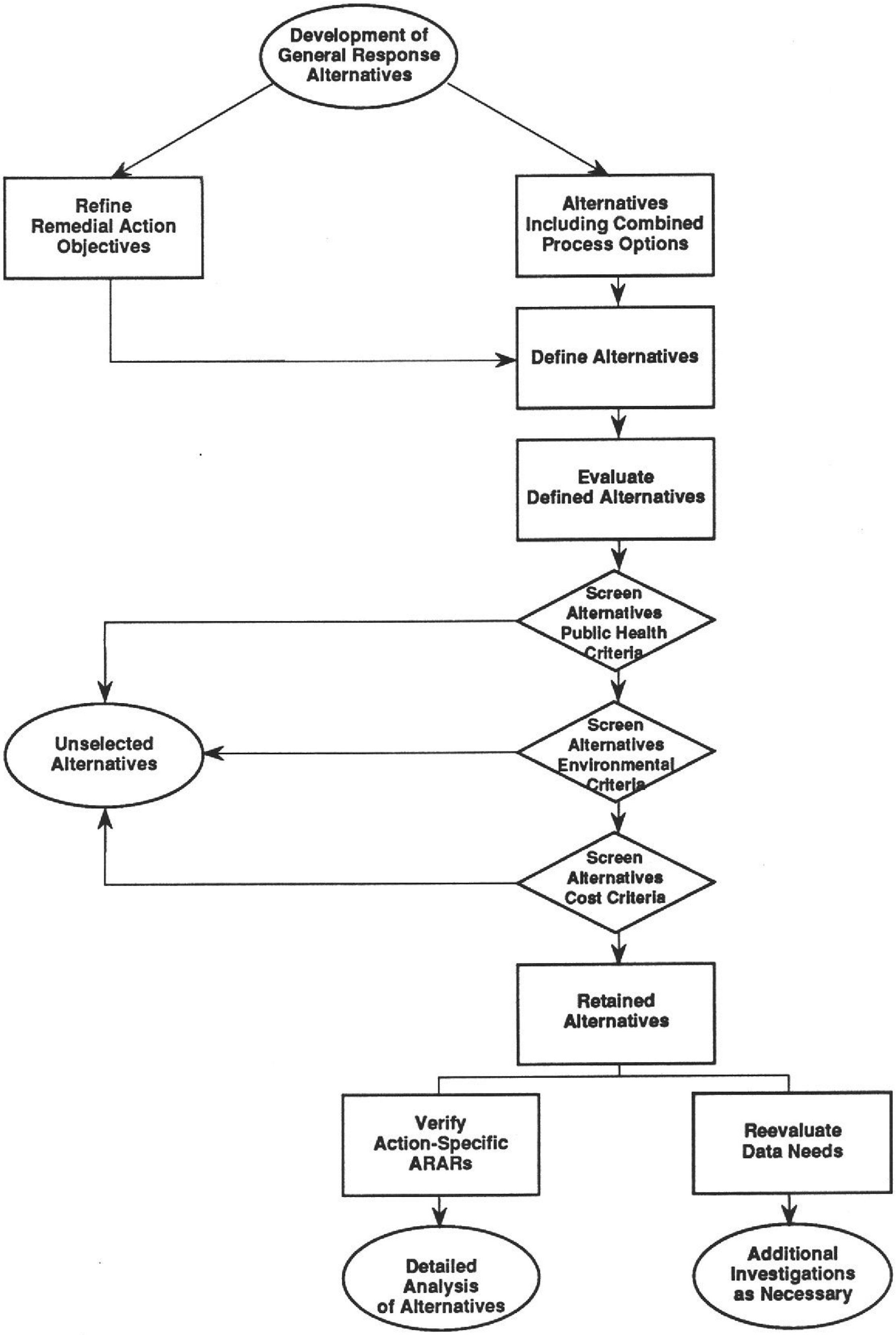
7.1.4 Development of Soil Treatment Alternatives

Development of soil treatment alternatives will follow the procedure presented in Section 7.1.2 of the Workplan which was used to develop ground water treatment alternatives. Parameters such as physical and chemical properties of the soil that would affect water contamination migration or excavation will be analyzed and incorporated into the process design. Expected cleanup efficiencies will also be analyzed. An assessment will be made of potential impacts of the treatment system on the environment and on public health, such as the impact of air emissions.

Selection of equipment for alternative processes will require more extensive research that for the ground water treatment processes. Careful review of available equipment will be weighed with cost, reliability and fit to site conditions. Because of the large volume of contaminated soil, processes involving emerging technologies will be evaluated based on implementability, cost and public health criteria.

Development of soil treatment alternatives will require close communication and cooperation with the leading regulatory agency to ensure acceptance of the selected technology.

Figure 3. Screening of Alternatives



Adapted from OSWER Directive 9355.3-01

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Industrial Asphalt

7.1.5 Soil Remediation Technology Applicable to the Industrial Asphalt Site

7.1.5.1 No Action Alternative

The no action alternative is retained primarily to serve as a baseline against which the adequacy of other remedial alternatives are judged in a comparative analysis. The soil would be left "as is" with no direct action taken for soil cleanup, but long term ground water monitoring would be implemented. This alternative would not reduce the potential for exposure of the public or the environment. However, if this alternative is selected in conjunction with a ground water extraction and treatment program, the monitoring will provide an assessment of the potential for exposure. The quantity of extracted ground water and the degree of treatment could be adjusted as necessary based on the varying effects of rainfall and subsequent infiltration of contaminants from the soil to the ground water, and offsite water extraction and uses. It is possible that a no action alternative for soil remediation could extend duration of the ground water remediation program substantially.

7.1.5.2 Alternatives Requiring Excavation and Disposal or Treatment

Because of the volume and depth of contaminated soil, many remediation systems are prohibitively costly and have not been considered as primary treatment options. Of these methods, excavation followed by disposal or treatment. The excavation alternative has been included for your information and to serve as a comparison to the remediation options presented in Section 7.1.5.3.

Excavation and disposal is a common method of site remediation. At the minimum, standard heavy equipment such as front loaders, backhoes, and excavators could be used to excavate the soil. It is expected that the extent of required excavation under this option would be assessed within reasonable limits based on additional soil characterization performed during the remedial investigation. However, additional soil sampling and testing as excavation progresses would provide the basis for actual excavation limits. The vertical extent of contamination is currently expected to reach down to the ground water table, i.e. at least ninety feet below the surface. With the use of additional equipment and assuming removal of a 90 x 90 feet column ninety feet deep, the minimum excavation requirement would be at least 27,000 cubic yards. This size of excavation could lead to significant disruption of the Industrial Asphalt operation.

Once the soil is excavated, affected soil would be loaded onto trucks for transport to an appropriately permitted landfill. Soils defined as hazardous would have to go to Class I landfills which are specially designated to contain hazardous waste. Soils destined for Class I disposal would be transported by haulers registered by DHS. Soils that pose a threat to human health and safety and the environment, but do not quality as hazardous waste could be taken to Class II or Class III landfills under the direction of the RWQCB. Transporters without DHS registration could be used for hauling to Class II and Class III landfills.

Disadvantages associated with Class I landfilling include:

- High transportation and disposal costs
- Potential liability for spills occurring during transport
- "Deep pocket" liability should the landfill be shown to leak.

Two Class I landfills that can accept contaminated soil are Kettleman landfill in California, and Environsafe landfill near Boise, Idaho.

Soils found to be non-hazardous could be transported to Class II or III landfill sites. This option may be considered only if the affected soil is nonhazardous. Only two Class III landfills, Anderson landfill near Redding, California and Forward, Inc., landfill near Stockton, California, have routinely accepted contaminated soil. Anderson landfill generally meets their allowable waste volume every month, thus acceptance of the soil could be delayed.

7.1.5.3 In-Situ Alternatives

Two treatment technologies that may be applicable to the site constraints are in-situ bioremediation and in-situ steam injection. Both technologies provide soil treatment without excavation and could run in accord with a pre-established ground water treatment system. Advantages exist to either system: steam injection is a much faster system, potentially requiring only several months of treatment to complete, while bioremediation may require three or four years. Steam injection requires significant energy consumption and may be more costly to set up and to operate.

Bioremediation

Because of the porous soil conditions at Industrial Asphalt, bioremediation may be an appropriate technology for the site. Through the use of injection wells, water containing microbial cultures, nutritional additives and oxygen would be introduced into the soil. In the gravelly soil microbes should be able to migrate through the large pore spaces and utilize the petroleum hydrocarbons which are attached to the gravel as a primary carbon source. In biodegradation, carbon compounds split into short chains which are partly consumed or which may undergo further degradation. The addition of water to the soil will act as a flushing mechanism, carrying contaminants and microbes down to the water table. Consequently, extraction of the additional ground water produced in this process is an essential consecutive step in the remediation process. Extraction wells used in the selected ground water treatment process may be used for soil bioremediation. Assuming all extracted ground water will require additional treatment, all water will be routed through the same system.

Steam Injection

Normally, in a steam injection system an area of contaminated soil is encompassed by a series of strategically located injection wells with a large diameter extraction well centrally located in the injection field. Steam injected through the wells removes contaminants by heating soil particles and mobilizing liquids and/or volatizing the contaminants. These constituents are then capable of moving through the soil to a collection point. The steam and condensate are collected and run through a condenser and separator where the contaminants are removed. Disposal options for the separated contaminants from the Industrial Asphalt site include shipment to a hazardous waste incineration repository or possibly onsite use as an ingredient in asphalt. Disposal of the treated water is discussed previously.

Combined Steam Injection and Bioremediation

An option geared to simultaneously reduce the energy consumption of steam injection and shorten the time required for bioremediation is the consecutive application of steam injection and bioremediation systems. As a preliminary remedial measure, steam injection application might focus on localized soils containing the highest contaminant concentrations, namely soils in the vicinity of the former underground storage tanks. Thereafter, bioremediation might be applied to the rest of the contaminated soil.

7.1.5.4 Discharge and Disposal Constraints

As a result of in-situ remediation, additional ground water would be extracted and treated at the surface. Disposal options for the water are the same as the options discussed in Section 7.1.2.1 of the workplan. Constraints on the removal of treated water are discussed in Section 7.1.3.2 as part of the permit acquisition procedures. Similarly, disposal of liquid hydrocarbon product would conform to the options described in Sections 7.1.5.4.

7.1.6 Criteria for Evaluation and Screening of Soil Treatment Alternatives

Evaluation and screening of soil treatment alternatives will follow the criteria outlined in Section 7.1.3 of the Workplan. General response alternatives will be categorized broadly into the following divisions:

TABLE 4.
CATEGORIES OF GENERAL RESPONSE ALTERNATIVES
FOR SOIL REMEDIATION

CATEGORY	GENERAL RESPONSE ACTION
No action	Continue monitoring the ground water, collecting and analyzing samples
Source control	Excavate "hot spots" in soil, such as additional soil at the former tank site
Total soil removal	Excavate all contaminated soil and backfill with clean material
In-situ soil treatment	Soil would be treated to destroy or remove constituents of concern without extraction from the ground

Technology options which will be relevant to these general action categories will be screened to eliminate technologies that will not be appropriate or could not be implemented at Industrial Asphalt. A block flow diagram will illustrate the steps taken in the screening process. Site specific conditions may suggest the elimination of some general response actions which will not be appropriate based on the criteria of public health, unlikely alternative based on cost criteria given the large volume and vertical extent of the contamination.

7.2 GROUND WATER TREATMENT IMPLEMENTATION

7.2.1 Preliminary Design

Data collected from previous investigations and the remedial investigation will be compiled and reviewed prior to formulation of a conceptual design of the remediation system. The data will be used in combination with clean up requirements, scheduling demands and overall costs as the basis for the remedial design. Integration of regulatory clean up requirements with the design will involve detailed determination of permit requirements (such as permits for air emissions and sewer discharge of treated water) as well as public health and safety requirements.

From the conceptual design, a process flow diagram will be prepared. A description of the process will include information on processing rates such as water flow rates with expected influent and effluent contaminant concentrations. Ground water remediation alternatives may need to include analysis of secondary impacts due to in-situ soil remediation. A remedial site safety plan will be included in the preliminary design.

A short letter report of the preliminary engineering entitled "Design Basis for Ground Water Remediation" will be submitted to Industrial Asphalt for review and approval.

7.2.2 Bench Scale or Pilot Testing

The following information will be required to define the treatability parameters and to effectively address the objectives for ground water remediation at Industrial Asphalt:

- Vertical and lateral extent of petroleum hydrocarbons and PCBs plumes and their movement over time.

- Water quality data obtained from the extension of monitoring wells MW-1, MW-2 and MW-3 down to water bearing elevations.

- Current and predicted ground water use including surface impoundment in gravel pits; location, depth; pumping characteristics and water use at nearby wells; and effects of demographic changes on ground water demand.

- Ground water flow rates will be determined by pumping tests performed onsite.

- Estimated trend in ground water elevations based on past data and on predicted use.

- Analysis of ground water samples to determine the specific identities and quantities of contaminant species, i.e., percent diesel and percent asphalt.

Definition of the above parameters and applications of ARARs will provide the guidelines for bench-scale testing in a laboratory or pilot testing in the field. A major objective of the tests will be to establish if the chemistry of the process works. Bench-scale or pilot testing will also provide information that will be the basis for detailed designs, equipment selection and equipment sizing. The tests will include observations on processing rates, physical through-put, and rates of extraction or destruction of contaminants. Studies will be performed to determine the potential for fouling the system by either biomass or by chemical deposition of compounds in solution. Potential for corrosion and general materials acceptability will be noted. Testing will also examine biological toxicity effects of contaminated ground water on the bioremediation process. Tests will be performed in batches with treatment parameters varied one at a time to evaluate performance under a range of conditions. However, in general, extensive testing of ground water treatment equipment is not expected at this stage.

Petroleum product which may be extracted or otherwise produced during the pilot testing will be sampled and evaluated for disposal alternatives. Testing may be performed at this time to evaluate product incineration or addition to asphalt.

7.2.3 Acquisition of Permits

Kleinfelder will assist in acquisition of necessary permits for the preliminary design including permit preparation and communication with regulatory agencies. A remedial workplan for ground water treatment will be submitted to the ACDEH and to the RWQCB. The approved workplan will establish what types of permits will be required.

7.2.4 Detailed Design

The next step in the remediation plan is development of design details. From the detailed design, information on budgeting, procurement and installation of the system will be developed. Design of large diameter extraction wells and selecting the major equipment will be the most likely activities to commence first. Information gathered from this step will greatly affect the rest of the system design.

Site drawings will be prepared showing the location of the remediation system onsite. A piping and instrument diagram (P & ID) will be drawn showing equipment, piping and controls in a schematic form.

Equipment layout drawings will show detailed equipment, piping and control arrangements. At this point, bid specifications will be prepared for equipment, services, and materials and sent to qualified sources. A budget and schedule for installation will be formulated based on response to the bid requests and will be sent to Industrial Asphalt for approval.

7.2.5 Procurement and Construction

With the approval of Industrial Asphalt for the design and installation budget, Kleinfelder will procure the equipment, material, and arrange for installation services needed for the construction and operation of the interim system. Major equipment may take six to eight weeks to deliver, but actual delivery dates will be confirmed during actual equipment selection. If preliminary site grading is required, it may be possible to utilize equipment and labor already present at Industrial Asphalt. A subcontract will be awarded to an approved contractor qualified to install the equipment. Installation and testing of the equipment will commence as quickly as possible.

Site construction will start with installation and testing ground water extraction wells. It is possible that this step may proceed prior to completion of the detailed design of the treatment system. Next underground pipelines connecting the extraction wells to the treatment pad will be installed followed by placement of a concrete pad at the treatment site. The concrete pad will be designed with a protective berm around the perimeter. Next major equipment will be installed with above ground piping including pipe connections to the underground pipelines. The last step in construction will be completion of instrumentation and electrical equipment.

7.2.6 Start Up, Operations, and Monitoring

The equipment will be pre-operationally functionally checked, instruments calibrated, and the system will be operated for a short time for proof of performance. System evaluation will be performed including sample collection and analysis for liquid and vapor emissions and for treatment efficiency. System performance will require review and approval by the regulatory agencies before operations commence on a full time basis. Upon receipt of the approval, Kleinfelder will prepare a report of the installation and preliminary operations for review and acceptance by Industrial Asphalt.

Once the system approval has been granted by Industrial Asphalt, operations of the system and disposal of the treated water will commence and run under a monitoring program involving regular sampling with reports submitted periodically to Industrial Asphalt and to the regulatory agencies, as required.

7.2.7 Final Remediation Requirements

Ground water remediation will continue as long as analysis of samples show detectable levels of petroleum hydrocarbons or until TPH concentrations are acceptable to the ACDEH and CRWQCB. Final samples will be taken and analyzed to support the closure of the treatment site. Once remediation is complete, process equipment will be disassembled. The results of the work will be summarized in a final report.

7.2.8 Schedule

Work on the plan may begin promptly. If the project can start in February 1990, the ground water treatment should begin by July 1990. A proposed project summary for the complete ground water and soil remediation schedule is shown in Plate 4.

7.3 SOIL TREATMENT IMPLEMENTATION

Once the vertical and horizontal extent of the soil contamination has been adequately evaluated, clean up objectives may be formalized. The objectives should reflect current site activity requirements, regulatory requirements and overall costs.

7.3.1 Preliminary Design

Preliminary engineering can begin once the remedial objectives have been finalized. The preliminary design developed at this stage will describe the remediation method, the basic system configuration and installation.

Review of available site data and determination of regulatory restraints and requirements will be the first step of the preliminary design. This work will follow the preliminary engineering for ground water treatment and will probably parallel continuing remedial investigation activities.

A process flow diagram with preliminary process information will be drawn up for the soil remediation process in the next step. The preliminary information will include soil and water quantities, amounts and concentrations of contaminants and anticipated processing rates. General information on how this system will fit into the pre-established ground water remediation system will also be presented at this stage. Included in the preliminary engineering will be the preparation of a site safety plan.

7.3.2 Bench-Scale or Pilot Testing

Application of emerging technologies to achieve remediation under the special conditions at Industrial Asphalt will most likely be preceded with careful bench-scale testing in a laboratory or pilot testing onsite. This work may be performed directly by Kleinfelder or by subcontractors who provide services and processes for in-situ remediation under Kleinfelder's supervision. For in-situ bioremediation, testing at this stage will help to establish the presence of inhibiting substances, necessary microbial quantities, nutritional additives and oxygen requirements. Tests on steam injection would indicate well spacing, process requirements and rates such as energy consumptions and time until product recovery. The information obtained at this stage will be used with information gathered during bench-scale or pilot testing of ground water as described in Section 7.2.2 of the workplan and also with field results from the pre-established ground water remediation program.

7.3.3 Acquisition of Permits

The information developed in the preliminary design and obtained during bench or pilot testing will be used as the basis for regulatory permit applications. Kleinfelder will assist with permit acquisition including preparation of permit applications and communication with agency representatives. While neither in-situ steam injection nor in-situ bioremediation should produce air emissions or liquid discharges that would require additional permits, the ground water treatment system will be receiving more water from the extraction wells. Some modifications to the permits granted for ground water extraction, treatment, and disposal may be necessary at this time.

7.3.4 Detailed Design

The information collected through the RI and through bench scale or pilot testing will be used in developing size requirements for the equipment needed for the treatment process. Equipment must be sized to fit both physical parameters and regulatory constraints. The information provided in this step is needed to develop budgets and schedules. Discussion with vendors will aid in the selection of equipment. A piping and instrument diagram (P & ID) which shows schematically how major equipment, piping and controls work together will be prepared. The P & ID will be used as a means of keeping track of all process equipment used in the remediation system. The location of the remediation system with respect to other site facilities will be shown as a site layout drawing. An equipment arrangement drawing will show the detailed physical arrangement of equipment, piping and controls.

7.3.5 Procurement and Construction

Bid specifications for equipment materials and subcontract services will be prepared based on the detailed design and sent to qualified sources. Based on subsequent bid submittals, a definitive installation schedule and budget can be prepared. The schedule and budget will be submitted to Industrial Asphalt for review and approval prior to procuring equipment or contract award. Major equipment may take six weeks to deliver.

Construction of the soil remediation system would probably start with the installation and testing of injection wells. Underground pipelines from the planned location of treatment equipment to the injection wells would be installed next. Thereafter, a concrete pad for treatment equipment would be built, followed by installation of equipment, above ground conduits, instruments and electrical components.

7.3.6 Start Up, Operation, and Monitoring

The equipment will be pre-operationally functionally checked, instruments calibrated, and the system will be operated for a short time for proof of performance. System evaluation will be performed including sample collection and analysis for liquid and vapor emissions and for treatment efficiency. System performance will require review and approval by the regulatory agencies before operations commence on a full time basis. Upon receipt of the approval, Kleinfelder will prepare a report of the installation and preliminary operations for review and acceptance by Industrial Asphalt.

Operation of the system will consist mainly of injecting a bioremediation solution and extracting ground water for surface treatment or injecting steam and removing the vapor by vacuum suction. Sampling and analyzing the soil and ground water under treatment will occur frequently with periodic reports following.

7.3.7 Final Remediation Requirements

After samples of soil and ground water exhibit TPH concentrations acceptable to the DHS, the treatment will cease and the equipment disassembled. The results will be summarized in a final report. Final site closure is discussed in Section 6 of the Workplan.

7.3.8 Schedule

The soil treatment phase of site remediation should be scheduled for implementation concurrently with the ground water treatment system. This will provide for integration of soil and ground water treatment needs. A proposed project summary for the complete ground water and soil remediation schedule is shown on Plate 4.

7.4 VERIFICATION OF REMEDIATION

At regular intervals throughout the remediation process, soil and ground water samples will be collected and analyzed for contaminants. The objective of the sampling program will be to verify whether the treatment process is performing as intended. For this reason, samples will need to be collected before and after treatment, both in the ground and at the treatment process. Sampling will be divided into three programs:

- Sampling of ground water from onsite monitoring wells
- Sampling of ground water influent and effluent at the treatment process
- Soil sampling from soil borings to be drilled during remedial activities.

7.4.1 Ground Water Sampling

Ground water samples will be collected on a monthly basis from onsite monitoring wells. Field measurements of pH, electrical conductivity, and temperature will be taken during sample collection. The samples will be used to determine the concentrations of contaminants remaining in the ground water. Analysis will be performed by a State-certified laboratory using EPA Methods 8080 (PCBs) 8015 (TPH-D) and 503 B (asphalt), if necessary.

Additional ground water samples will be collected from sampling points installed before the ground water goes through treatment and after treatment. If the treatment system involves more than one process, samples also will be collected between processes to evaluate the performance of each process. During the first week of treatment at least five samples will be collected of influent and effluent ground water. Thereafter, weekly sampling will ensue for a few weeks, tapering off to monthly sampling for the remainder of the treatment period.

7.4.2 Soil Sampling

Once soil remediation has been in operation for a significant period of time (i.e. a few months or when process observations indicate that little or no contaminants are being removed, soil borings will be drilled. Soil samples will be collected at varying depths and used to evaluate the effect of treatment on concentrations. Samples will be analyzed by a State-certified laboratory using EPA Methods 8080 for PCBs, 8015 for diesel/waste oil.

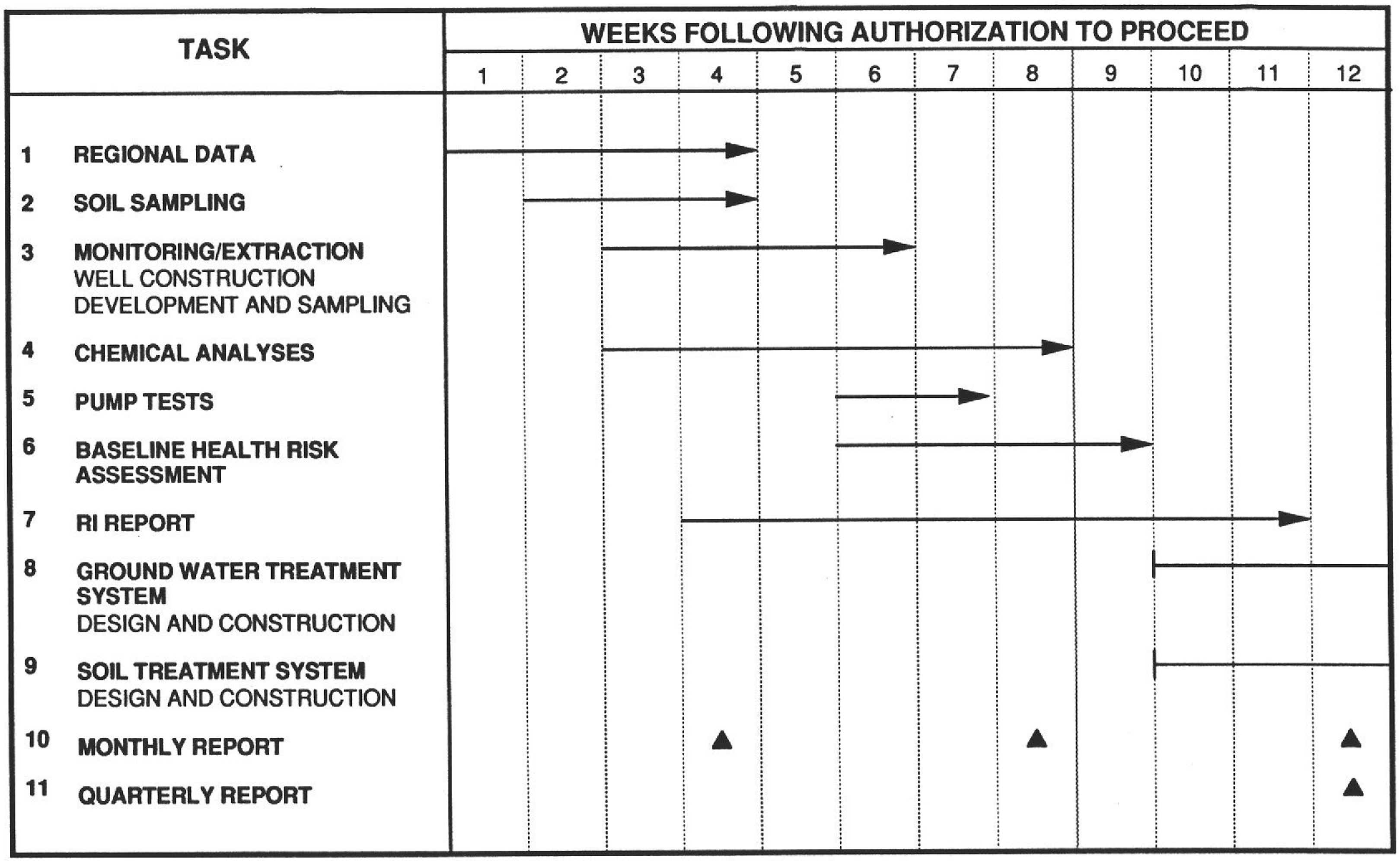
7.5 SITE CLOSURE

After verification of required remediation, Kleinfelder will submit a report of remedial activities with sampling results to Industrial Asphalt, the ACDEH, and CRWQCB. If the regulatory agencies agree that the remedial objectives have been met and that further remedial actions are unnecessary, treatment will cease. The treatment system will be decommissioned and removed from site with minimal disruption of Industrial Asphalt operations. Ground water monitoring will continue for a year after halting soil and ground water remediation. Ground water samples will be collected and analyzed on a quarterly basis using the same procedures and tests used during treatment. A report of monitoring activities will be submitted to Industrial Asphalt and to appropriate regulatory agencies on a quarterly basis and a final report will be submitted after one year.

8. SCHEDULE

A proposed summary project schedule is shown in Figure 4. A detailed critical path version of the same schedule is included in Appendix B. As indicated, Kleinfelder can start work upon approval of the RI/RAP by the ACDEH. Note that the schedule assumes two to three weeks standard turnaround on laboratory analyses and approximately two weeks for the drilling company work backlog.

Figure 4. Project Schedule



9. LIMITATIONS

This report was prepared in general accordance with the accepted standard of practice which exists in Northern California at the time the investigation was performed. It should be recognized that definition and evaluation of environmental conditions is a difficult and inexact art. Judgements leading to conclusions and recommendations are generally made with an incomplete knowledge of the conditions present. More extensive studies, including additional environmental investigations, can tend to reduce the inherent uncertainties associated with such studies. If the Client wishes to reduce the uncertainty beyond the level associated with this study, Kleinfelder should be notified for additional consultation.

Our firm has prepared this report for the Client's exclusive use for this particular project and in accordance with generally accepted engineering practices within the area at the time of our investigation. No warranties, expressed or implied, as to the professional advice provided are made.

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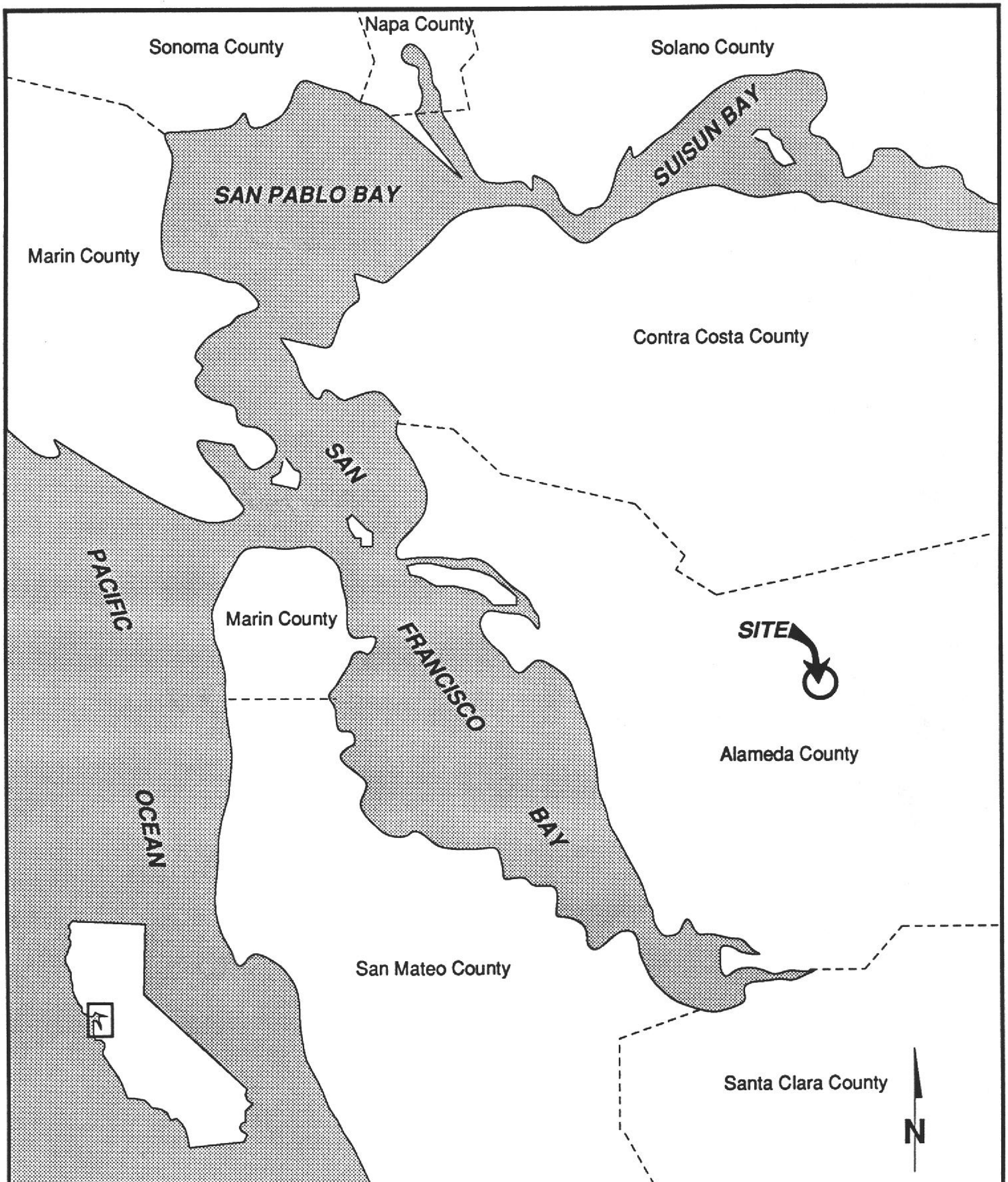

KLEINFELDER		REGIONAL LOCALITY MAP INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 1
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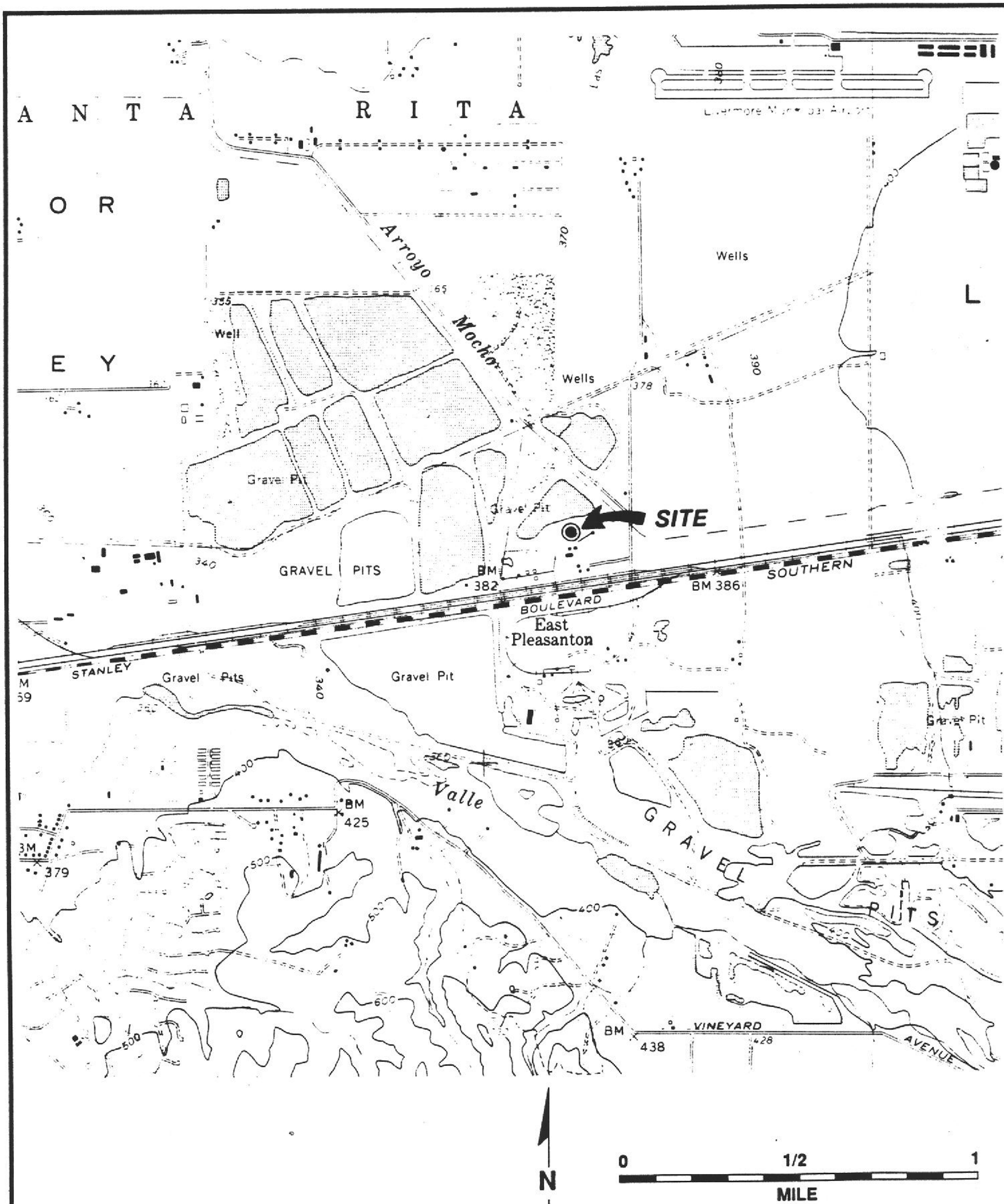
CHECKED BY: K. Jesionek	DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER

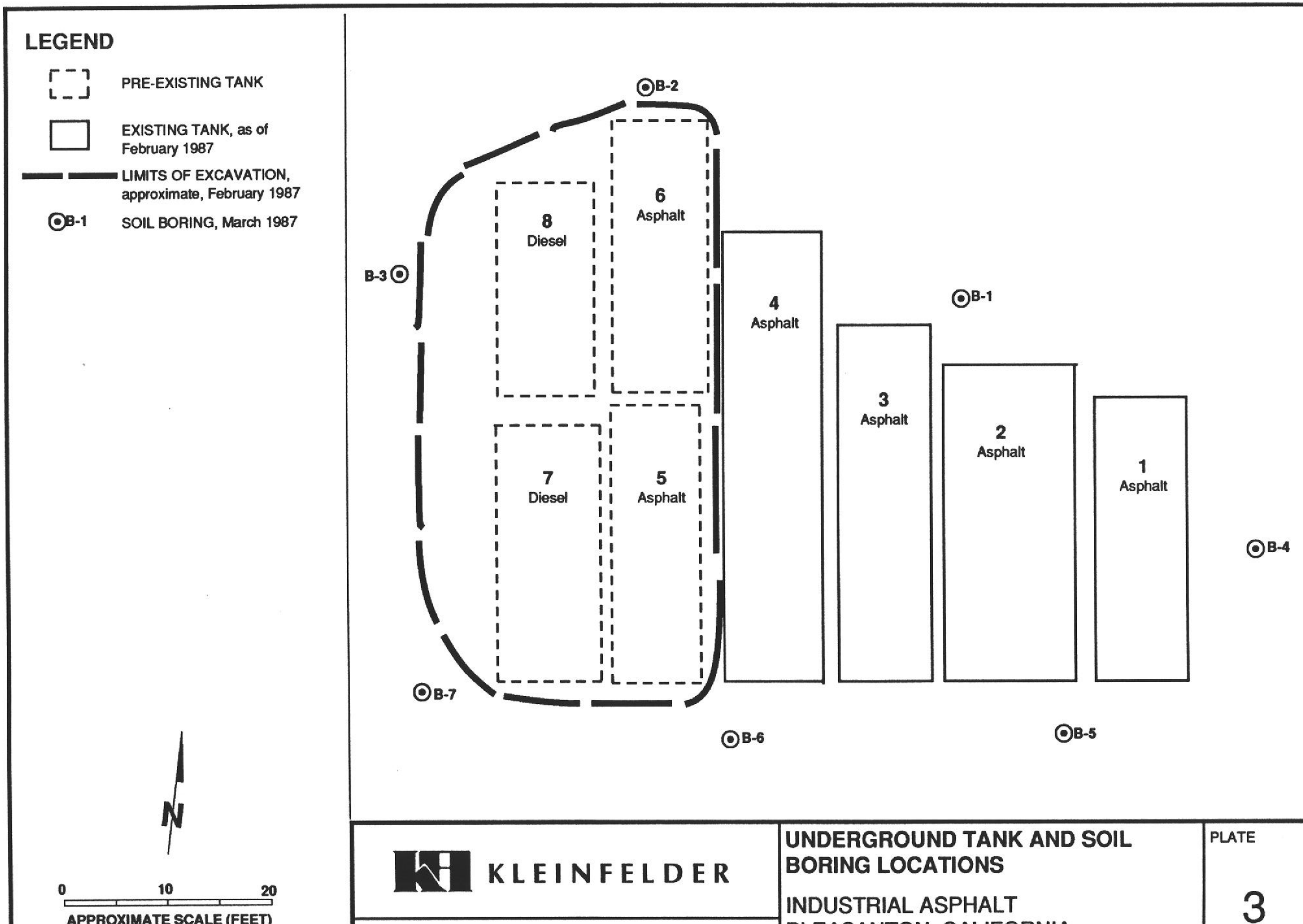
PROJECT NO. 10-1682-05

SITE LOCATION MAP

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PLATE

2



KLEINFELDER

UNDERGROUND TANK AND SOIL BORING LOCATIONS

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PLATE 3

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CHECKED BY:	K. Jesionek	DATE:	1-10-90

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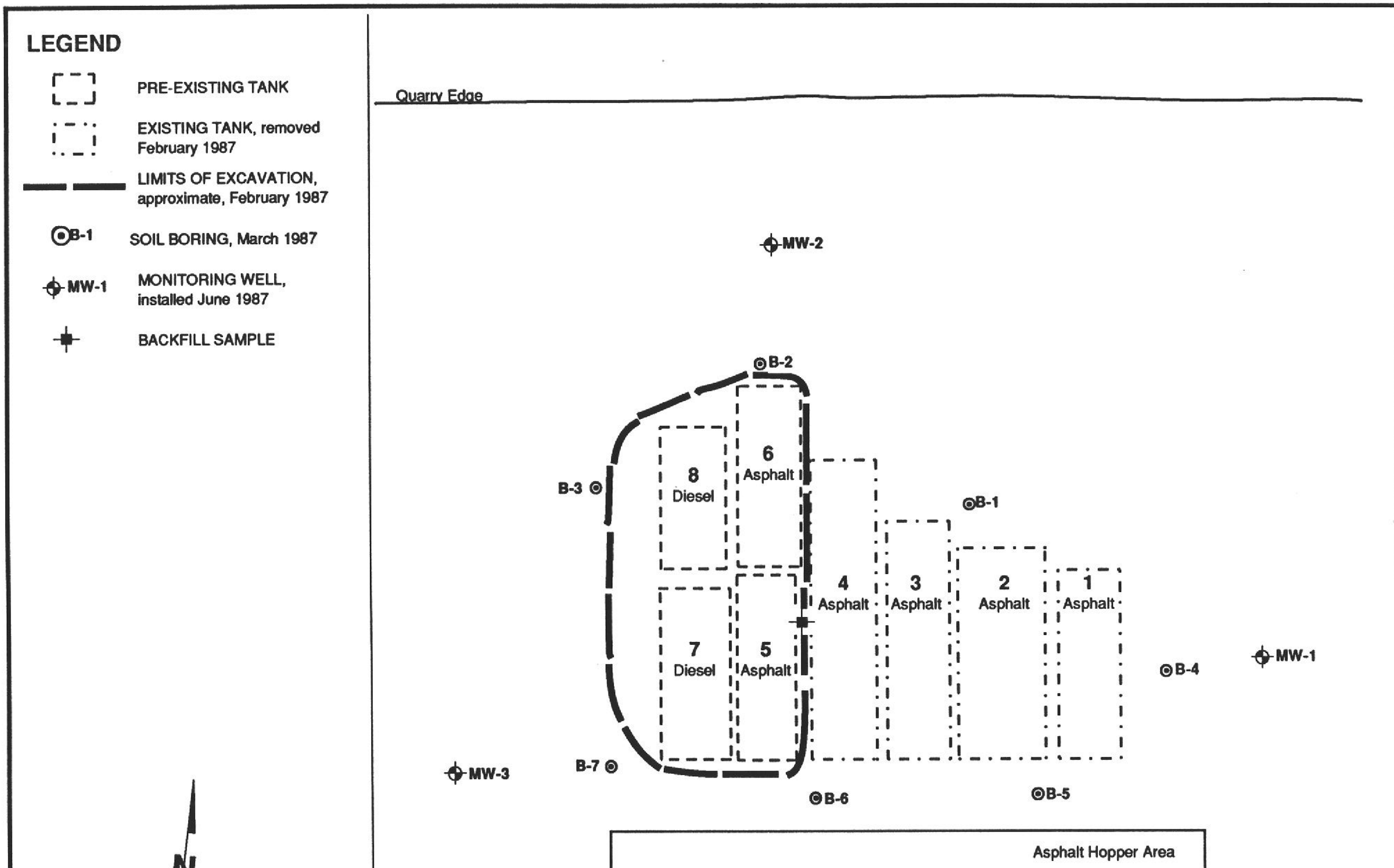

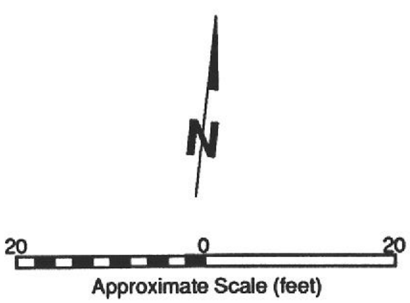

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DRAFTED BY: L. Sue	DATE: 1-5-90
CHECKED BY: K. Jesionek	DATE: 1-10-90

MONITORING WELL LOCATIONS, 1987

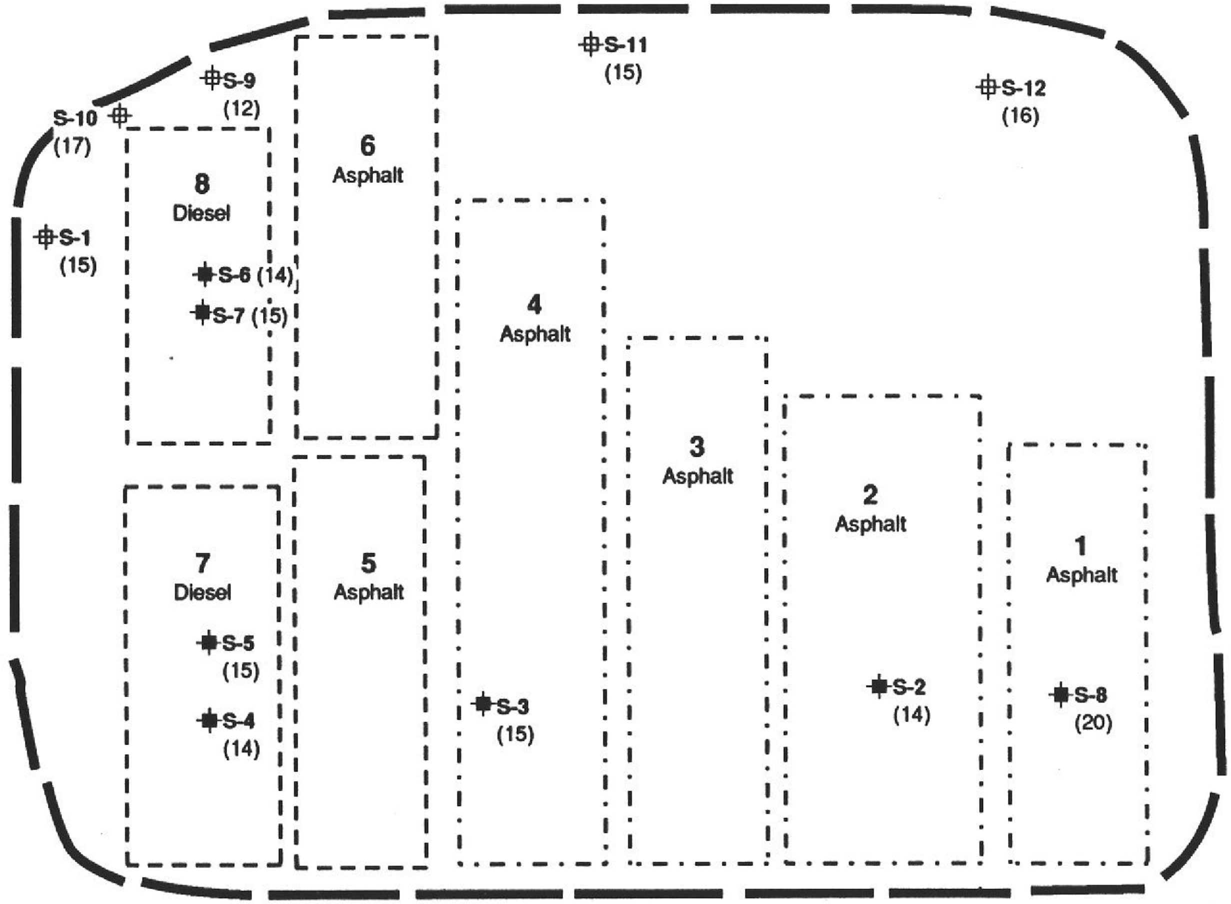
INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE 4

LEGEND

- TANK, excavated February 1987
- TANK, excavated September 20, 1987
- LIMITS OF EXCAVATION, approximate
- S-2 (14) — CLOSURE SAMPLE from excavation floor (DEPTH, feet)
- S-1 (15) — CLOSURE SAMPLE from excavation sidewall (DEPTH, feet)



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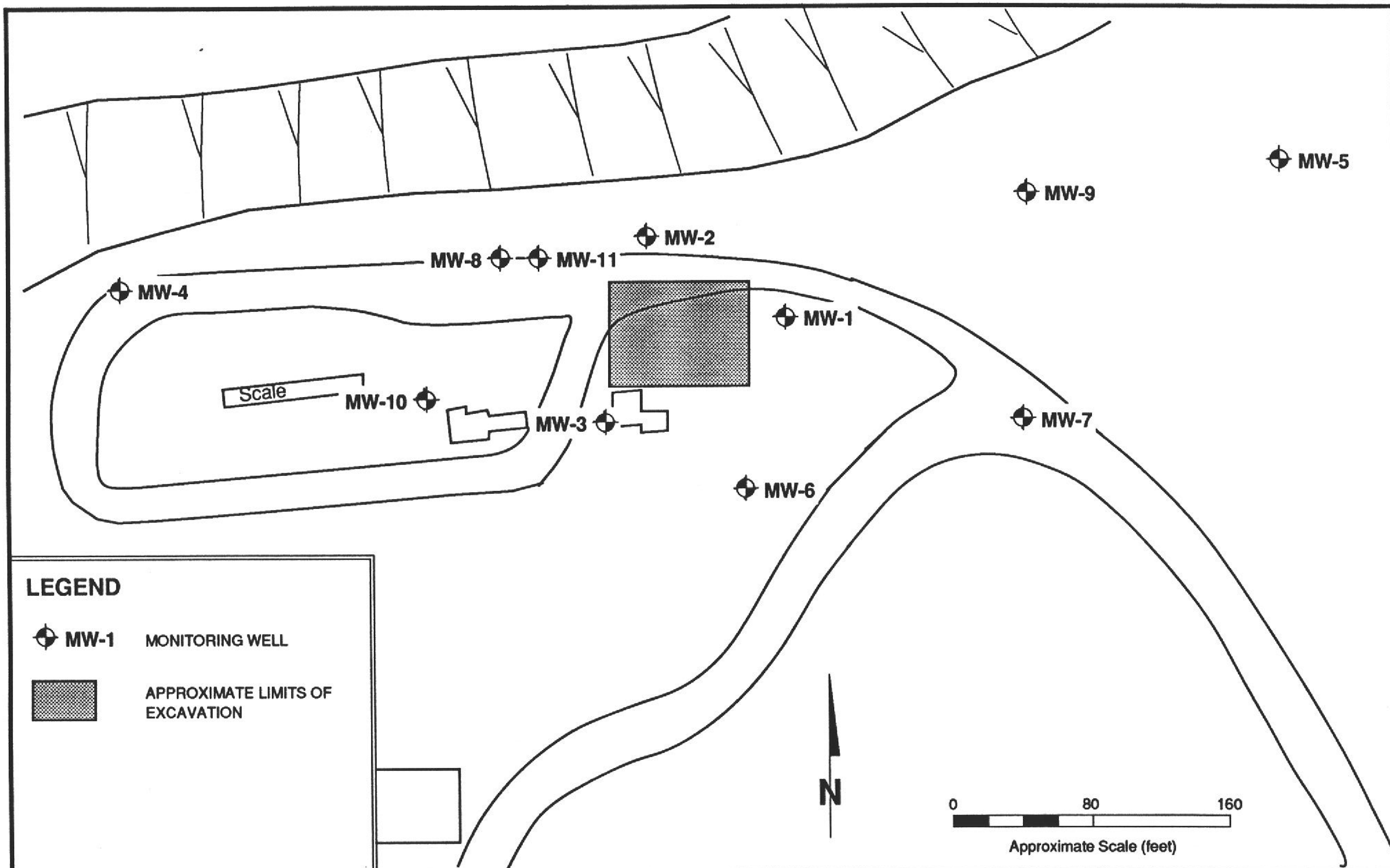
APPROXIMATE SCALE (FEET)

KLEINFELDER

DRAFTED BY: L. Sue	DATE: 1-5-90	**UNDERGROUND TANK AND CLOSURE SAMPLE LOCATIONS** INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 5
CHECKED BY: K. Jesionek	DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER

MONITORING WELL LOCATIONS (1989)

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PLATE 6

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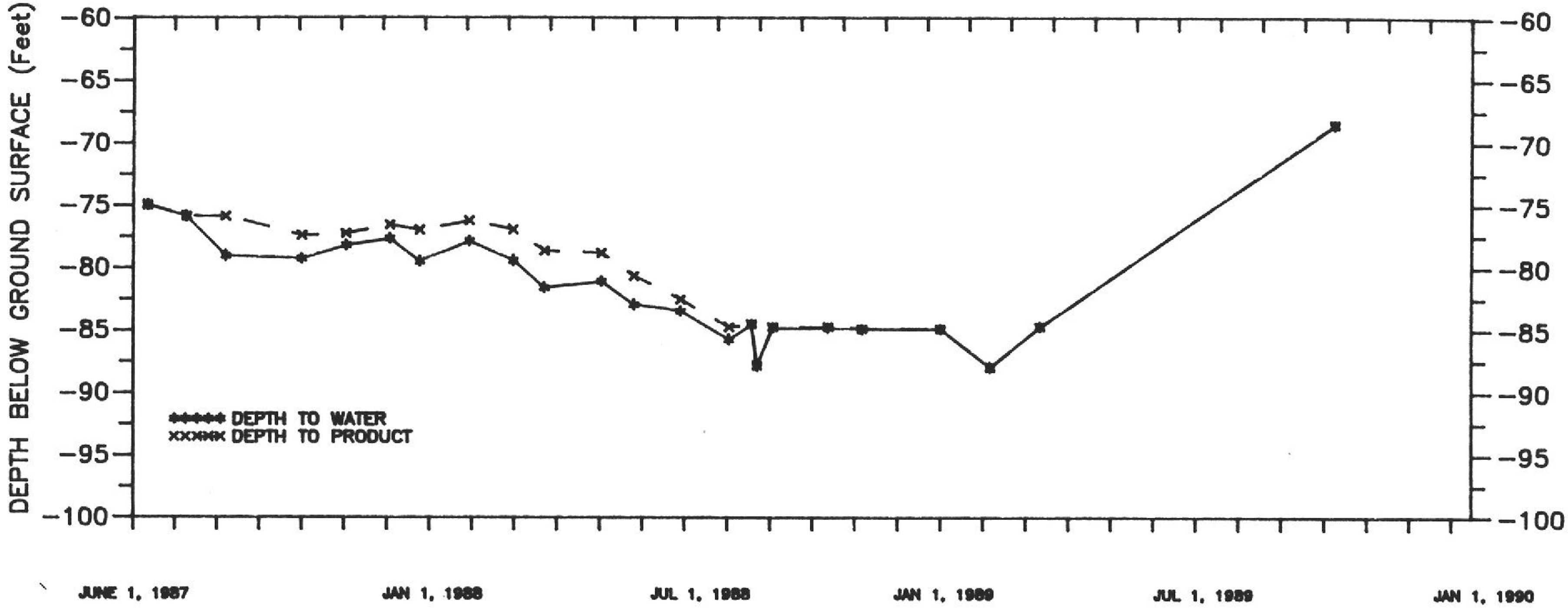


KLEINFELDER

DRAFTED BY: M. Singer DATE: 1-10-90

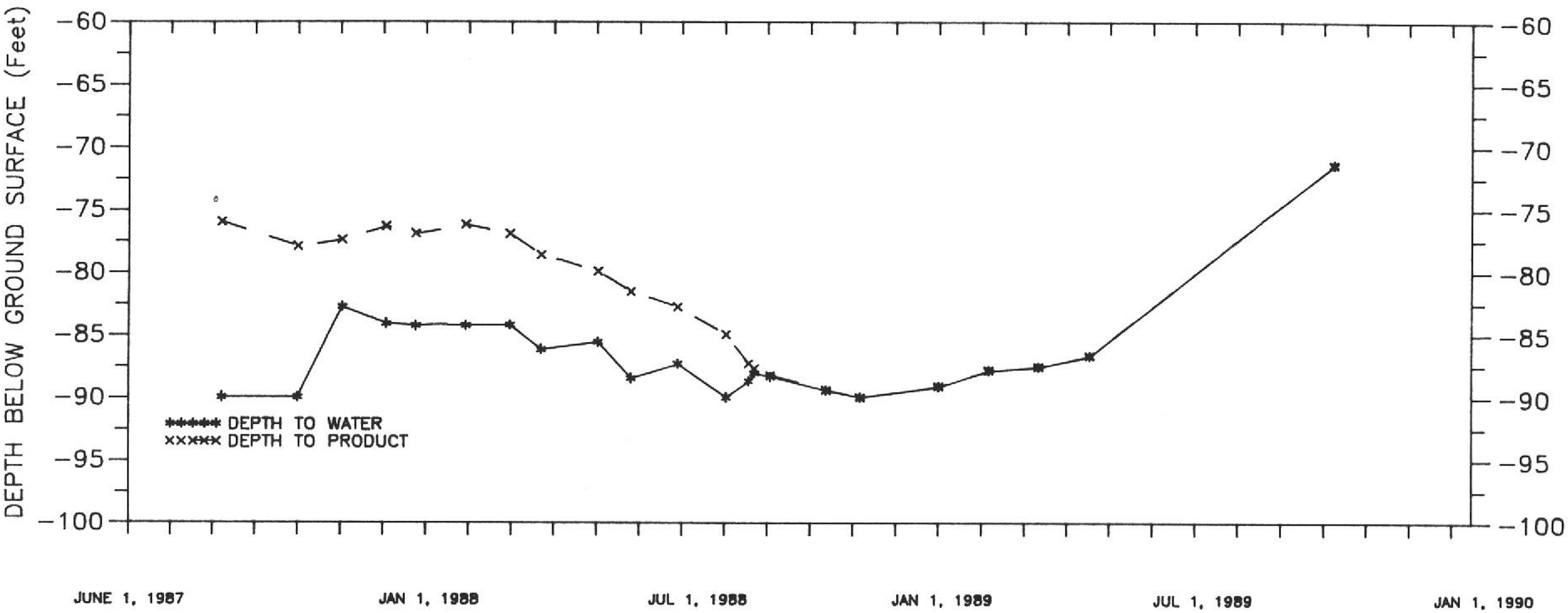
CHECKED BY: K. Jesionek DATE: 1-10-90

DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-1

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE 7



KLEINFELDER	DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-2 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 8
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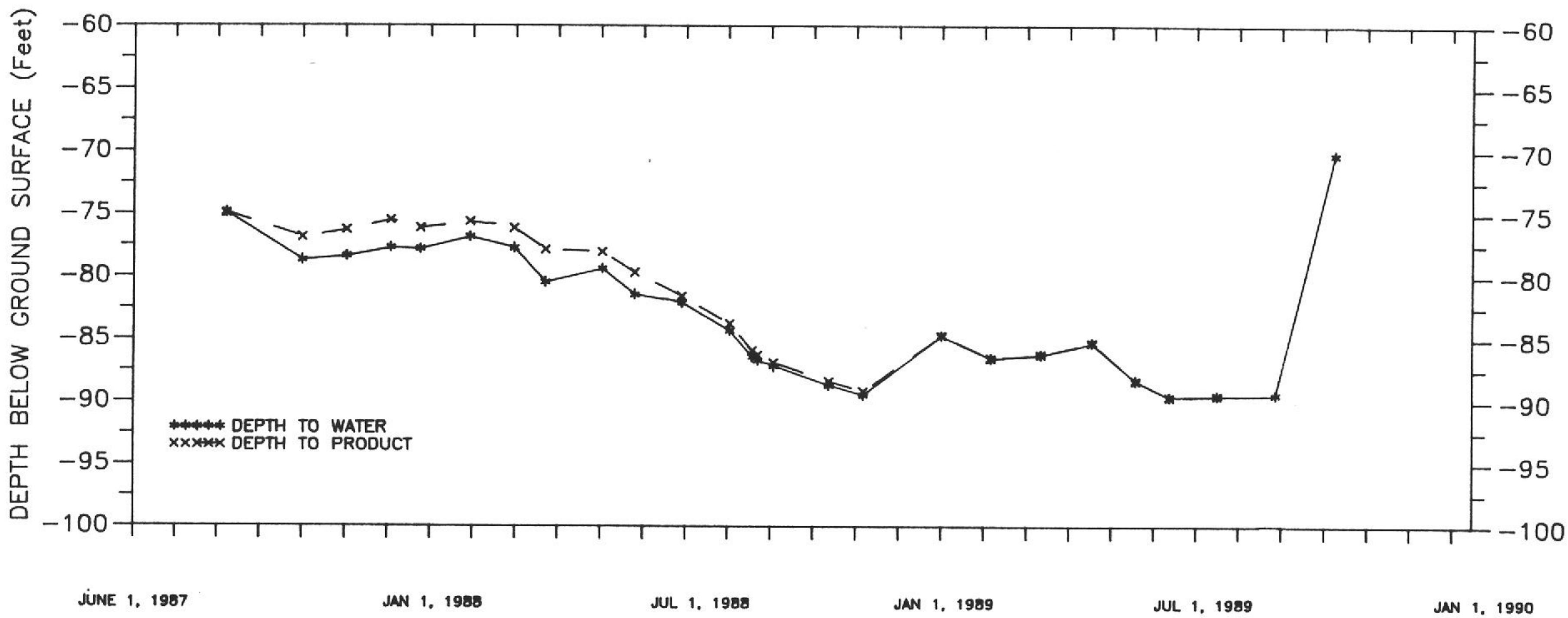
CHECKED BY: K. Jesionek DATE: 1-10-90	PROJECT NO. 10-1682-05	



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DRAFTED BY: M. Singer	DATE: 1-10-90
CHECKED BY: K. Jesionek	DATE: 1-10-90

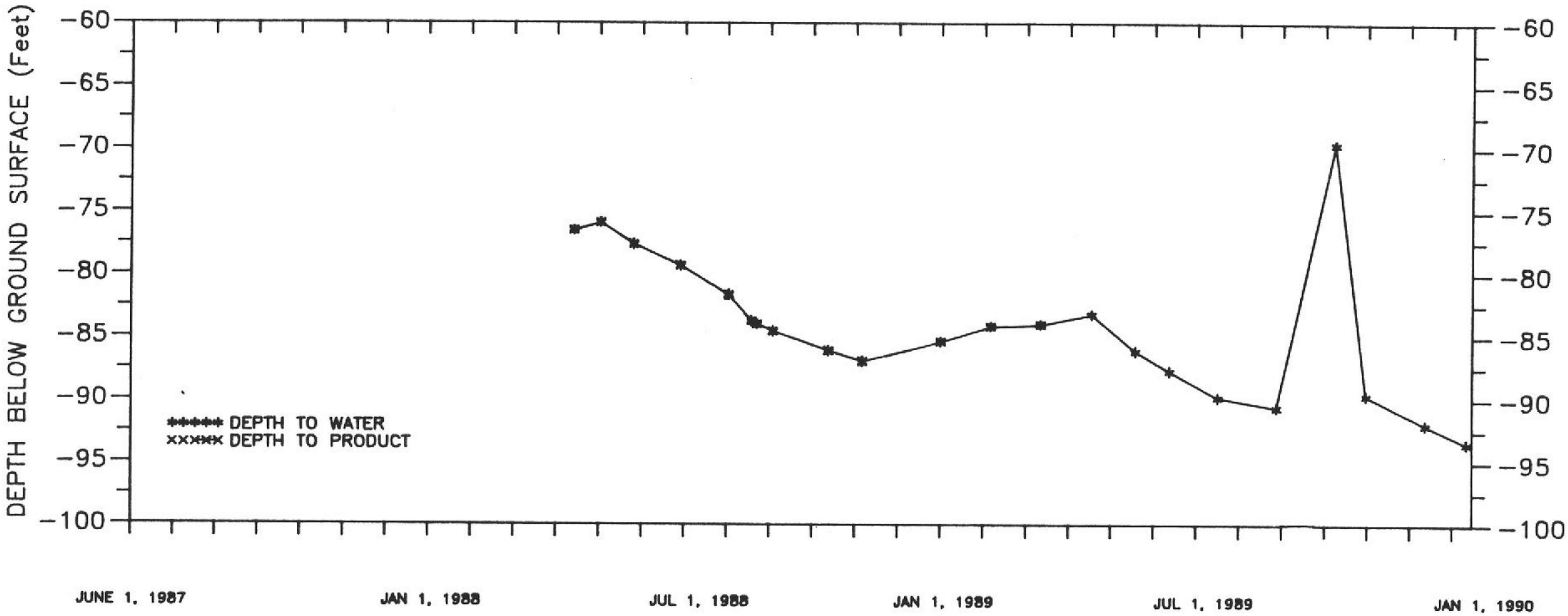
DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-3

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE

9



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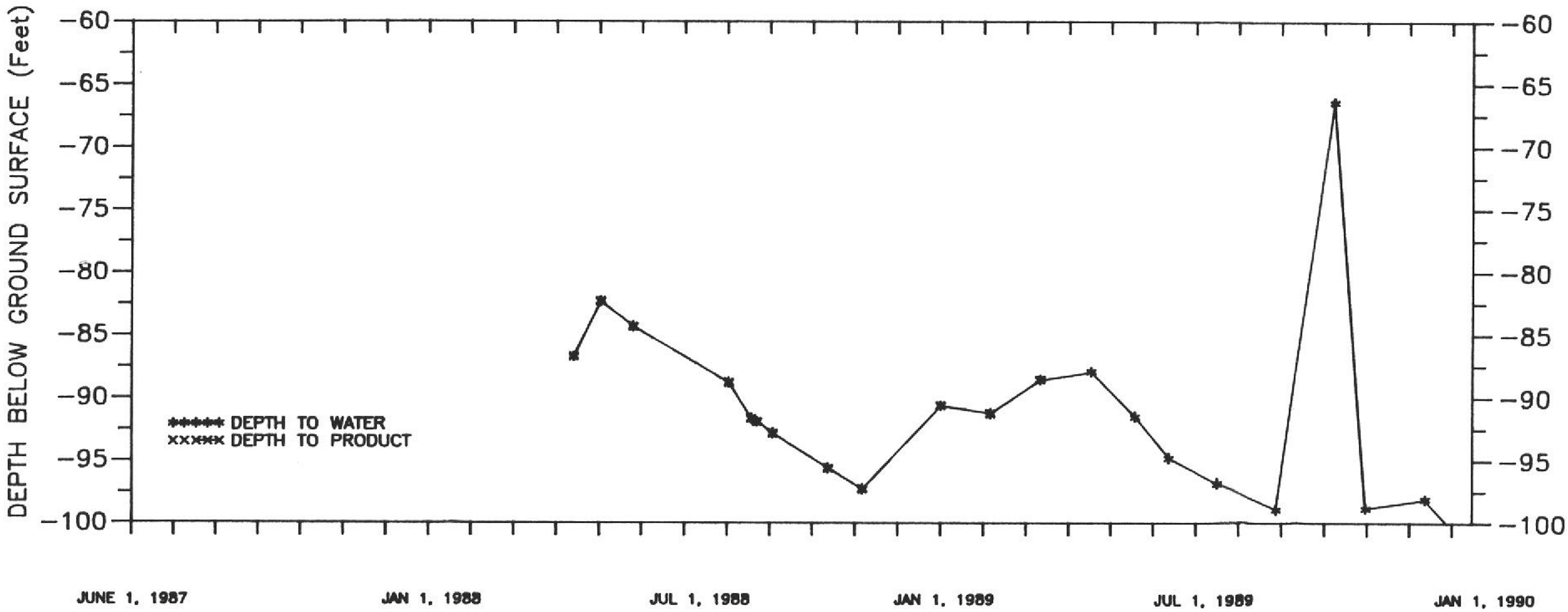
CHECKED BY: K. Jesionek	DATE: 1-10-90	

DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-4

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE
10



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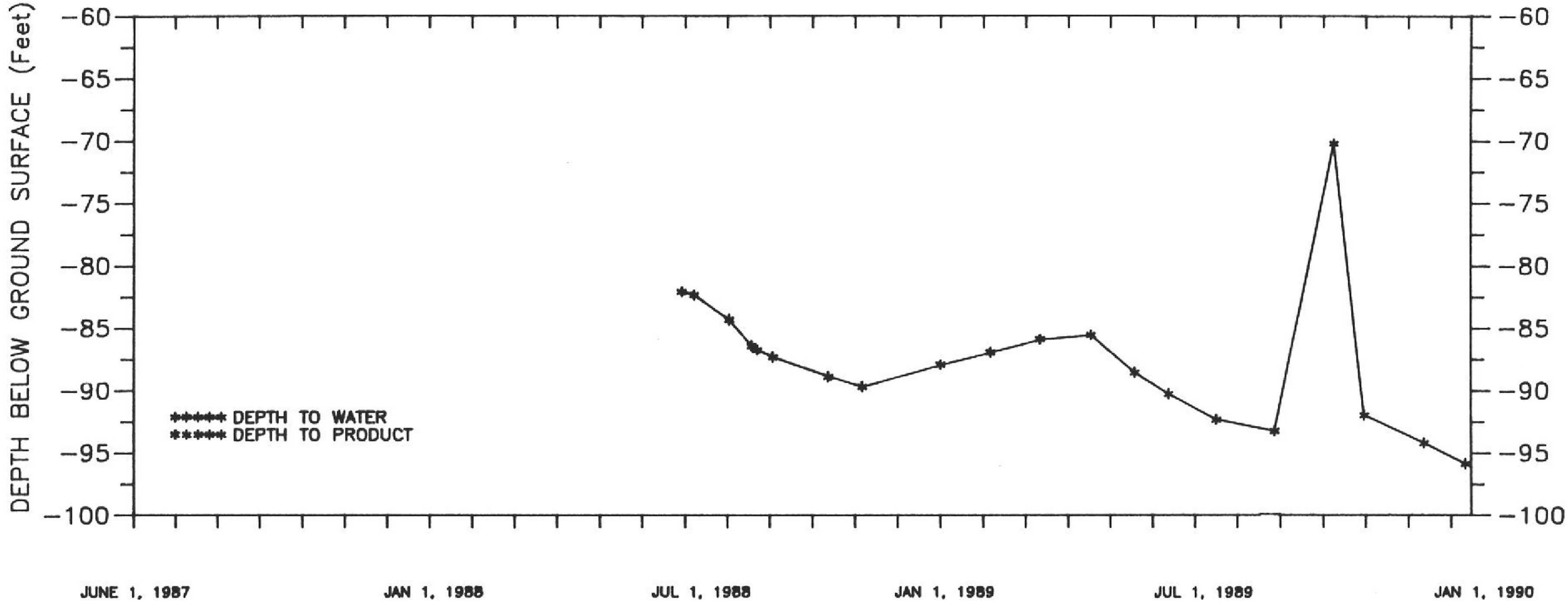
CHECKED BY: K. Jesionek DATE: 1-10-90

DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-5

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE 11



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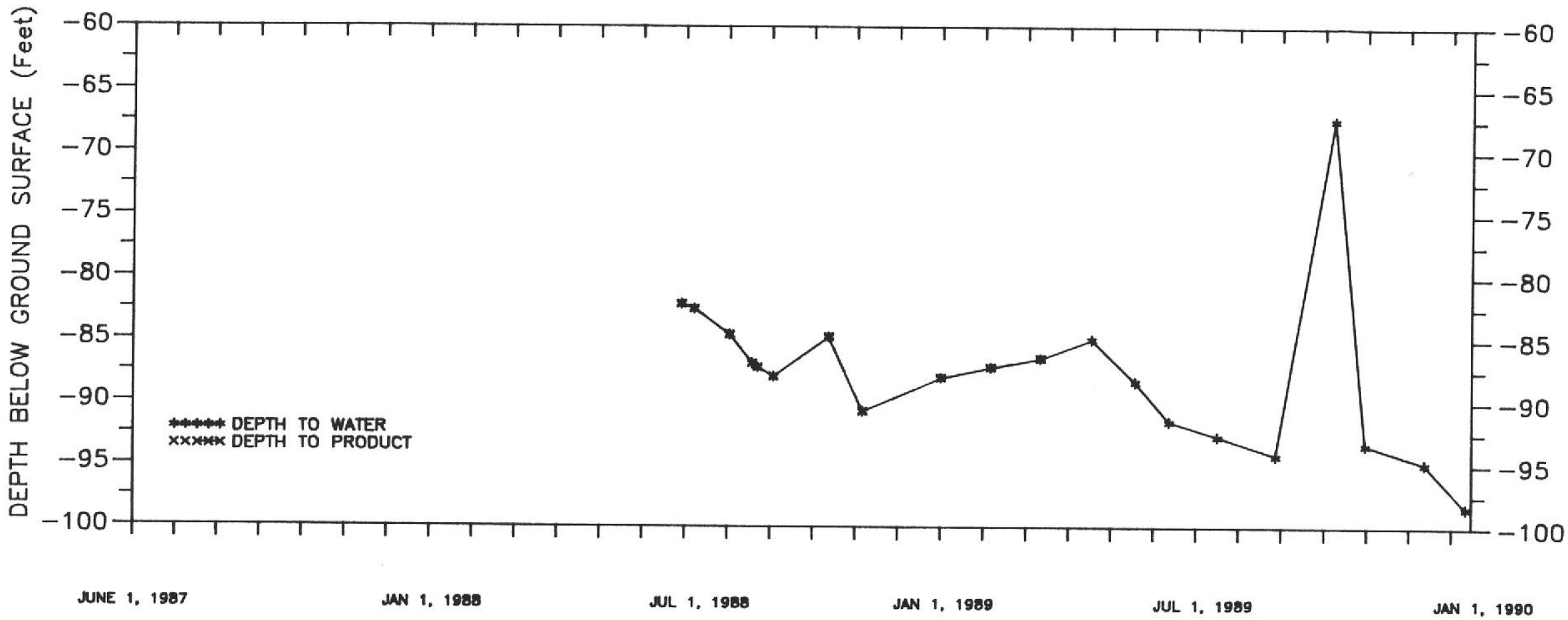
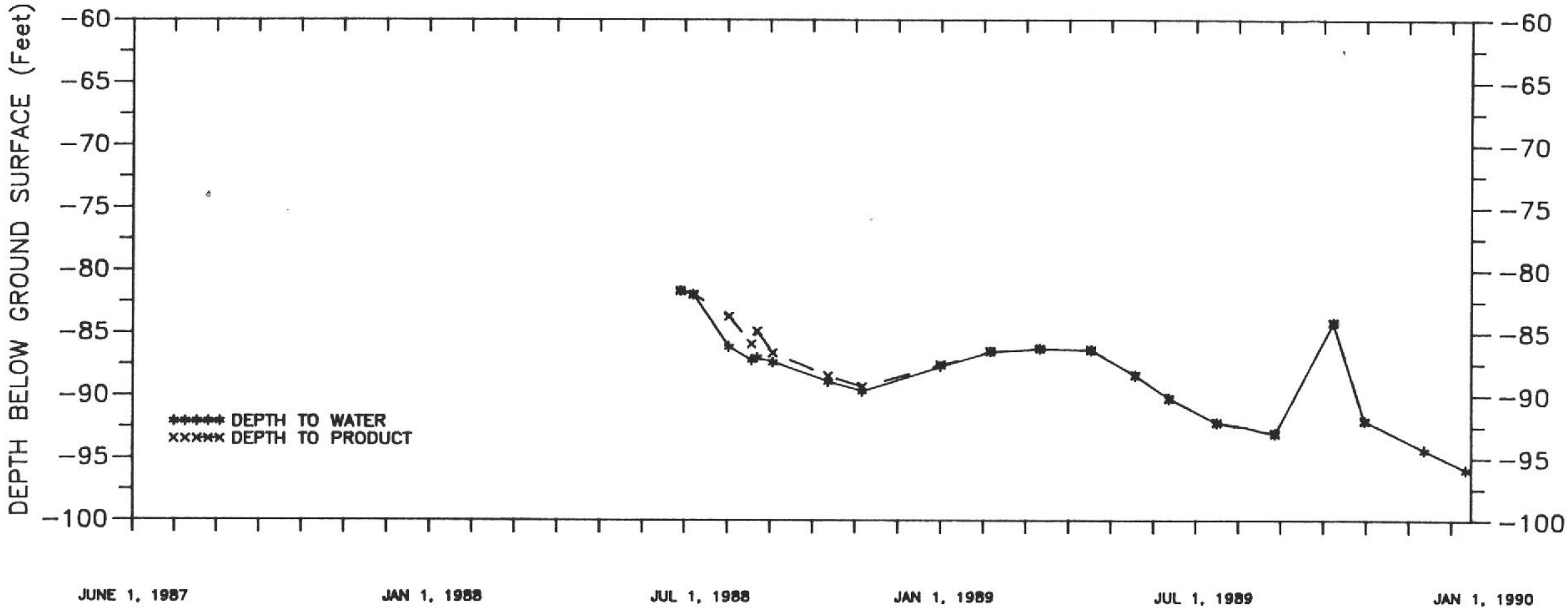
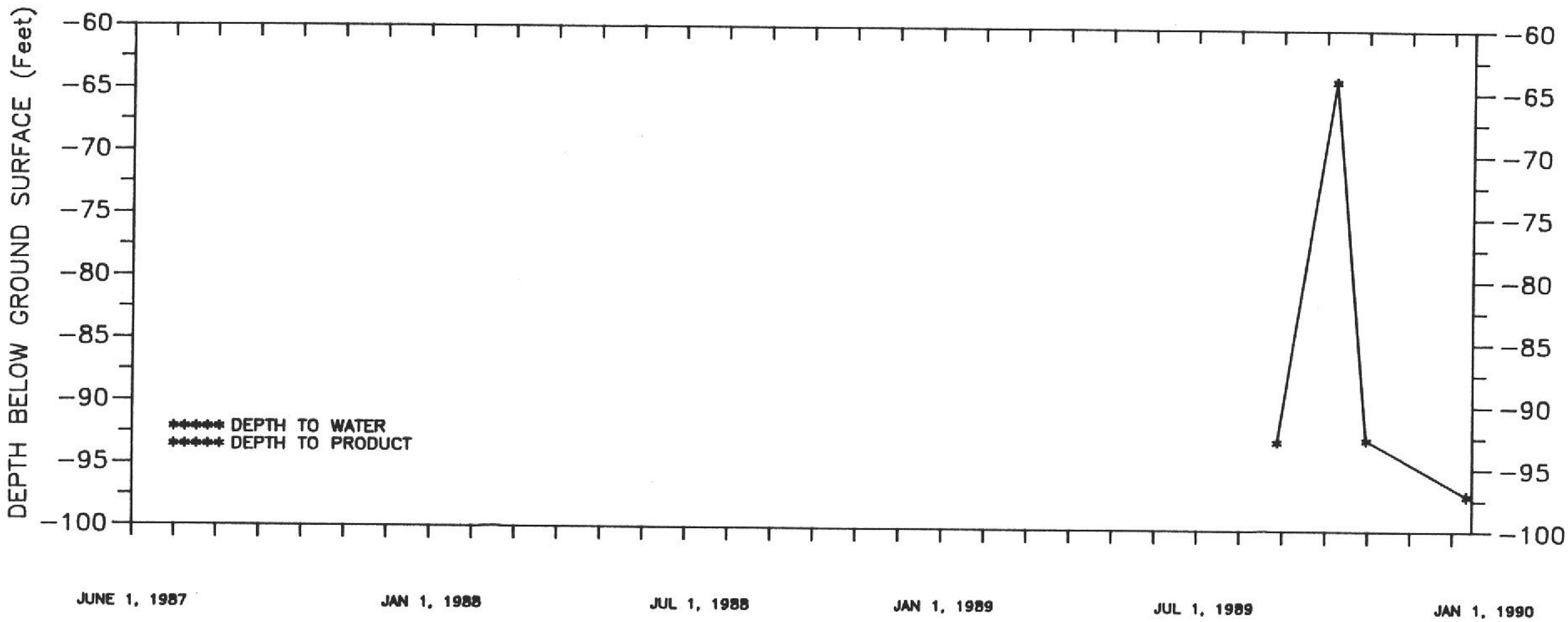
CHECKED BY: K. Jesionek	DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER		DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-7 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 13
DRAFTED BY: M. Singer	DATE: 1-10-90		
CHECKED BY: K. Jesionek	DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER	DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-8 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 14
DRAFTED BY: M. Singer DATE: 1-10-90 CHECKED BY: K. Jesionek DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER

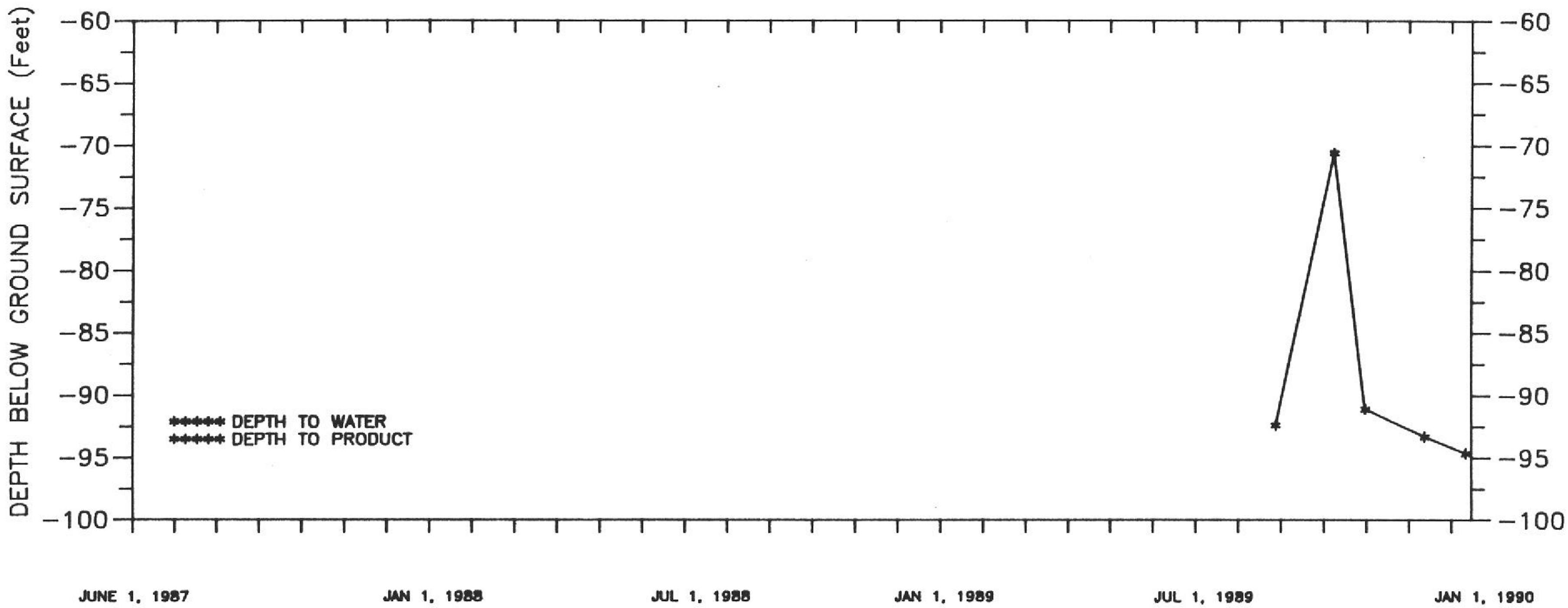
DRAFTED BY: M. Singer	DATE: 1-10-90
CHECKED BY: K. Jesionek	DATE: 1-10-90

DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-9

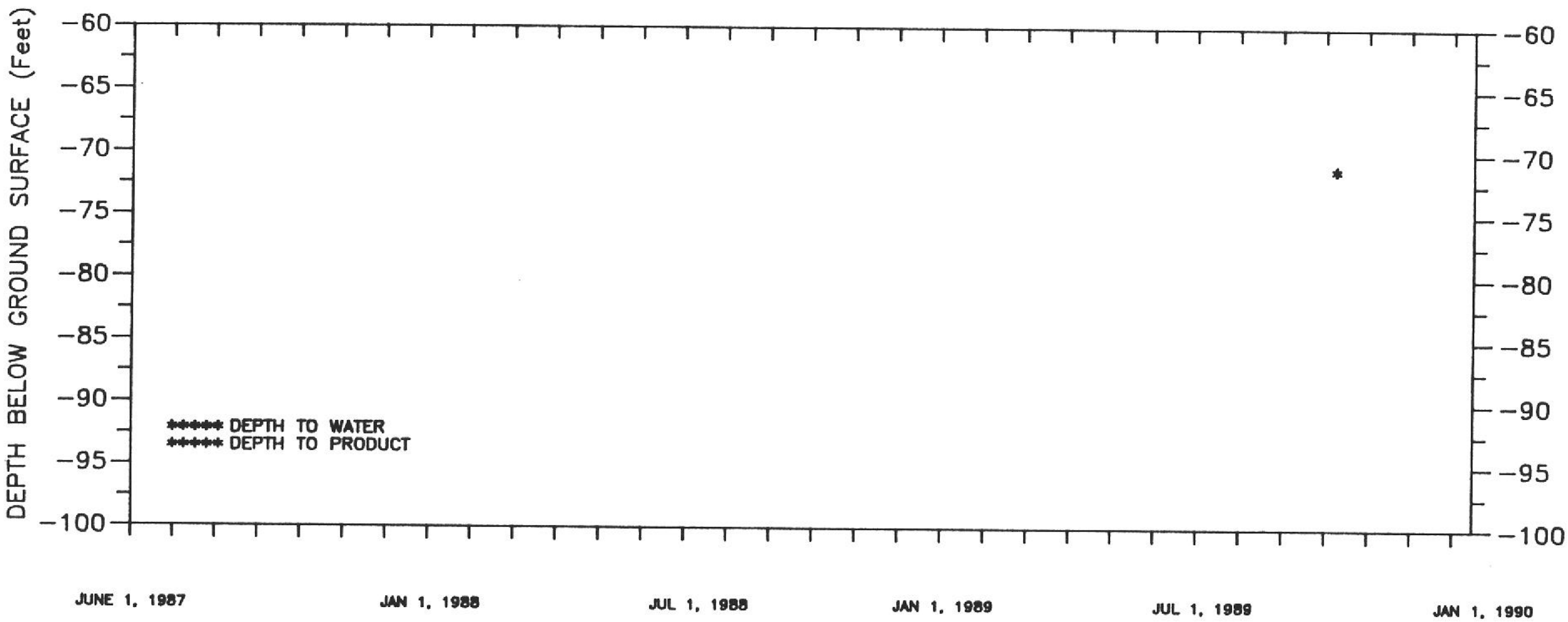
INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE 15



KLEINFELDER		DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-10 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 16
DRAFTED BY: M. Singer	DATE: 1-10-90		
CHECKED BY: K. Jesionek	DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER	DEPTH TO WATER AND FREE-PRODUCT HYDROGRAPH FOR WELL MW-11 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 17
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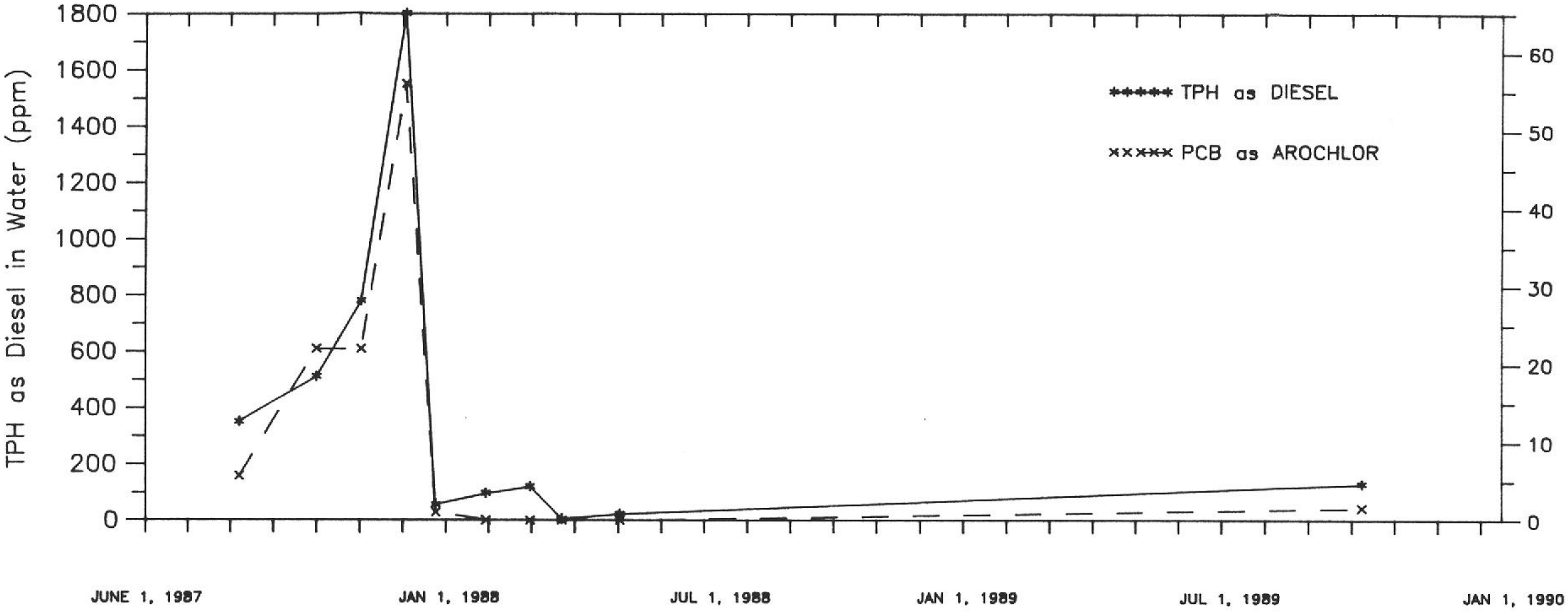
CHECKED BY: K. Jesionek DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER

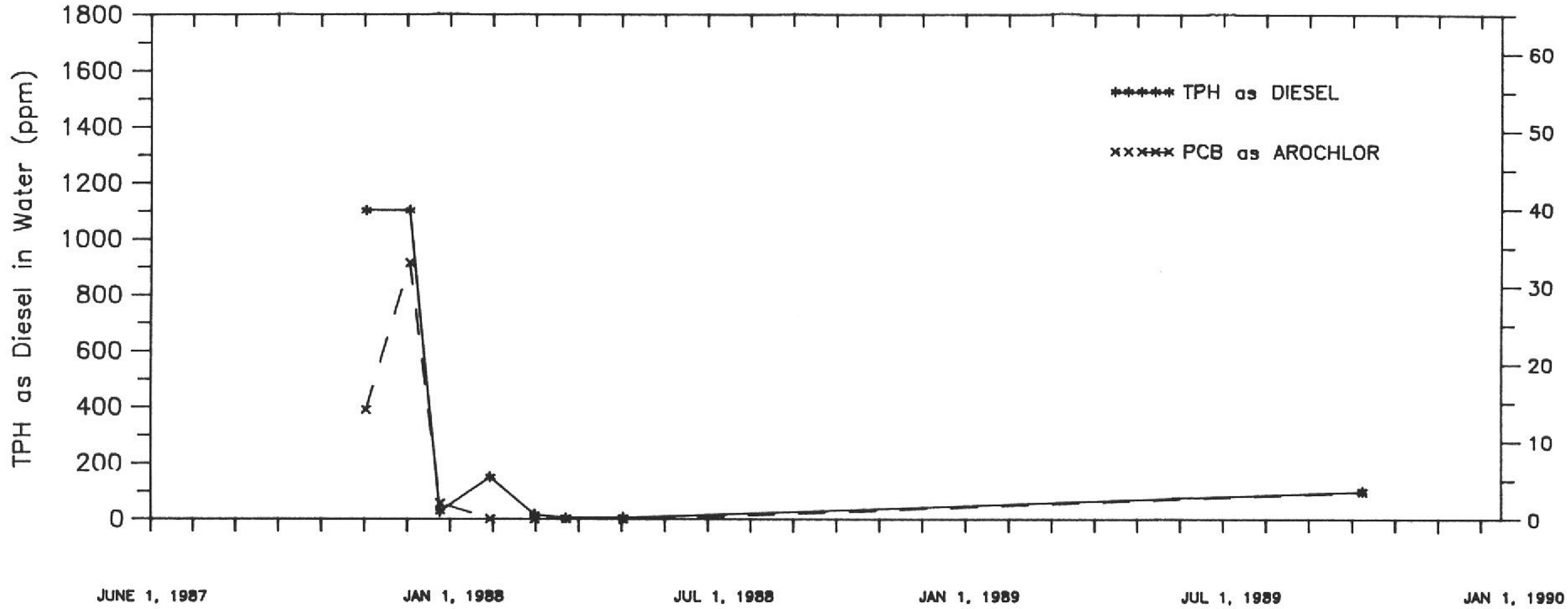
DRAFTED BY: M. Singer	DATE: 1-10-90	
CHECKED BY: K. Jesionek	DATE: 1-10-90	

TPH AS DIESEL AND PCBs CONCENTRATION—TIME DATA FOR MW-1

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE 18



KLEINFELDER		TPH AS DIESEL AND PCBs CONCENTRATION—TIME DATA FOR MW-2 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 19
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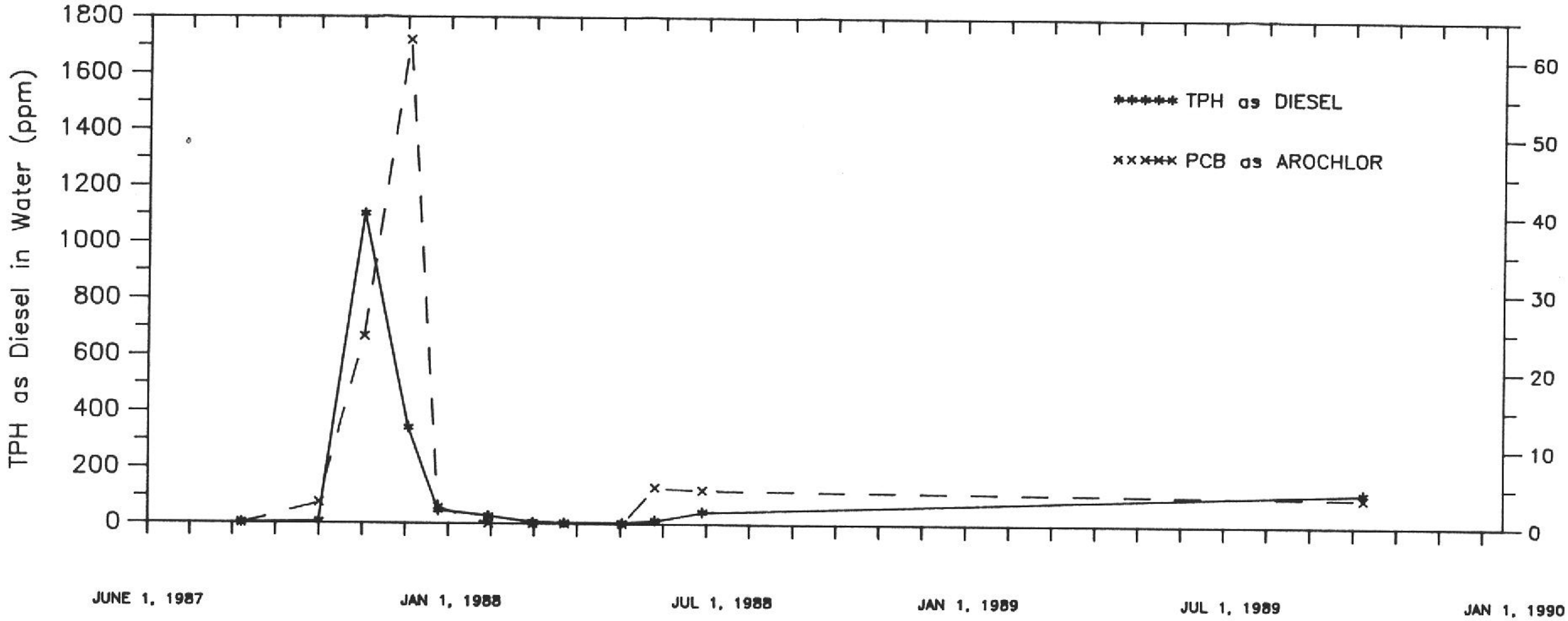
CHECKED BY: K. Jesionek	DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER	TPH AS DIESEL AND PCBs CONCENTRATION—TIME DATA FOR MW-3 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE
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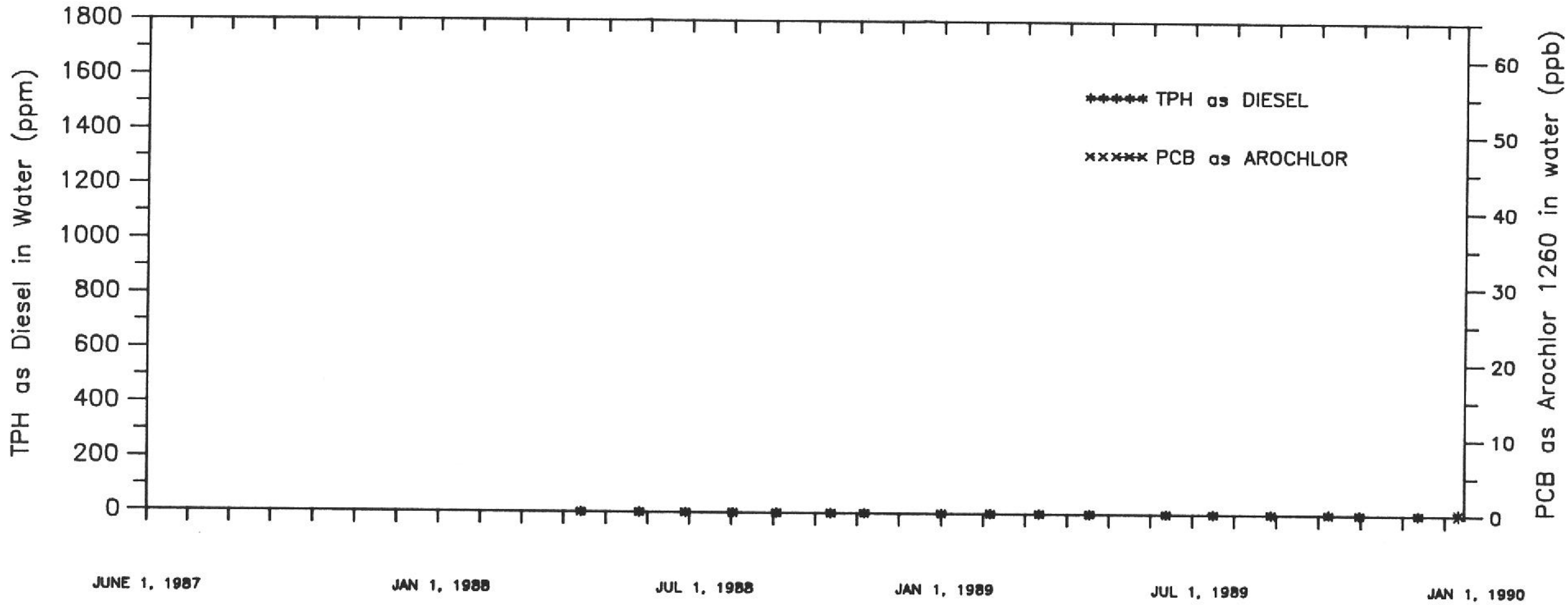
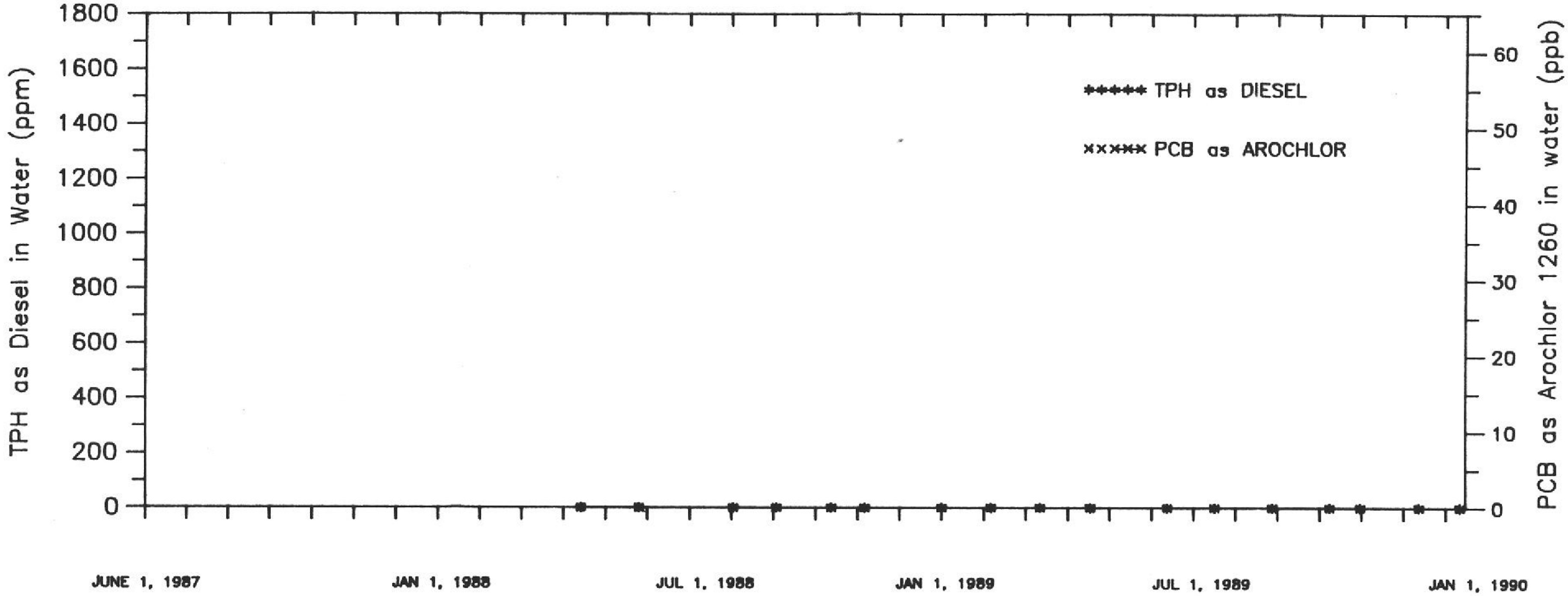
CHECKED BY: K. Jesionek DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER	TPH AS DIESEL AND PCBs CONCENTRATION—TIME DATA FOR MW-4 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 21
DRAFTED BY: M. Singer DATE: 1-10-90 CHECKED BY: K. Jesionek DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER

TPH AS DIESEL AND PCBs CONCENTRATION—TIME DATA FOR MW-5

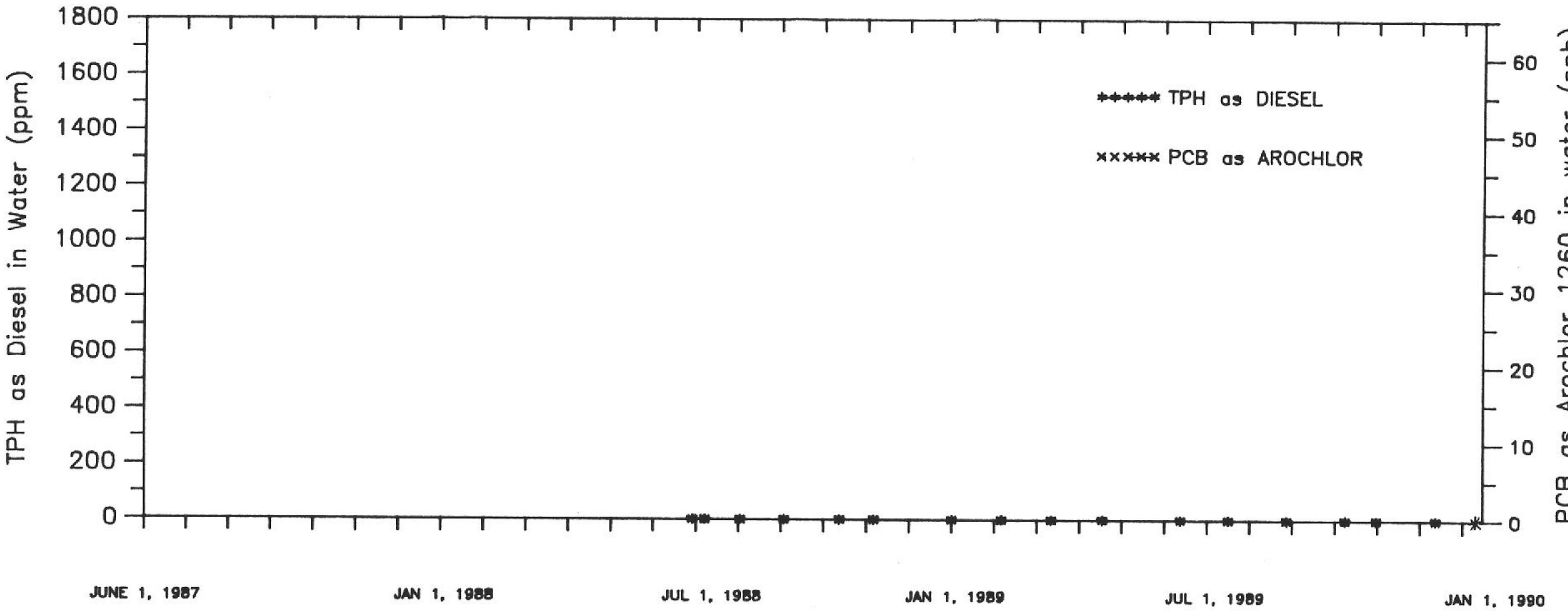
INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PLATE 22

DRAFTED BY: M. Singer DATE: 1-10-90

CHECKED BY: K. Jesionek DATE: 1-10-90

PROJECT NO. 10-1682-05



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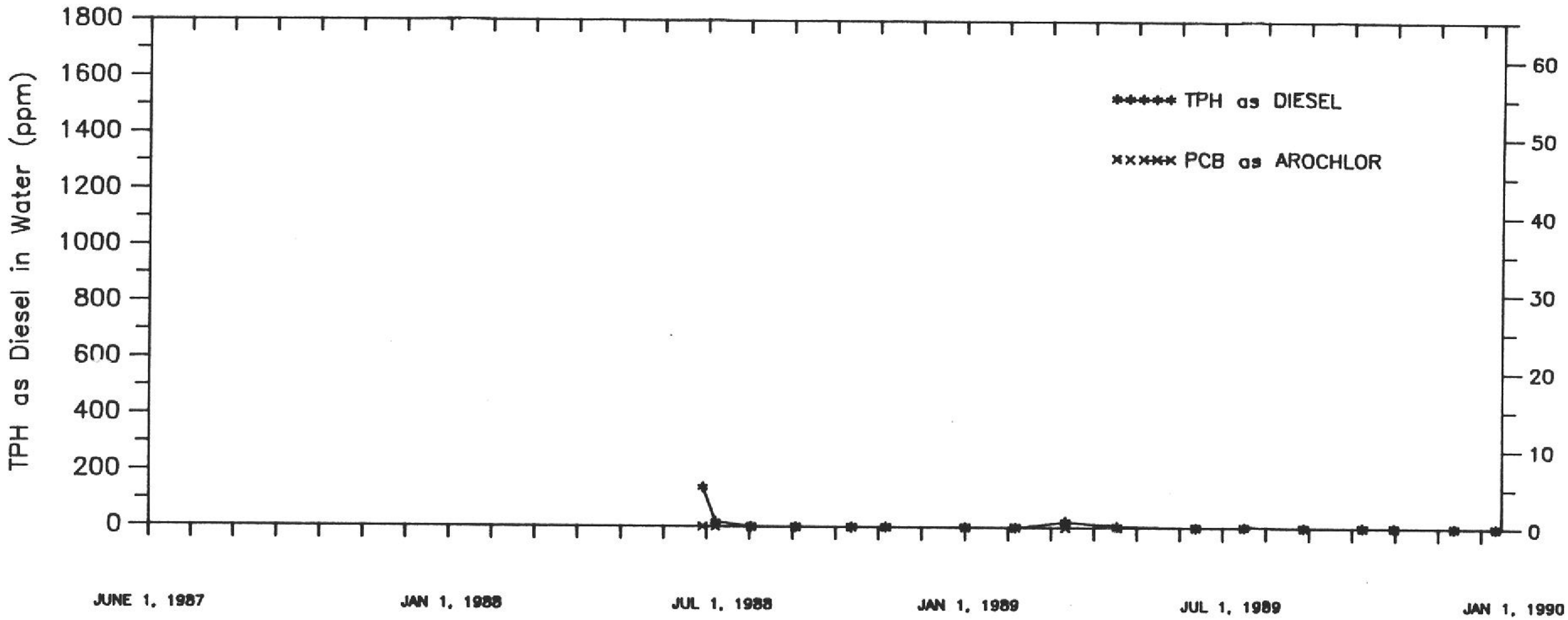
DRAFTED BY: M. Singer	DATE: 1-10-90		
CHECKED BY: K. Jesionek	DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER

TPH AS DIESEL AND PCBs CONCENTRATION—TIME DATA FOR MW-7

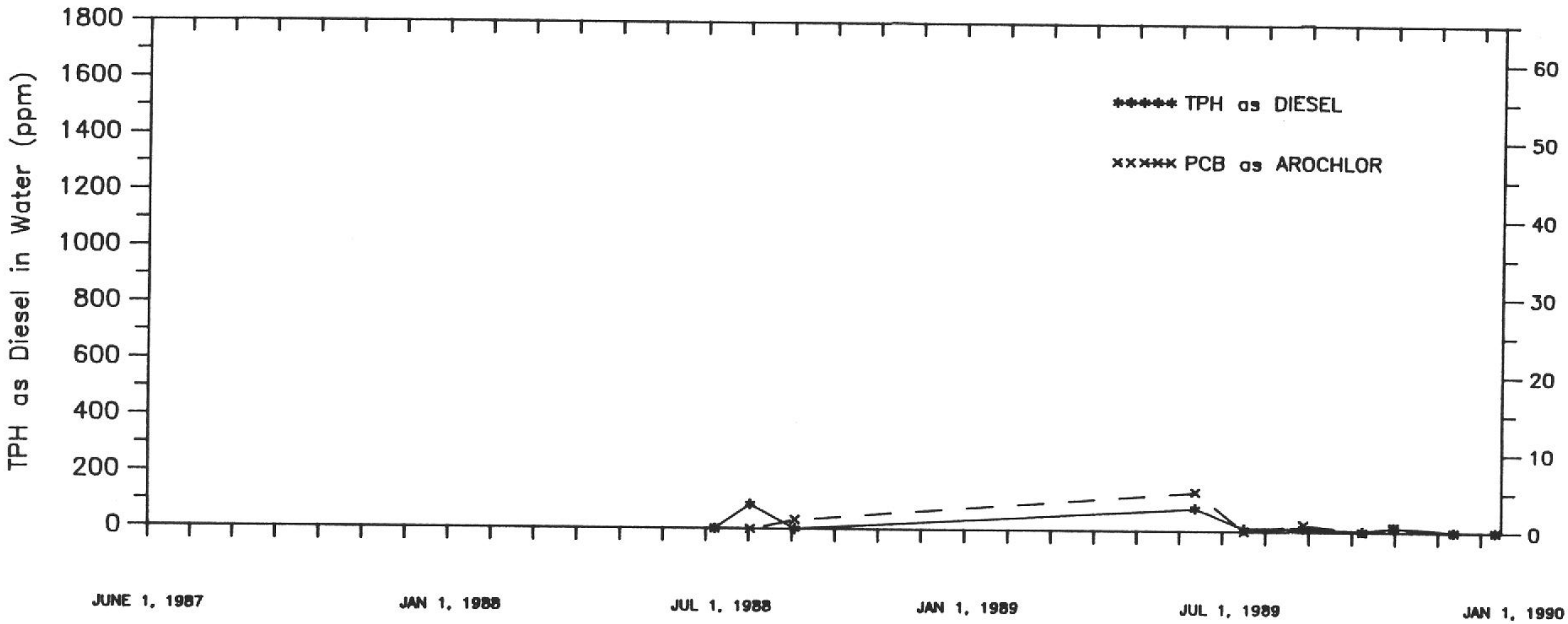
INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PLATE 24

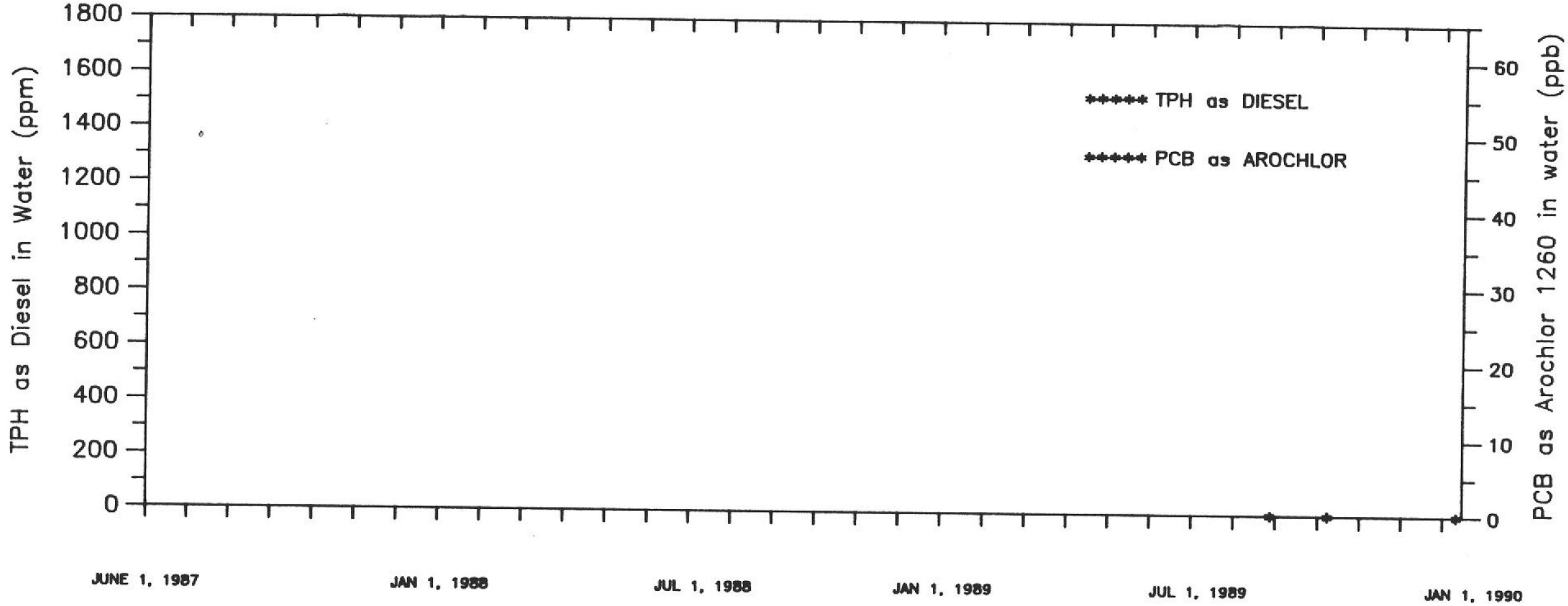
DRAFTED BY: M. Singer DATE: 1-10-90

CHECKED BY: K. Jesionek DATE: 1-10-90

PROJECT NO. 10-1682-05



KLEINFELDER			TPH AS DIESEL AND PCBs CONCENTRATION—TIME DATA FOR MW-8 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 25
DRAFTED BY: M. Singer	DATE: 1-10-90			
CHECKED BY: K. Jesionek	DATE: 1-10-90		PROJECT NO. 10-1682-05	



KLEINFELDER

DRAFTED BY: M. Singer DATE: 1-10-90

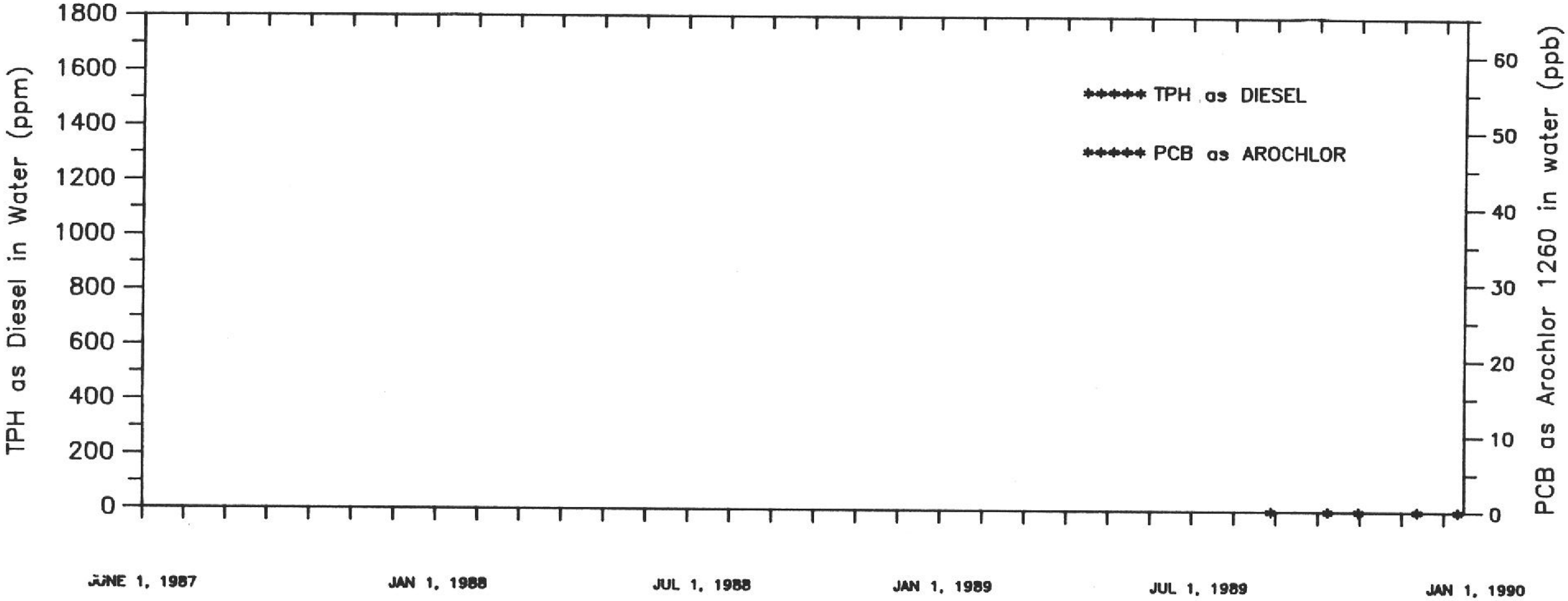
CHECKED BY: K. Jesionek DATE: 1-10-90

TPH AS DIESEL AND PCBs CONCENTRATION—TIME DATA FOR MW-9

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE 26



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DRAFTED BY: M. Singer DATE: 1-10-90

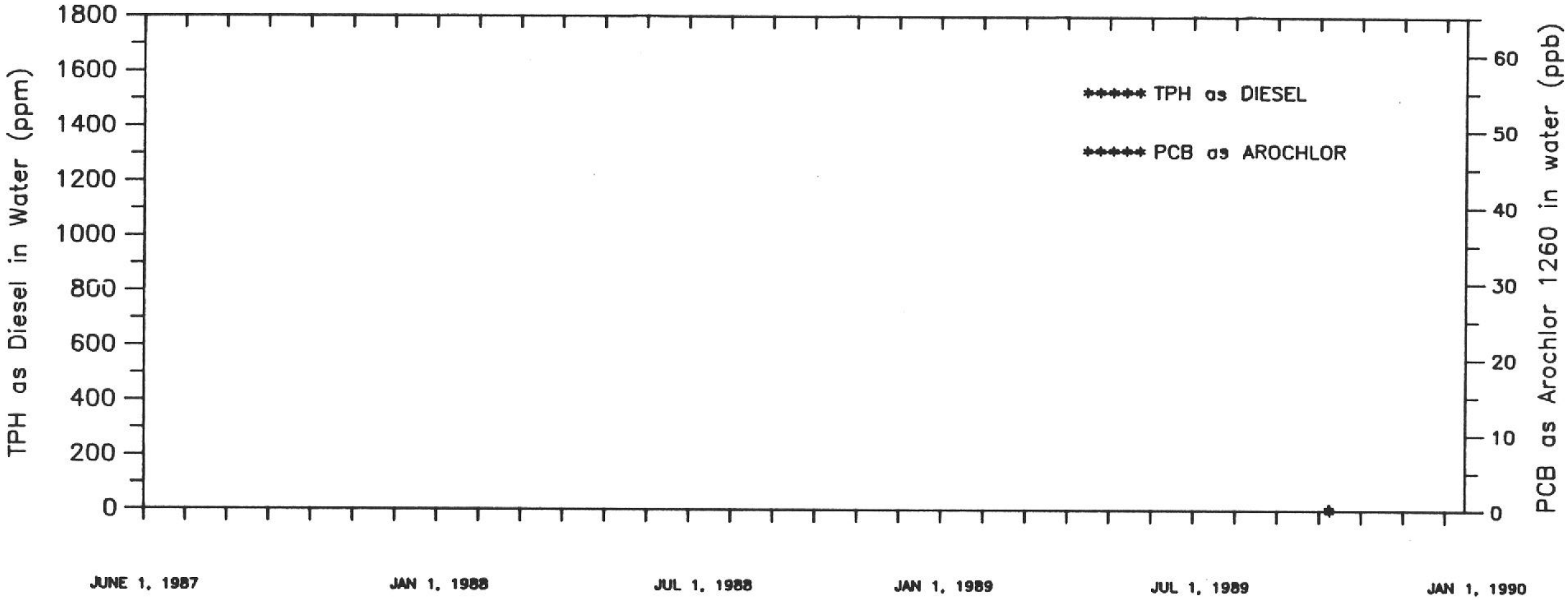
CHECKED BY: K. Jesionek DATE: 1-10-90

TPH AS DIESEL AND PCBs CONCENTRATION—TIME DATA FOR MW-10

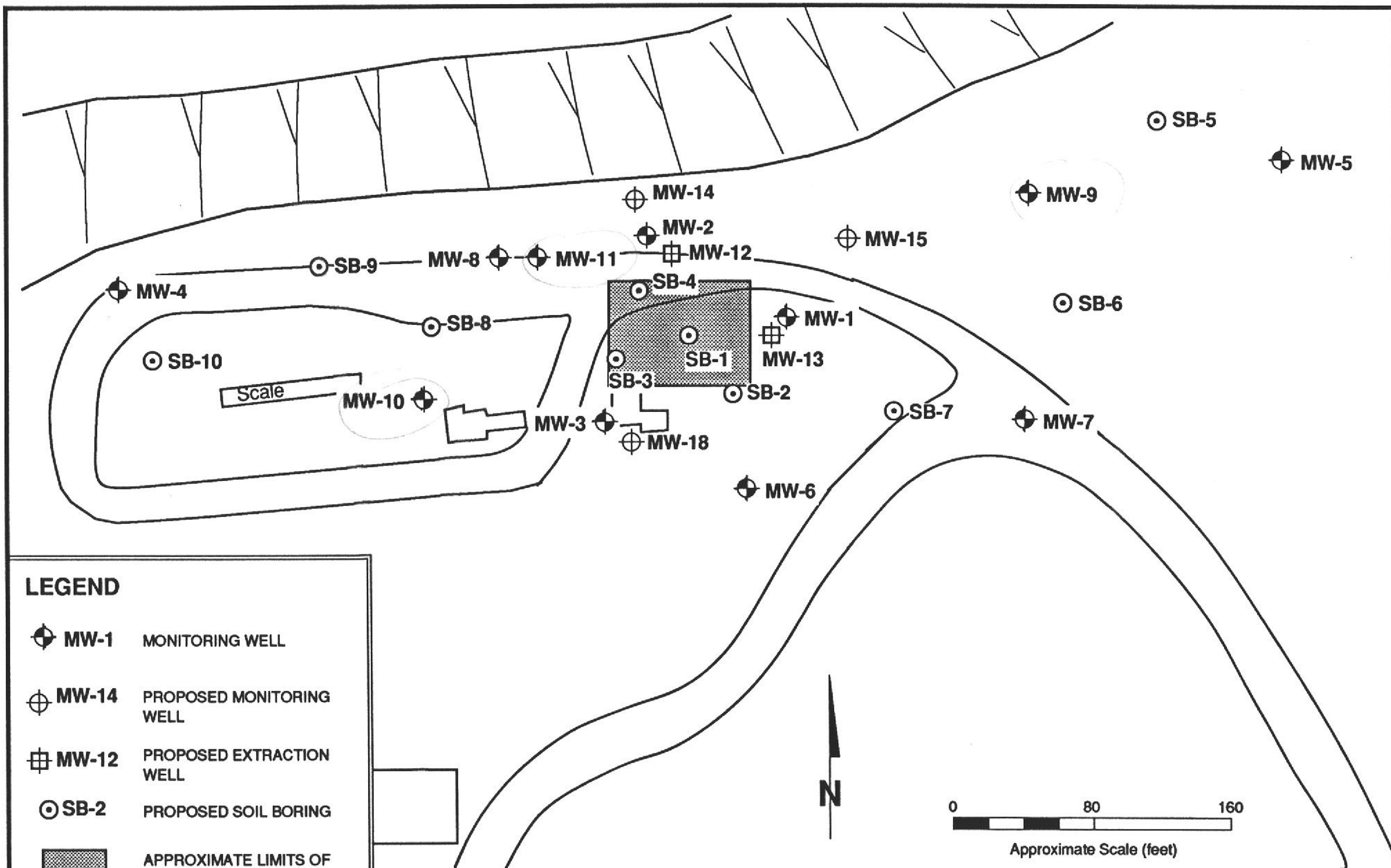
INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE 27



KLEINFELDER		TPH AS DIESEL AND PCBs CONCENTRATION TIME DATA FOR MW-11 INDUSTRIAL ASPHALT PLEASANTON, CALIFORNIA	PLATE 28
DRAFTED BY: M. Singer	DATE: 1-10-90		
CHECKED BY: K. Jesionek	DATE: 1-10-90	PROJECT NO. 10-1682-05	



KLEINFELDER

DRAFTED BY: L. Sue DATE: 1-10-90

CHECKED BY: K. Jesionek DATE: 1-10-90

PROPOSED WELL AND SOIL BORING LOCATIONS

INDUSTRIAL ASPHALT
PLEASANTON, CALIFORNIA

PROJECT NO. 10-1682-05

PLATE

29

GENERAL DATA REQUIREMENTS

General data requirements described in the NCP (Ref. 16) and in EPA guidance (Ref. 1) include the following:

1. Source Characterization/Site History Information
   - Source location
   - Integrity of waste/chemical containment
   - Type of waste/chemical containment
   - Drainage control
   - Engineered structures
   - Site security
   - Known discharge points (outfalls, stacks)
   - Mapping and surveying
   - Waste Characteristics: types, quanitities, chemical and physical properties, and concentrations.

2. Soil and Vadose Zone Information
   - Soil characteristics
   - Soil chemistry characteristics
   - Vadose zone characteristics
3. Site Hydrogeology Information

   3.1 Geologic aspects:
   - Type of water-bearing unit or aquifer (overburden, bedrock)
   - Thickness, areal extent of water-bearing units, sub-units, and aquifers
   - Type of porosity (primary, such as intergranular pore space, or secondary, such as bedrock discontinuities)
   - Presence or absence of impermeable units or confining layers
   - Depths to water table; thickness of vadose zone.

3.2 Hydraulic aspects:

- Hydraulic properties of water-bearing unit or aquifer (hydraulic conductivity, transmissivity, storage coefficients, porosity, dispersivity)
- Pressure conditions (confined, unconfined, leaky confined)
- Ground water flow directions horizontal and vertical (hydraulic gradients), volumes (specific discharge), rate (average linear velocity)
- Recharge and discharge areas
- Ground water to surface water interactions; areas of ground water discharge to surface water
- Seasonal variations of ground water conditions

Ground water use aspects:

- Identify existing or potential aquifers
- Determine existing near site use of ground water

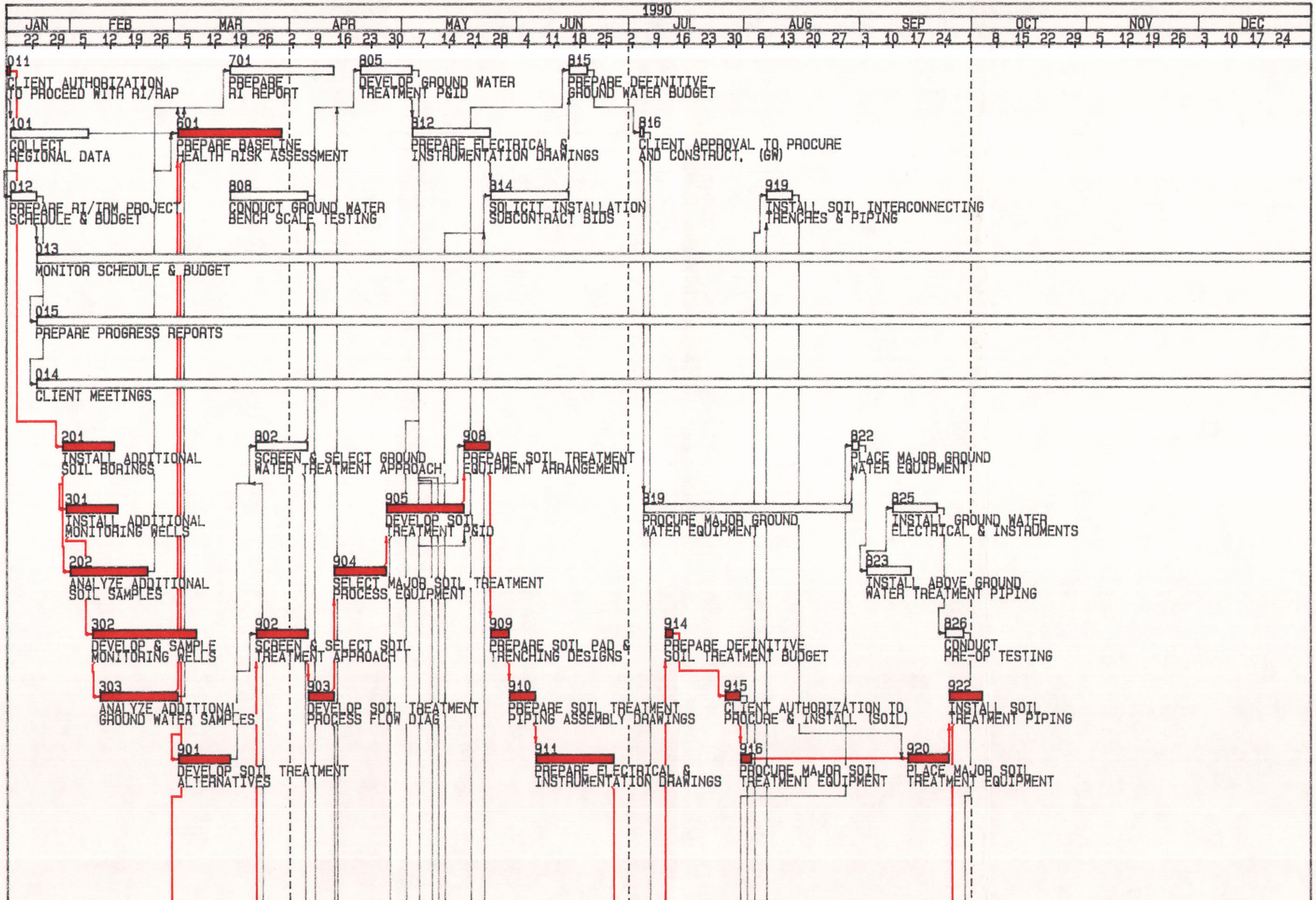
4. Surface Water Information
   - Drainage Patterns: Overland flow, topography, channel flow patterns, tributary relationships, soil erosion, and sediment transport and deposition
   - Surface Water Bodies: Flow, stream widths and depths, channel elevations, flooding tendencies, physical dimensions of surface water impoundments, and tidal fluctuations.
   - Structures
   - Surface water to ground water relationships
   - Surface water quality: pH, temperature, total suspended solids, suspended sedimet, salinity, and specific containment concentrations.

5. Distribution of Contamination Information
   - Define vertical and hoizontal extent of contamination in soil, ground water, surface water, and air
   - Consider the phsical and chemical properties of the contaminants, such as density and mobility, to assess their potential for migration.

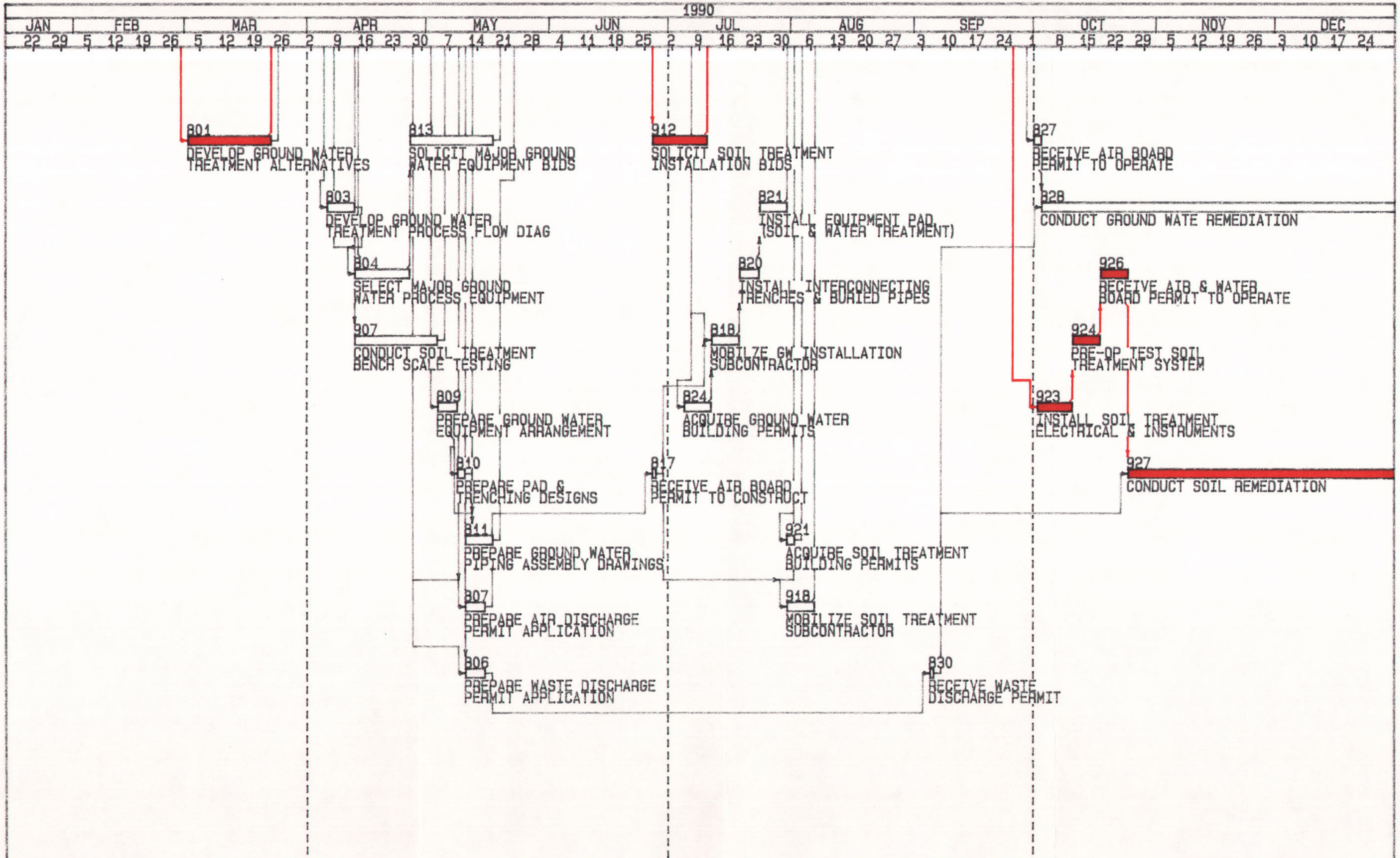
6. Migration Pathway Information
   - Determine the migration of contaminants in air, surface water, soil, and ground water
   - Evaluate specific potential pathways including: buried lines, sewers, zones of high permeability in aquifers, aquitard leakage, wells tapping multiple aquifers, interconnection between surface and ground water.

7. Potential Receptor Populations/Public Health Hazards

8. Ecological Information
   - Fauna and Flora
   - Critical Habitats
   - Land Use Characteristics
   - Water Use Characteristics
   - Biocontamination.



1990
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
22 29 5 12 19 26 5 12 19 26 2 9 16 23 30 7 14 21 28 4 11 18 25 2 9 16 23 30 6 13 20 27 3 10 17 24 1 8 15 22 29 5 12 19 26 3 10 17 24
011 CLIENT AUTHORIZATION TO PROCEED WITH RI/RAP
701 PREPARE RI REPORT
805 DEVELOP GROUND WATER TREATMENT P&ID
815 PREPARE DEFINITIVE GROUND WATER BUDGET
101 COLLECT REGIONAL DATA
601 PREPARE BASELINE HEALTH RISK ASSESSMENT
812 PREPARE ELECTRICAL & INSTRUMENTATION DRAWINGS
816 CLIENT APPROVAL TO PROCURE AND CONSTRUCT. (GW)
012 PREPARE RI/IRM PROJECT SCHEDULE & BUDGET
808 CONDUCT GROUND WATER BENCH SCALE TESTING
814 SOLICIT INSTALLATION SUBCONTRACT BIDS
919 INSTALL SOIL INTERCONNECTING TRENCHES & PIPING
013 MONITOR SCHEDULE & BUDGET
015 PREPARE PROGRESS REPORTS
014 CLIENT MEETINGS
201 INSTALL ADDITIONAL SOIL BORINGS
802 SCREEN & SELECT GROUND WATER TREATMENT APPROACH
908 PREPARE SOIL TREATMENT EQUIPMENT ARRANGEMENT
822 PLACE MAJOR GROUND WATER EQUIPMENT
301 INSTALL ADDITIONAL MONITORING WELLS
905 DEVELOP SOIL TREATMENT P&ID
819 PROCURE MAJOR GROUND WATER EQUIPMENT
825 INSTALL GROUND WATER ELECTRICAL & INSTRUMENTS
202 ANALYZE ADDITIONAL SOIL SAMPLES
904 SELECT MAJOR SOIL TREATMENT PROCESS EQUIPMENT
823 INSTALL ABOVE GROUND WATER TREATMENT PIPING
302 DEVELOP & SAMPLE MONITORING WELLS
902 SCREEN & SELECT SOIL TREATMENT APPROACH
909 PREPARE SOIL PAD & TRENCHING DESIGNS
914 PREPARE DEFINITIVE SOIL TREATMENT BUDGET
826 CONDUCT PRE-OP TESTING
303 ANALYZE ADDITIONAL GROUND WATER SAMPLES
903 DEVELOP SOIL TREATMENT PROCESS FLOW DIAG
910 PREPARE SOIL TREATMENT PIPING ASSEMBLY DRAWINGS
915 CLIENT AUTHORIZATION TO PROCURE & INSTALL (SOIL)
922 INSTALL SOIL TREATMENT PIPING
901 DEVELOP SOIL TREATMENT ALTERNATIVES
911 PREPARE ELECTRICAL & INSTRUMENTATION DRAWINGS
916 PROCURE MAJOR SOIL TREATMENT EQUIPMENT
920 PLACE MAJOR SOIL TREATMENT EQUIPMENT



act id / description	
	Activity Bar/Early Dates
	Critical Activity
	Progress Bar

Primavera Systems, Inc. 1984-1989

INDUSTRIAL ASPHALT
RI/RAP FOR SOIL & GROUND WATER
S1: NONEND-TO-END ACTIVITY PLACEMENT

Project Start : 15JAN90
Project Finish: 30DEC92*

Sheet 2 of 2

Data Date: 15JAN90
Plot Date: 19JAN90

REMEDIAL INVESTIGATION & INTERIM REMEDIATION

Date	Revision	Checked	Approved