groundwater resources inc.

5400 ALDRIN CT.
BAKERSFIELD, CALIFORNIA 93313
General Engineering Contractor
Class A/Haz License No. 520768

MALIBU GRAND PRIX
8000 South Coliseum Way
Oakland, California

SITE ASSESSMENT REPORT
July 16, 1990

MAILING ADDRESS: P.O. BOX 9383, BAKERSFIELD, CA 93389 (805) 835-7700
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SITE ASSESSMENT REPORT
July 16, 1990

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ILLUSTRATIONS

APPENDICES

1.0 INTRODUCTION

This report provides the results of an investigation to determine the existence of a hydrocarbon plume in the soil and groundwater at the Malibu Grand Prix Race Track facility, 8000 South Coliseum Way, Oakland, California (Plate 1). In addition, an assessment of a groundwater plume, previously identified at the Malibu Grand Prix Castle, has been continued and is included (see Preliminary Site Assessment Report, 11-15-89). Concentrations of hydrocarbons were found in all groundwater monitoring wells located near the Race Track tank excavation. Hydrocarbons were also reported in four of the five wells located near the Castle tank excavation. Floating product was observed at both locations. The extent of the groundwater plumes have not been completely defined. Groundwater Resources, Inc. (GRI) recommends that remediation of the groundwater at both location begin as soon as possible.

2.0 BACKGROUND

The Malibu Grand Prix (MGP) facility maintained two 6,000 gallon underground storage tanks containing marine mix gasoline. The tanks were located at the MGP Castle and Race Track. They were removed on March 29, 1989 and February 1, 1990 respectively. Closure reports were submitted to the Alameda County Department of Environmental Health with all relevant waste manifests and analysis results. On June 29, 1989 a letter from Alameda County was sent to Malibu Grand Prix Corp. requiring an initial site investigation to determine the extent of soil and groundwater contamination present at the MGP Castle. A verbal request was issued for an assessment at the Race Track during the time of the tank removal. The site assessment at the Castle began on September 21, 1989 and a report was issued on November 15, 1989 recommending further work. The assessment work at the Race Track, and the continued assessment at the Castle began on June 12, 1990.

3.0 BORINGS AND MONITORING WELL COMPLETIONS

Six groundwater monitoring wells and twelve soil borings were made on the days of June 12-14, 1990. The monitoring wells were drilled using ten inch hollow stem augers while the soil borings were made using six inch solid stem augers. MW's 5-7 were constructed west and southwest of the Castle tank location in an attempt to define the downgradient terminus of the groundwater plume (Plate 2). MW's 8-10 were constructed at the Race Track to define the limits of the groundwater plume at that location (Plate 3). Construction of the groundwater monitoring wells was accomplished by advancing a ten inch boring to a depth of twenty feet. Fifteen feet of four-inch PVC, 0.020" slotted casing, was placed in each borehole with five feet of blank casing to the surface (see Log of Borings, Plates 4-10). MW-9 was the exception with only ten feet of slotted casing and five feet of blank to the surface. A filter pack of #3 grade sand was placed to four feet from the surface. Each well has a two to three foot bentonite surface seal and was capped with concrete. All of the wells were secured with locking caps and a traffic box.

Four soil borings were made south of the Castle tank location. These borings were drilled to the groundwater so that a water grab sample could be collected at that location. The borings were positioned to help define the southern extent of the Castle plume. A six-inch solid stem auger was

drilled to ten feet and groundwater was allowed to fill the borehole (see Boring Logs, Plates 10-21). After a sample was collected, the boreholes were abandoned with bentonite and concrete.

Eight soil borings were drilled at the Race Track. The borings were located around the perimeter of the tank, downgradient of the tank, along the product line and under the dispenser. Soil samples were collected from borings 10-15. Boring B-10 was angle drilled at approximately 20 degrees from vertical so that a soil sample could be collected from beneath the dispenser. A water grab sample was collected from all of the borings except B-10. The boreholes were abandoned in the same manner as those at the Castle location.

4.0 SAMPLING PROCEDURES

All soil samples were collected using a two and one-half inch diameter California splitspoon sampler containing four six-inch brass sleeves. The cores selected for analysis were sealed in the sleeve with teflon lined plastic end-caps and integrity tape. The core-sampler was washed and rinsed after each use to avoid cross contamination.

A groundwater grab sample was collected from all of the borings where water had infiltrated into the borehole. A sample was retrieved with a bailer and placed in a 40 ml VOA bottle. These samples were collected for screening purposes only and may not represent true hydrocarbon concentrations for the water at that location. They can, however, indicate whether the groundwater plume is present at the location of the boring.

After the monitoring wells were constructed, approximately three to four well volumes were pumped from each well to insure that the water present in the well was representative of the groundwater in the formation. The groundwater samples collected from each well and boring were analyzed, along with the soil samples, for Benzene, Toluene, Xylene and Ethylbenzene (BTX & E) and Total Petroleum Hydrocarbon (TPH) for gasoline. All samples were labeled, chilled and transported to a State Certified Laboratory under a Chain of Custody (Appendix B).

5.0 FINDINGS

5.1 Race Track

Soil samples analyzed from the vadose and monitoring well borings indicate that hydrocarbons are present in all of the locations sampled except for the five foot samples collected at MW-10 (see Table 1). Analysis of the water samples collected from MW's 8-10 and Borings 11-16 were reported to contain hydrocarbon concentrations . Hydrocarbons were not detected in the sample collected from B-17. As noted in Table 1, floating product was observed in borings B-11, B-12, B-13 and B-14. The product consisted of a black oily substance that would adhere to the sampling equipment.

During the drilling operations, abundant debris material was observed in the cuttings. This material included glass, brick, concrete, metal and wood. At B-15 and B-16, wood (possibly old railroad ties or telephone poles) treated with a substance having the odor of creosote, was encountered at approximately four to six feet.

5.2 Castle

All water samples collected from the monitoring wells and the borings were reported to contain hydrocarbons, with the exception of MW-5 and B-9. Floating product was noted in B-7 and B-8, but not in the quantity noted in the borings at the Race Track. Debris material was also noted from the borings drilled at the Castle.

The soil encountered while boring was typically a black to dark gray silty clay with low to medium plasticity. A clayey gravel was observed in the boring for MW-9. The first five feet of soil encountered was generally fill material consisting of silty clay and debris.

The groundwater gradient has been calculated from the wells previously surveyed at the Castle (Plate 22). The gradient direction has a southwestward trend with a dip of 7.28 feet per 100 feet.

TABLE 1

ANALYTICAL RESULTS OF SOIL AND WATER SAMPLES

BORING	BENZENE	TPH
	SOIL @ 3 feet (ppm)	
B-10	20	550
B-11	85	2,400
B-12	1.7	29
B-13	51	720
B-14	.35	5.3
B-15	.41	9.4
MW-8	.55	16
MW-10	ND	ND
	WATER (ppb)	
MW-1	.66	210
MW-2	ND	ND
MW-3	.90	ND
MW-4	200	660
MW-5	ND	ND
MW-6	73	1,800
MW-7	.84	58
MW-8	680	13,000
MW-9	12	3,200
MW-10	20	400
B-6	15	160
B-7	.76	380 *
B-8	43	7,900 *
B-9	ND	ND
B-11	6,100	120,000 *
B-12	2,100	19,000 *
B-13	23,000	290,000 *
B-14	12,000	230,000 *
B-15	120	1,300
B-16	240	4,400
B-17	ND	ND

ND = None Detected

* Floating Product Observed

6.0 CONCLUSIONS

6.1 Race Track Plume

Soil samples collected from the borings around the tank location indicate that some impact to the soil has occurred. It is apparent from field observations, however, that the samples collected at three feet are in the capillary fringe of the water table. This can be expected since the static water level in MW-8 was 3.82 feet and the soil matrix is comprised of silts and clay, which would have a relatively thick capillary zone. Since the tank and piping was buried to a depth of approximately four feet, it is unlikely that any soil above four feet was directly impacted from a tank or piping leak. It is more likely that fluctuations in the water table, due to tidal or seasonal influences, and the capillary action of the soil, has smeared the vadose zone above the tank with either floating or dissolved product.

The limit of the Race Track plume has not been completely defined, however a zero line can be drawn around the B-17 location (Plate 3). From the data collected to date, it is likely that the groundwater plume has migrated southwestward and may extend as far as MW-3. If this is the case, the zero line of the plume is probably past the sidewalk and into the street. The north and west boundary of the

plume is not expected to extent a great distance from the tank location since that area is upgradient from the suspected source of the release.

6.2 Castle Plume

The zero limit of the groundwater plume at the Castle location has been defined at MW-5 and B-9, west and south of the tank location respectively (Plate 2). The plume extends southwest past MW-6 and B-8 and is past the property lines into the street. As with the Race Track, the Castle groundwater plume is not expected to extent very far north and east.

7.0 RECOMMENDATIONS

Three possible plans of action for further work at the site are proposed below.

7.1 No Action

With this plan, the hydrocarbons are allowed to degrade naturally and no further action in assessing or remediating the site is proposed. Periodic monitoring of the wells should take place to assess the completeness of the hydrocarbon degradation. In favor of this plan is the fact that the land beneath the site consists of imported fill material containing preexisting substances that would tend to make the water unusable, as evident from the creosote treated wood observed at the Race Track. Since the groundwater is also shallow, unconfined and brackish, it would not be considered suitable as a public water source. The risk to other biological receptors from the water, as it migrated toward the San Francisco Bay, however, cannot be evaluated from the data obtained to date.

7.2 Further Assessment of the Plumes

This plan of action encompasses the complete definition of both groundwater plumes. The drilling of wells off property lines can be envisioned with the construction of at least eight more monitoring wells at various locations. After the plumes are defined, a decision can be made as to what form of remediation, including no action, should take place. The advantage of this plan is the fact that the entire dimensions of the plumes are defined and total hydrocarbon concentrations in the groundwater can be assessed. This would aid in the design of a remediation system since almost all of the parameters needed will have been defined. Once the plumes are defined, It may become apparent that a "no action" plan is feasible and that the plumes pose a minimal risk to plant and animal life in the area.

7.3 Implementation of Remedial Action

With the immediate implementation of groundwater treatment, an attempt will be made to arrest the further migration of the plumes. After the cleanup process has been under way for a period of time, confirmation wells should be constructed to isolate the plume boundary and act, if necessary, as recovery wells in the event that the zero limit of the plume(s) has not been delineated. It is GRI's opinion that due to the nature of the land fill beneath the site, a complete cleanup of the groundwater to drinking water standards should not be necessary. The main focus of the groundwater remediation effort should be the removal of any free product and the reduction of dissolved gasoline constituents to a level acceptable to the Alameda County Health Agency.

GRI recommends the third option, of immediate remedial action, to be implemented at both locations. Pumping of the groundwater will slow or reverse the migration of the plume, therefore it is recommended that treatment should begin as soon as possible. This plan will minimize the spreading and decrease the size of the plumes and is seen as a significant advantage over a prolonged assessment phase followed by a remediation phase. This plan may also minimize the number of wells needed to define the boundaries of the plumes. The plumes, to date, have been defined sufficiently to allow for an accurate evaluation of the progress of a remediation project. The type of equipment to be used should be determined after pump tests have been performed on the wells and aquifer characteristics have been evaluated. It is envisioned that a pump and treat method of remediating the groundwater will be the most effective, however an in situ biological treatment may be proposed if insufficient recovery of free product occurs due to slow mobility of the viscous oil through the dense soil matrix. A remediation plan should be sent to the Alameda County Health Agency for approval before treatment of the groundwater begins.

8.0 LIMITATIONS

This report was prepared for the exclusive use of the Malibu Grand Prix Corporation as it relates to the property described. The discussion and conclusions presented in this report are based on:

- The test borings performed at this site.
- The observations of field personnel.
- The results of laboratory tests performed by SMC Laboratory Bakersfield, California.
- Our understanding of the regulations of Alameda County and the California Regional Water Quality Control Board.

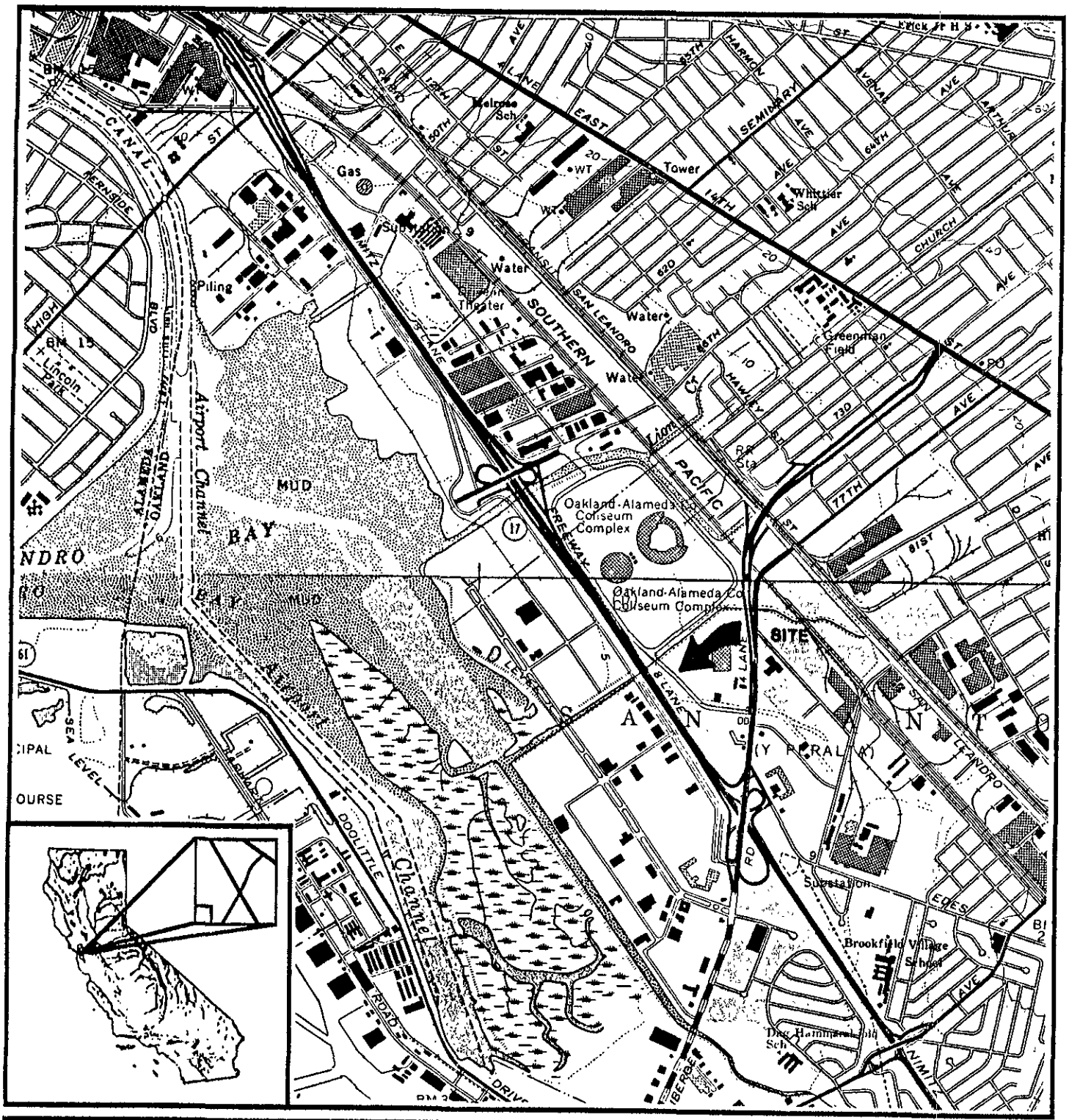
Possible variations in the soil or groundwater conditions which may exist beyond the points explored in this investigation might effect the validity of this report unless those variations or conditions come to our attention and are reviewed and assimilated into the conclusions and recommendations of this report. Also, changes in the hydrologic conditions found could occur with time due to variations in rainfall, temperature, regional water usage, or other factors, any of which could effect this report.

The services performed by GRI have been conducted in a manner consistent with the levels of care and skill ordinarily exercised by professionals currently practicing under similar conditions in California. The absence of contamination on or beneath the property cannot be guaranteed by this report. GRI is not responsible for any contamination or hazardous material found on the property. No other warranty expressed or implied, is made.

Respectfully submitted,

Timothy C. Reed
Project Geologist

Rex J. Young
State Registered Geologist #720



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PROJECT NUMBER: 390-3

MALIBU GRAND PRIX

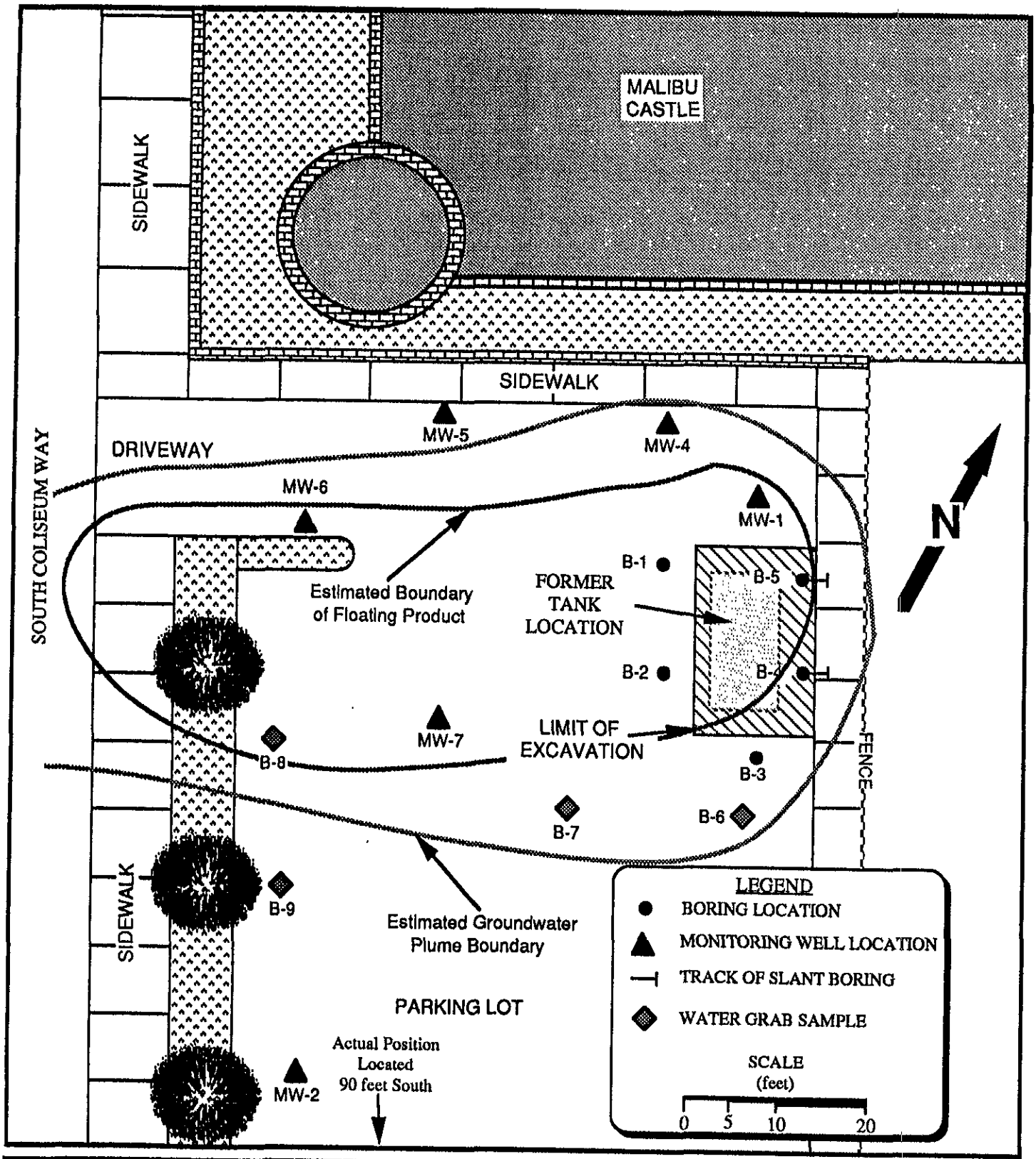
8000 SOUTH COLISEUM WAY

OAKLAND, CALIFORNIA

LOCATION MAP

PLATE

1



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Project Number: 390-3

6-19-90

MALIBU GRAND PRIX

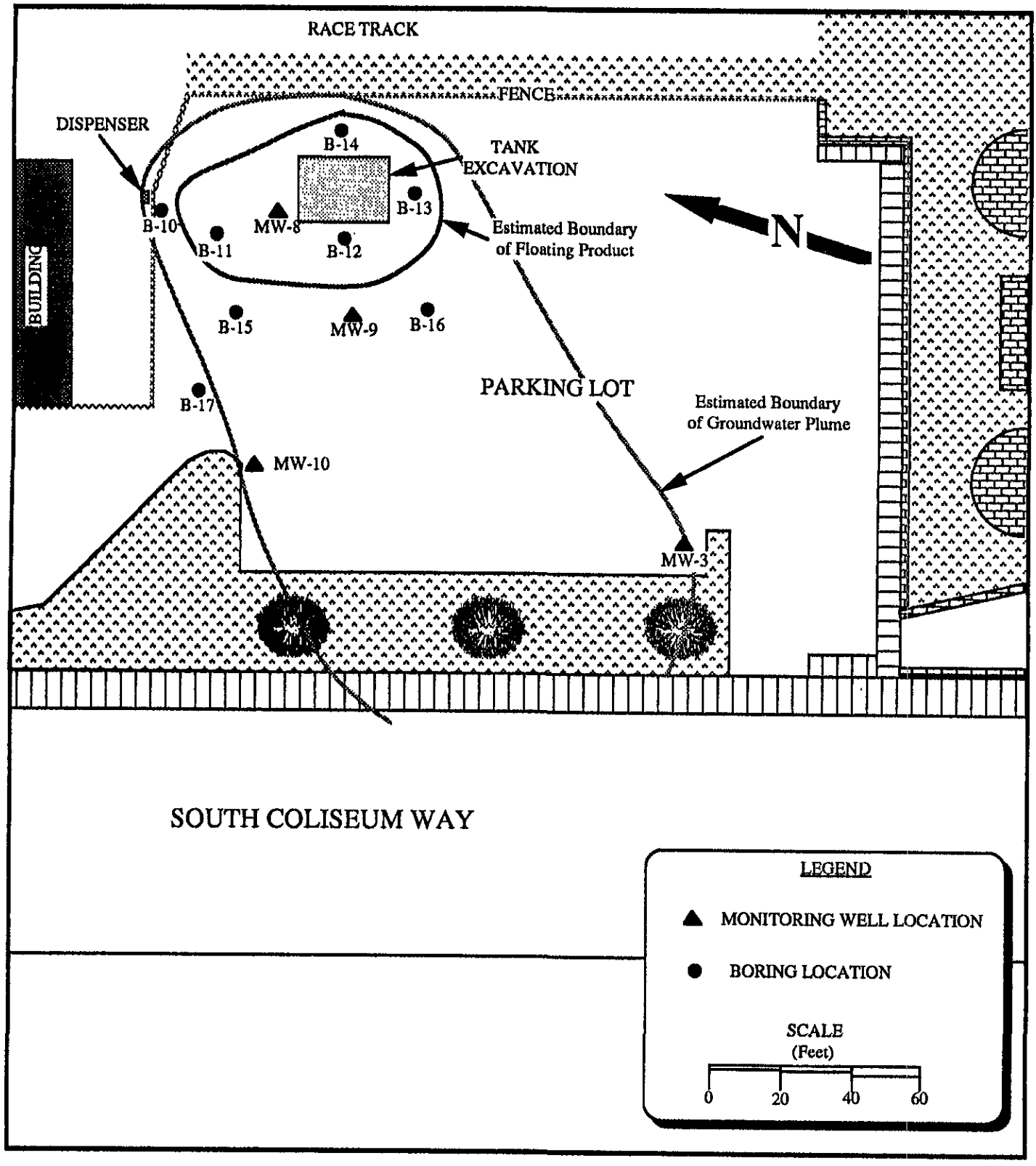
8000 SOUTH COLISEUM WAY

OAKLAND, CALIFORNIA

CASTLE PLOT PLAN

PLATE

2



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MALIBU GRAND PRIX

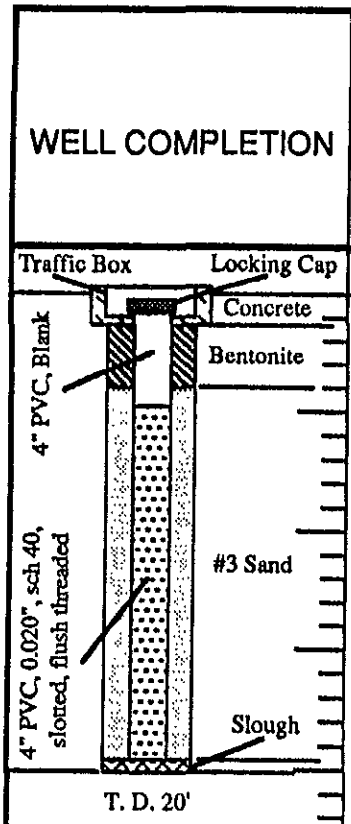
8000 SOUTH COLISEUM WAY

OAKLAND, CALIFORNIA

RACE TRACK PLOT PLAN

PLATE

3



WELL COMPLETION	ANALYSES Lab Benzene TPH ppm	ANALYSES Field Hnu P.I.D. ppm	BLOWCOUNT	DEPTH (feet)	SAMPLE INTERVAL	SAMPLE NUMBER	lithology symbol	u.s.c.s.-desig.	SOIL DESCRIPTION
				0					
				5					FILL MATERIAL- blk, clayey silt, vfn-sand, med plast, moist, no odor, no stn
	WATER (ppb)			10				SM	SILT- blk, v clayey, fn-med sand, mod-high plast, wet, no odor, no stn
	ND	ND		15				CL	CLAY- blk, v silty, tr fn sand, high plast, saturated, no odor, no stn
				20				CL	CLAY- blk, v silty, tr fn sand, high plast, saturated, no odor, no stn
				25					
				30					
				35					
				40					
				45					
				50					

SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 20 ft
DATE DRILLED: 6-12-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Eight inch
WATER ENCOUNTERED AT: 10.23 ft

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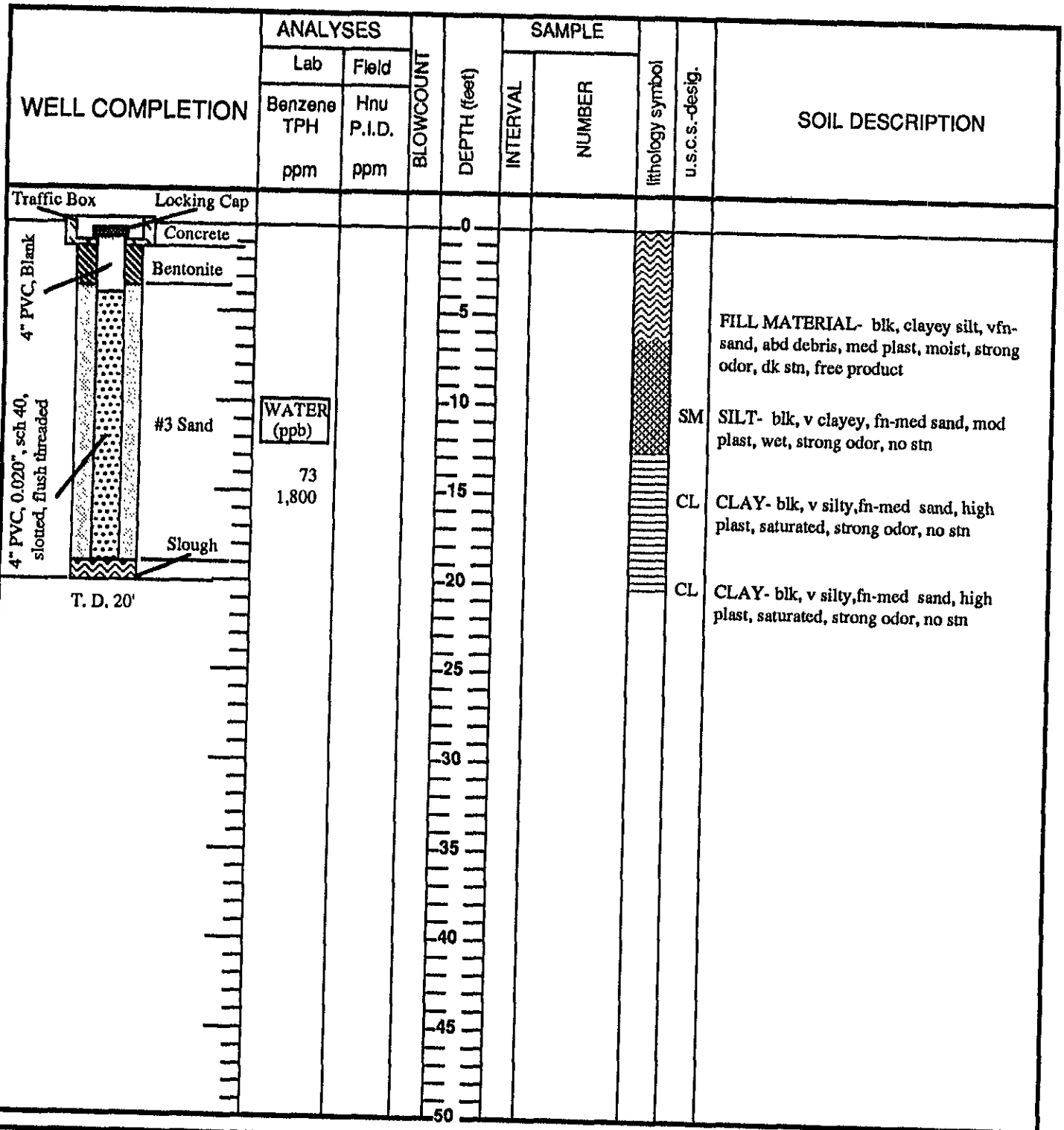
PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - CASTLE

LOG OF BORING MW-5

PLATE
4



SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 20 ft
DATE DRILLED: 6-12-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Eight inch
WATER ENCOUNTERED AT: 9.93 ft

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PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - CASTLE

LOG OF BORING MW-6

PLATE
5
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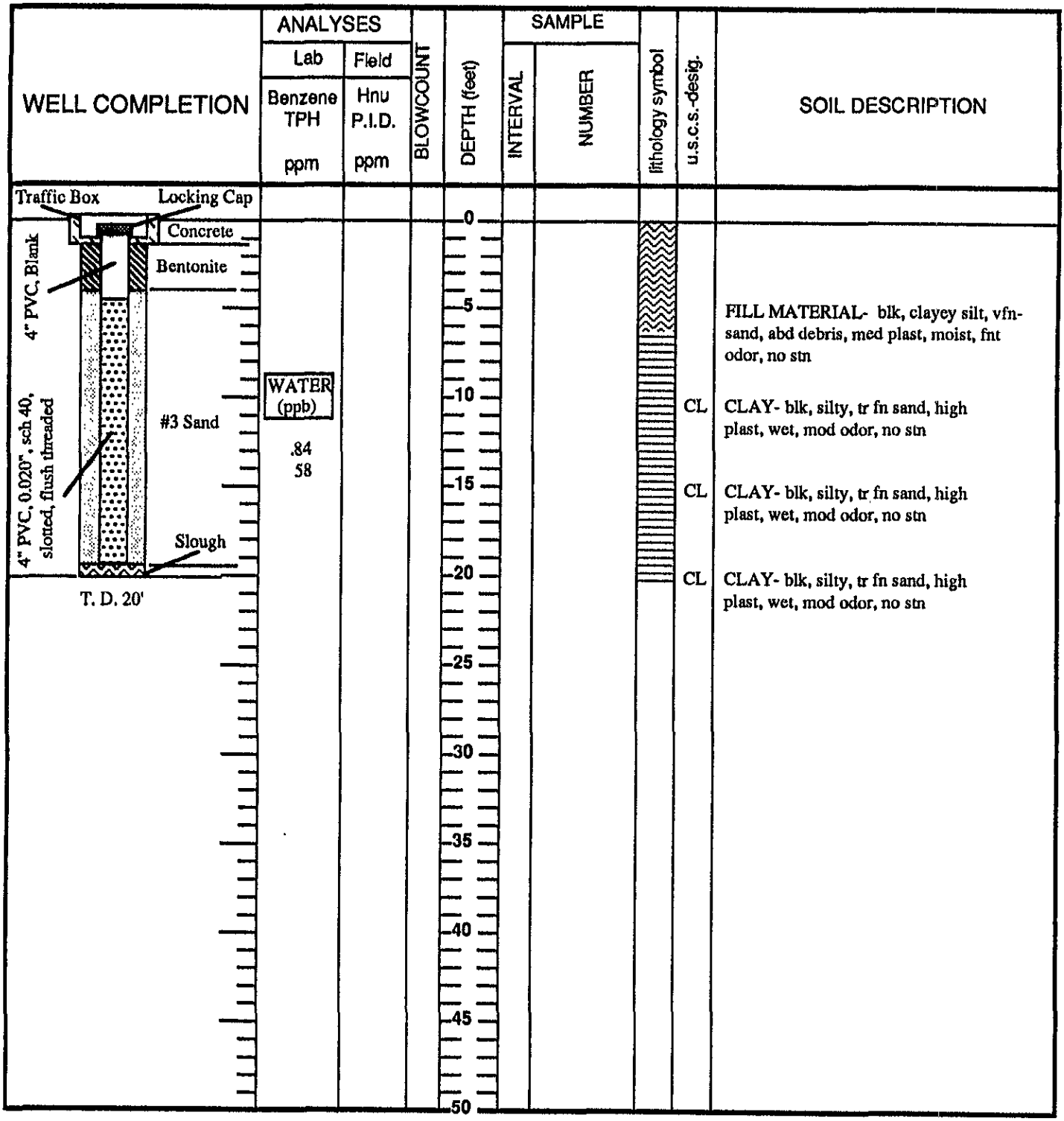

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TOTAL DEPTH: 20 ft
DATE DRILLED: 6-12-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Eight inch
WATER ENCOUNTERED AT: 10.28 ft

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PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - CASTLE

LOG OF BORING MW-7

PLATE
6
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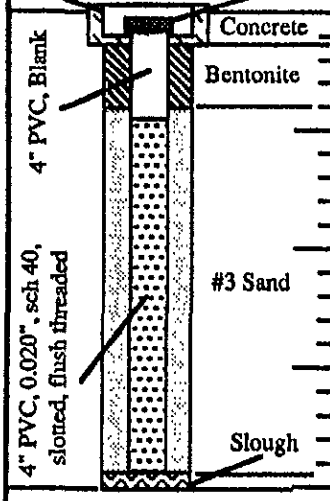

WELL COMPLETION	ANALYSES Lab Benzene TPH ppm	ANALYSES Field Hnu P.I.D. ppm	BLOWCOUNT	DEPTH (feet)	SAMPLE INTERVAL	SAMPLE NUMBER	lithology symbol	u.s.c.s.-desig.	SOIL DESCRIPTION
				0					
	.55	16		5		MW-8-5			FILL MATERIAL- blk, clayey silt, abd sand and fn gravel, occ debris, med plast, moist, mod odor, no stn
	WATER (ppb)			10				ML	SILT- blk, clayey, fn sand, mod-high plast, saturated, mod odor, no stn
	680	13,000		15				ML	SILT- blk, clayey, fn sand, mod-high plast, saturated, mod odor, no stn
				20				CL	CLAY- blk, silty, tr fn sand, high plast, wet, mod odor, no stn
				25					
				30					
				35					
				40					
				45					
				50					

SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 20 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Eight inch
WATER ENCOUNTERED AT: 3.82 ft

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PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING MW-8

PLATE
7
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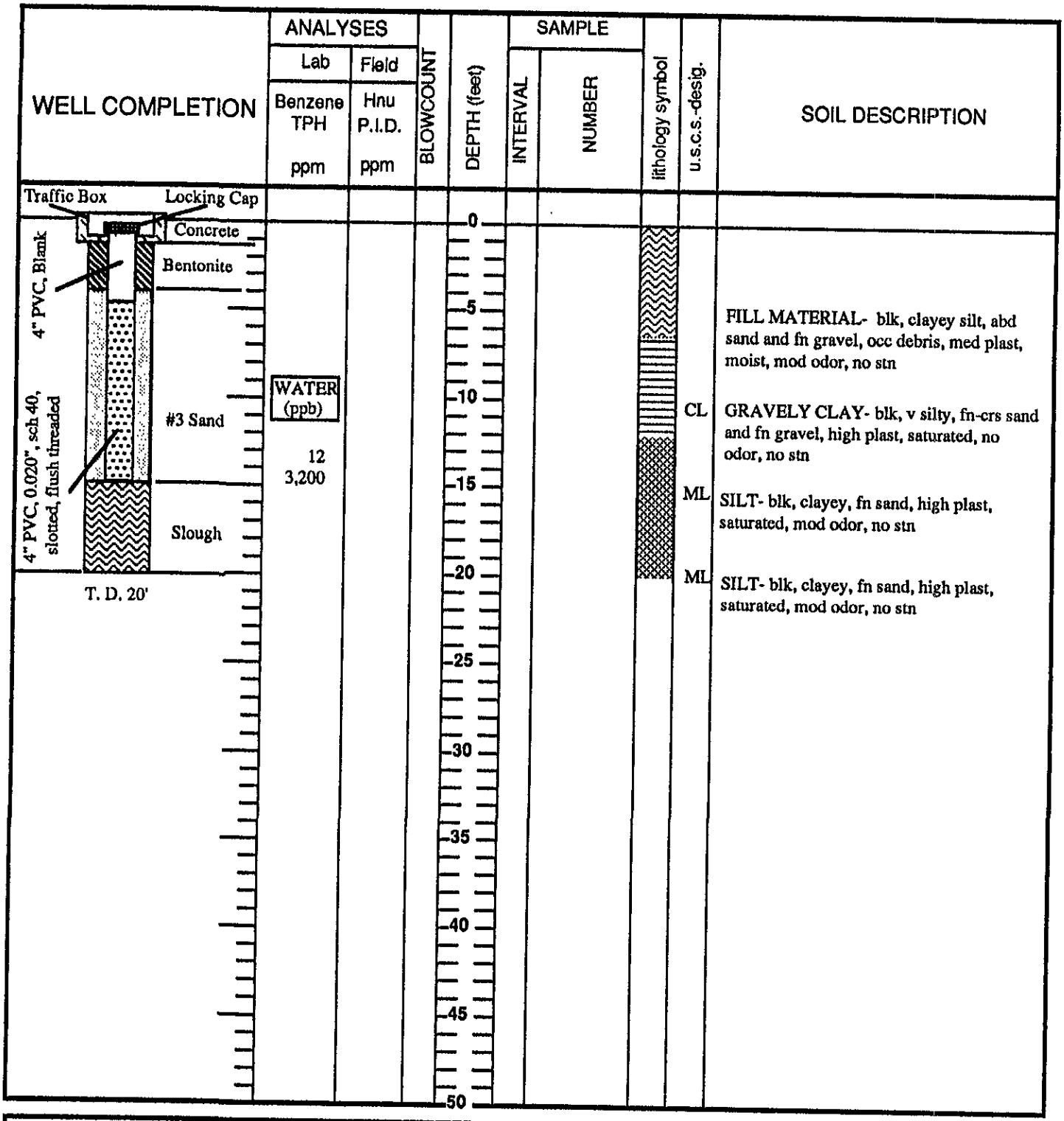

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DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Eight inch
WATER ENCOUNTERED AT: 4.80 ft

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PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING MW-9

PLATE
8
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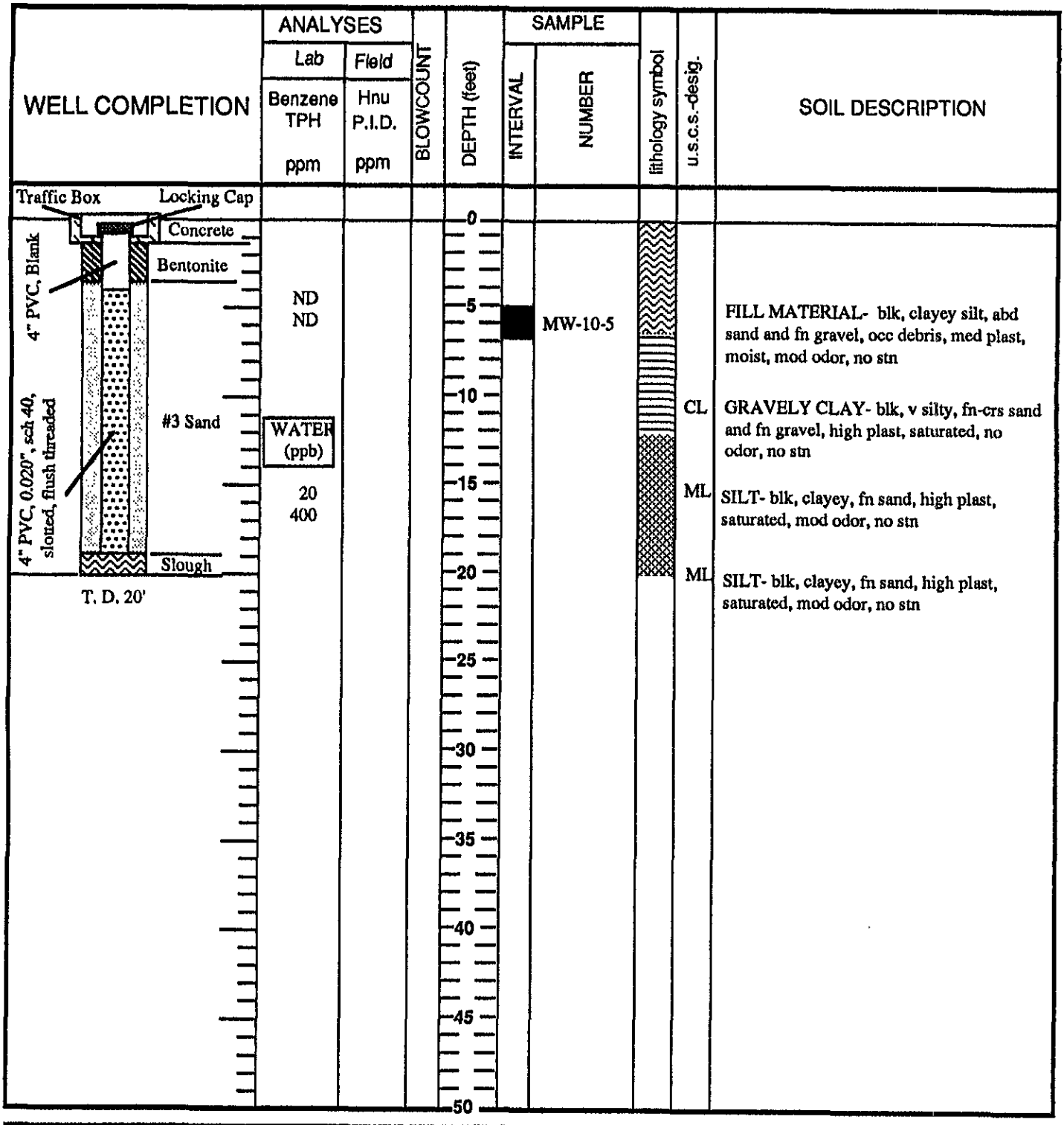

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TOTAL DEPTH: 20 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Eight Inch
WATER ENCOUNTERED AT: 5.91 ft

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PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING MW-10

PLATE
9
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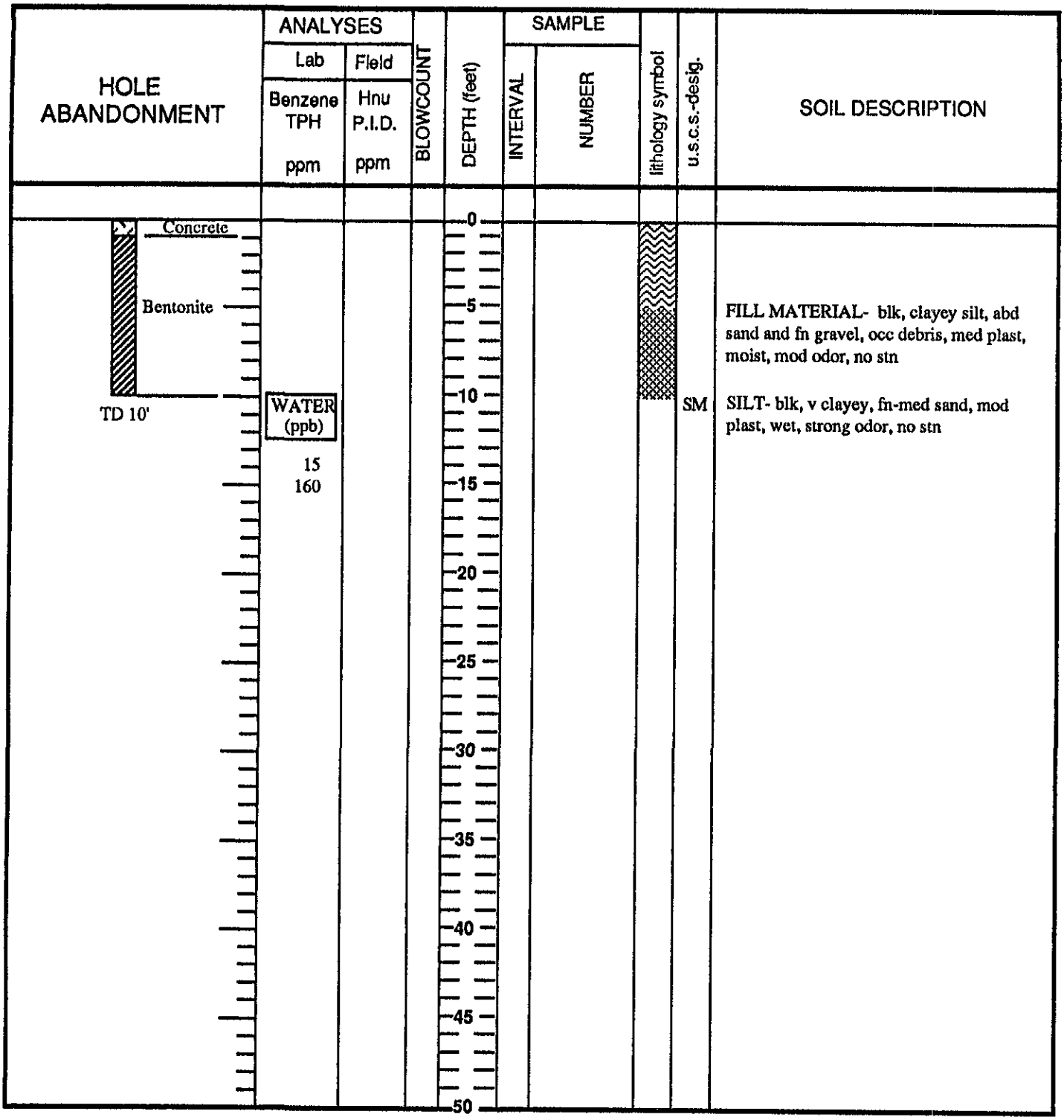

SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 10 ft
DATE DRILLED: 6-12-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 10 ft

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PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - CASTLE

LOG OF BORING B-6

PLATE
10
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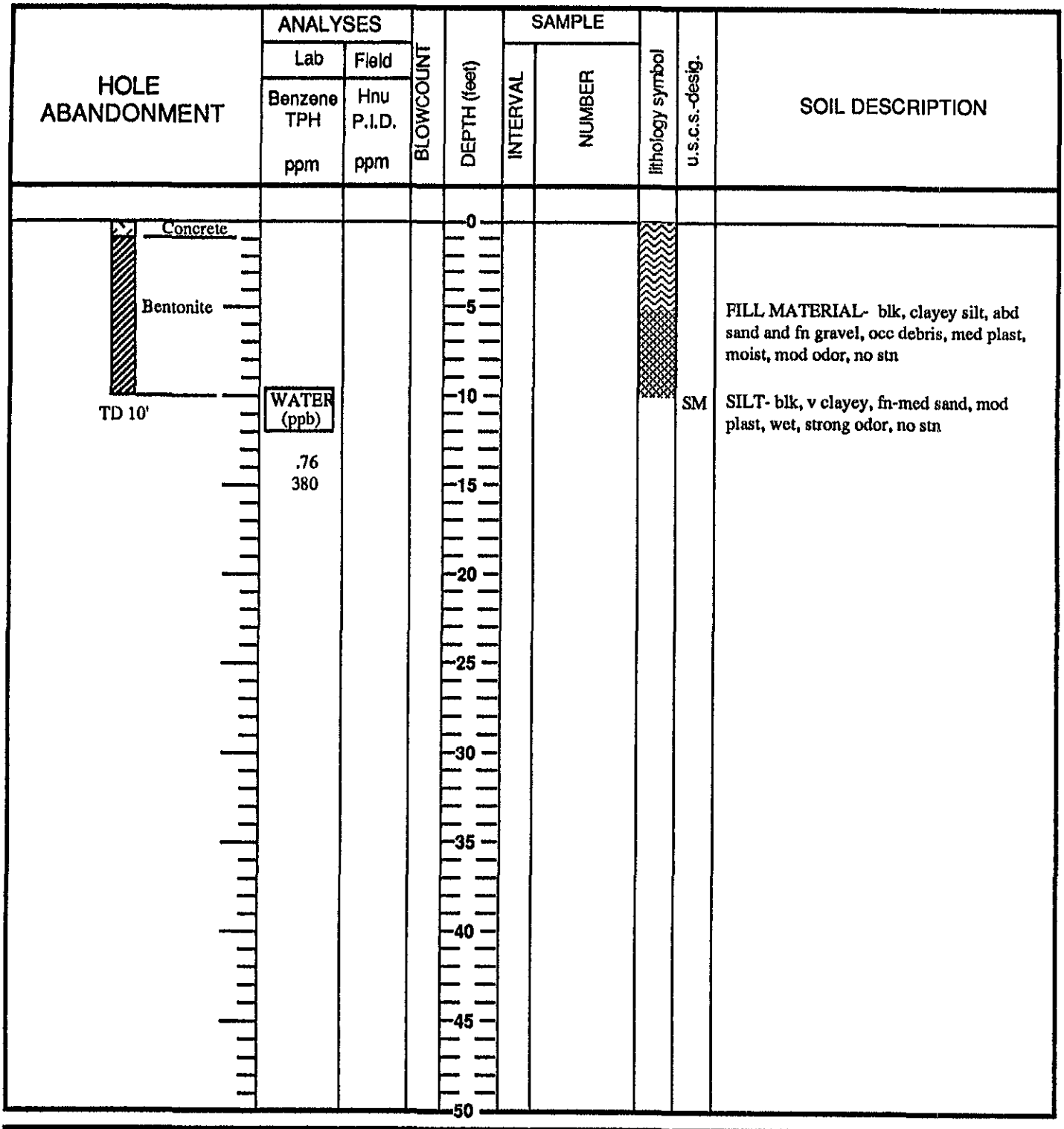

SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 10 ft
DATE DRILLED: 6-12-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 10 ft

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PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - CASTLE

LOG OF BORING B-7

PLATE
11
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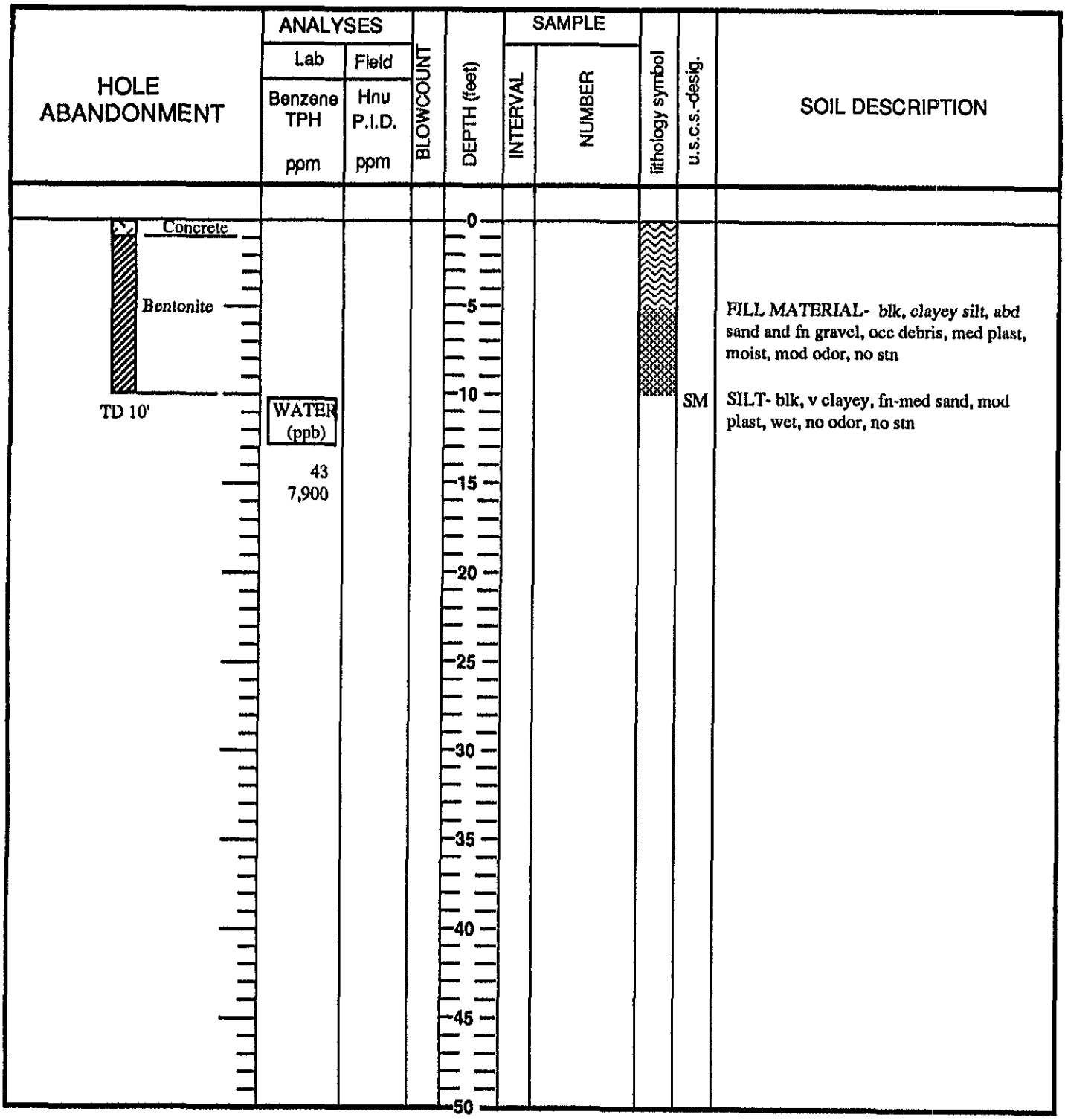

SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 10 ft
DATE DRILLED: 6-12-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 10 ft

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PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - CASTLE

LOG OF BORING B-8

PLATE
12
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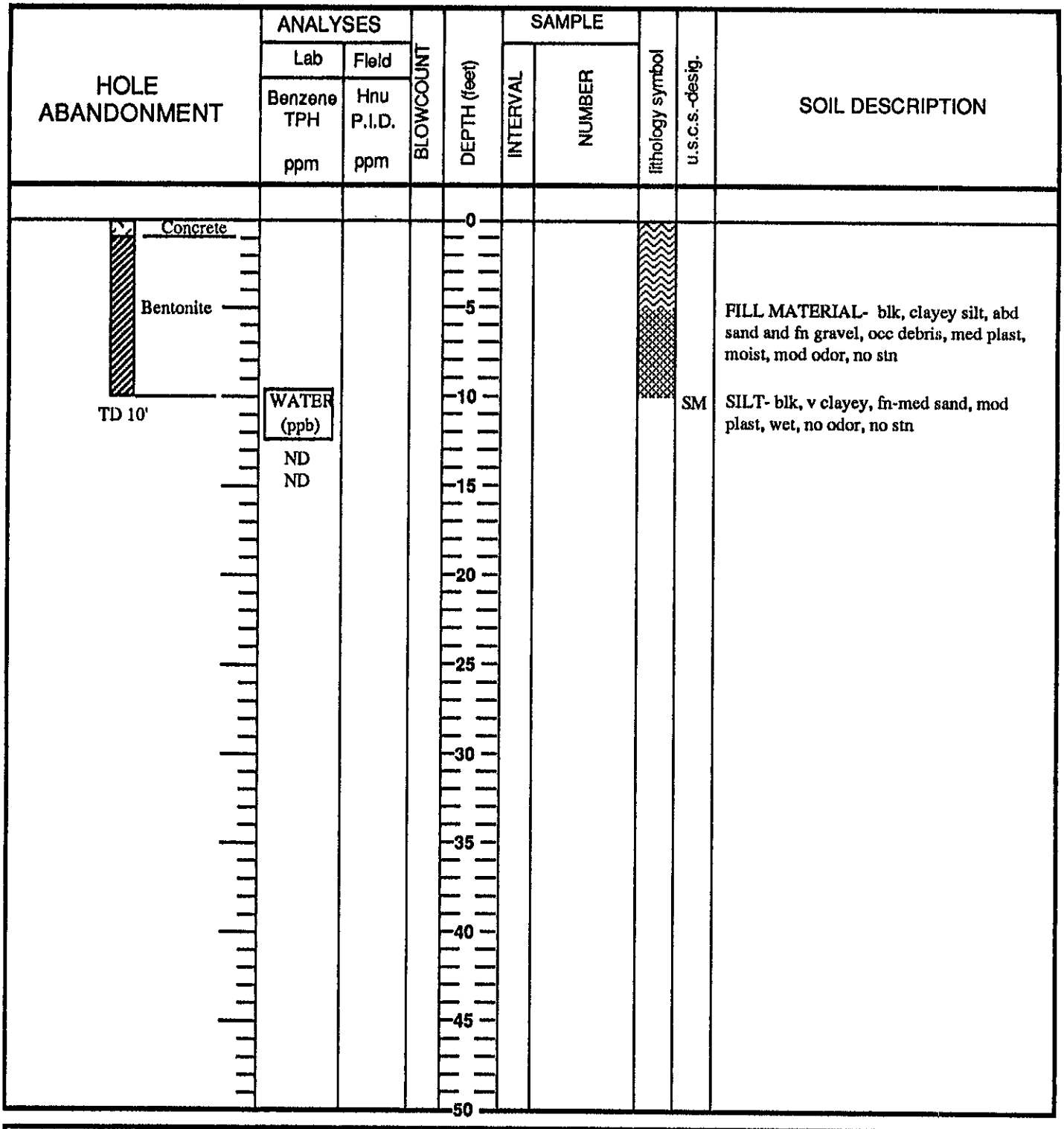

SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 10 ft
DATE DRILLED: 6-12-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 10 ft

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PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - CASTLE

LOG OF BORING B-9

PLATE
13
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HOLE ABANDONMENT	ANALYSES Lab Benzene TPH ppm	ANALYSES Field Hnu P.I.D. ppm	BLOWCOUNT	DEPTH (feet)	SAMPLE INTERVAL	SAMPLE NUMBER	lithology symbol	u.s.c.s.-desig.	SOIL DESCRIPTION
Concrete / Bentonite / TD 5'	20 550			0 5 10 15 20 25 30 35 40 45 50		B-10-3			FILL MATERIAL- blk, clayey silt, abd sand and fn gravel, occ debris, med plast, moist, mod odor, no stn

SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 5 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: none encountered

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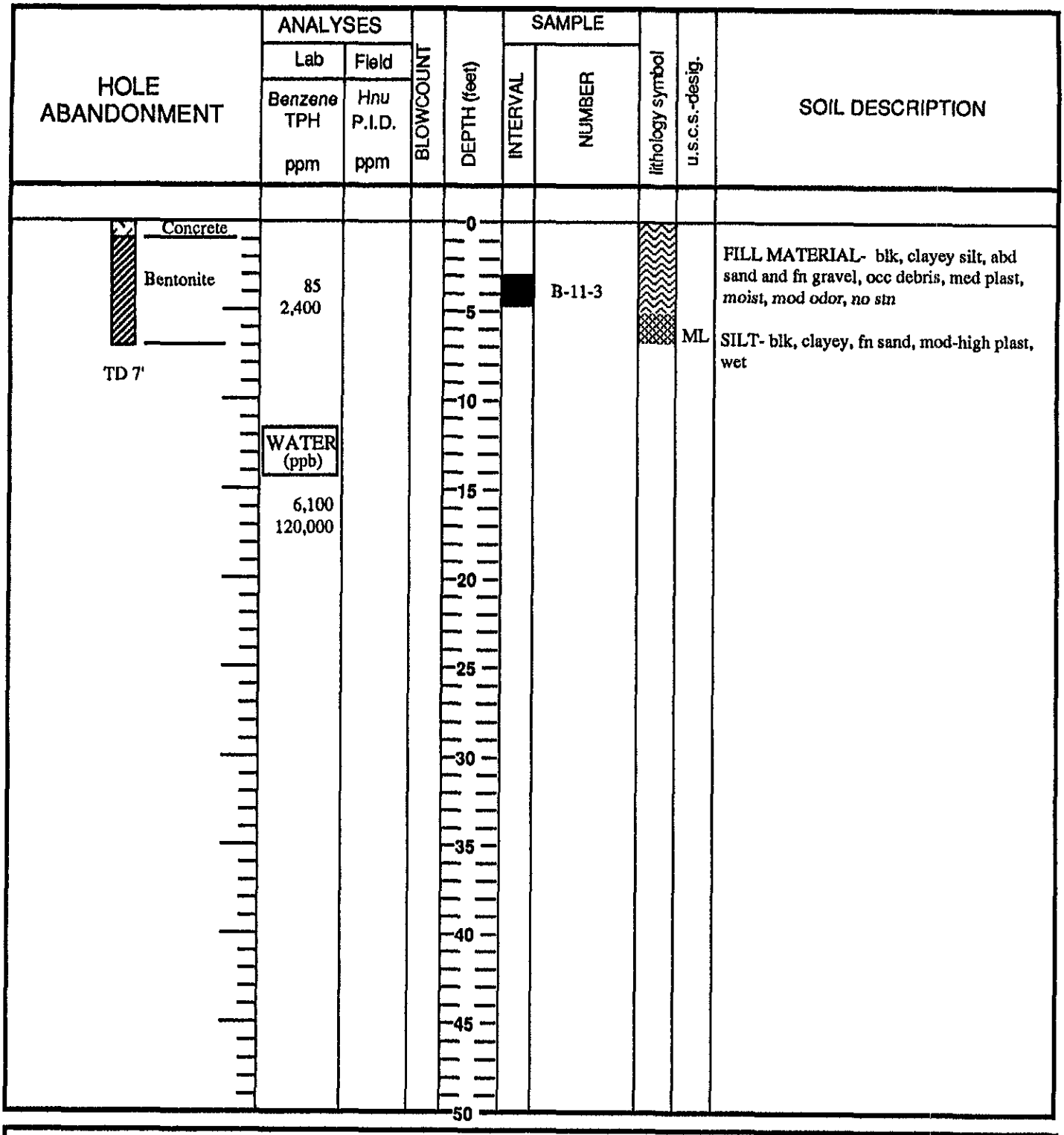
PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING B-10

PLATE
14



SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 7 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 5 ft

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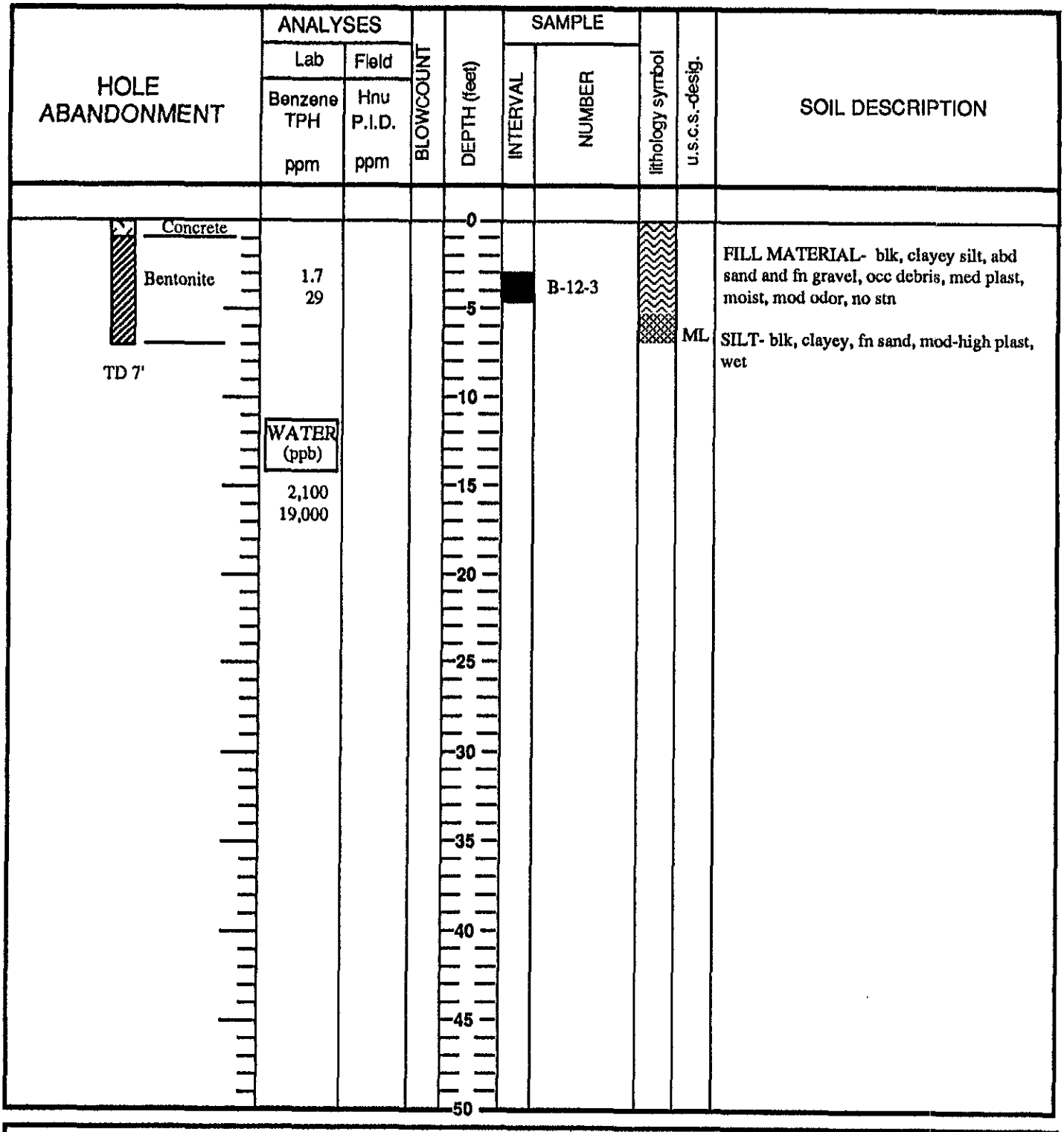
(805)835-7700
environmental/geotechnical services

PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING B-11

PLATE
15
page 1 of 1



SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 7 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 5 ft

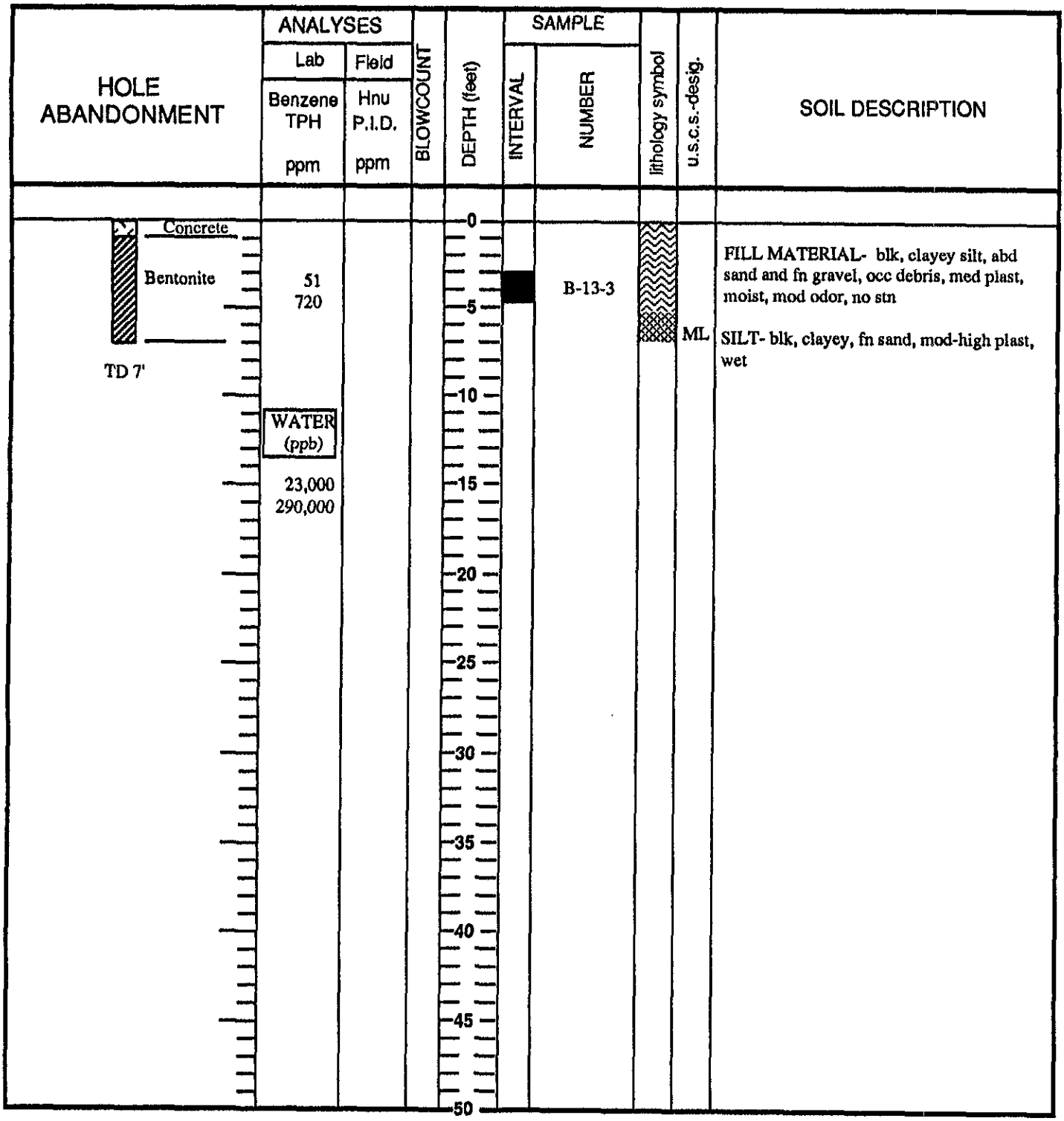
GROUNDWATER RESOURCES, INC.
(805)835-7700
environmental/geotechnical services

PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING B-12

PLATE
16
page 1 of 1



SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 7 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 5 ft

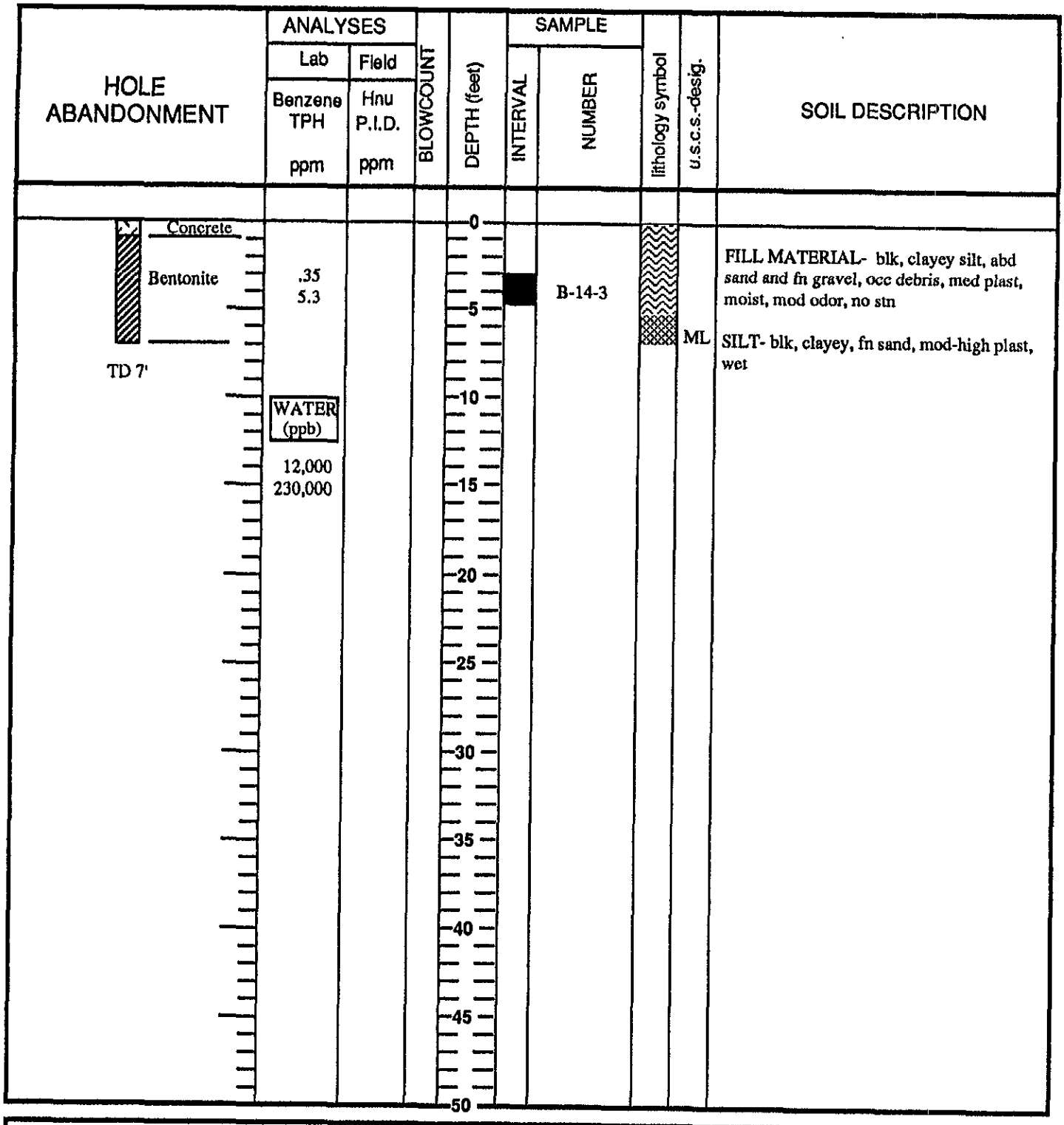
GROUNDWATER RESOURCES, INC.
(805)835-7700
environmental/geotechnical services

PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING B-13

PLATE
17



SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 7 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 5 ft

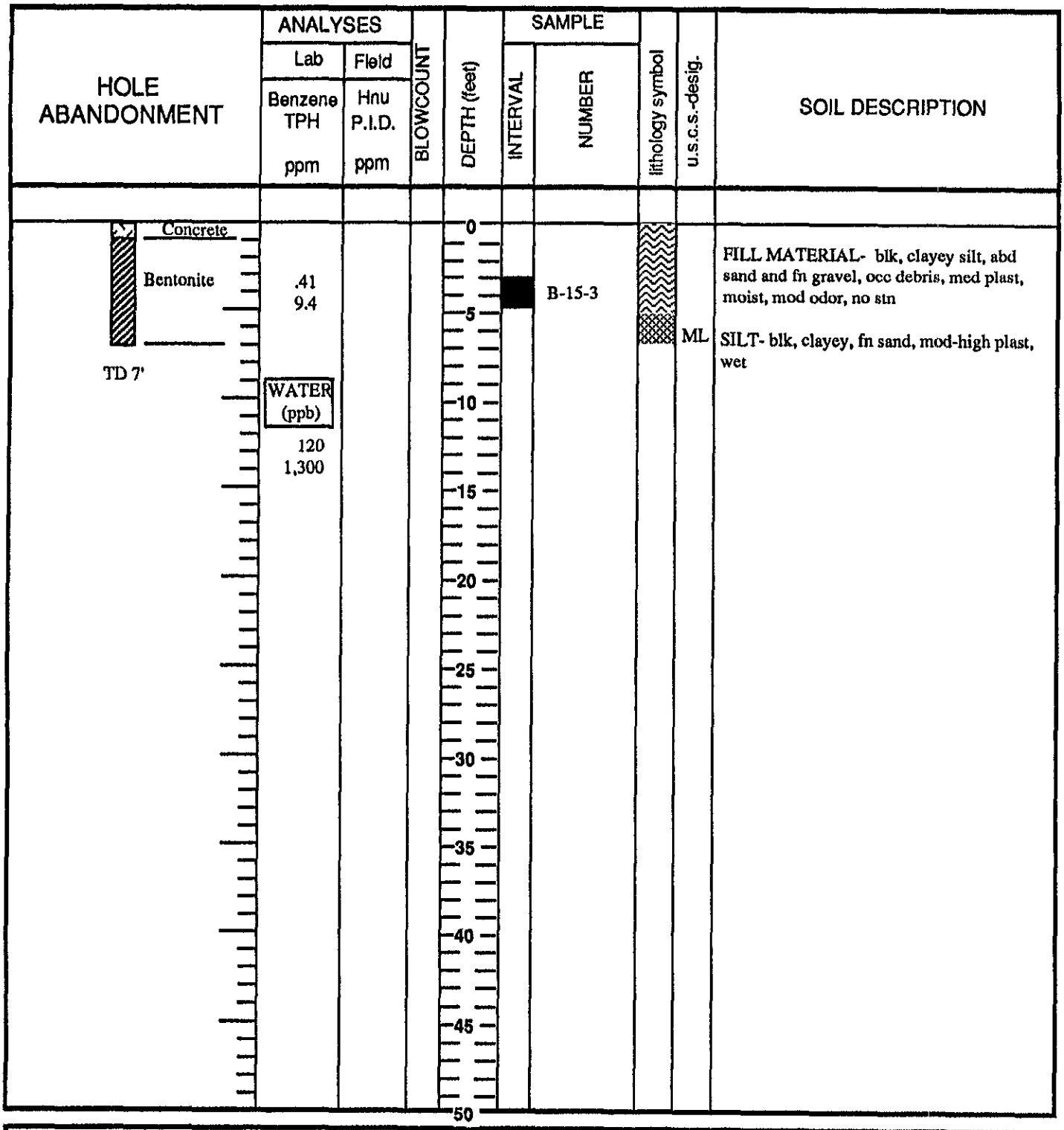
GROUNDWATER RESOURCES, INC.
(805)835-7700
environmental/geotechnical services

PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING B-14

PLATE
18
page 1 of 1



SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 7 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six Inch
WATER ENCOUNTERED AT: 5 ft

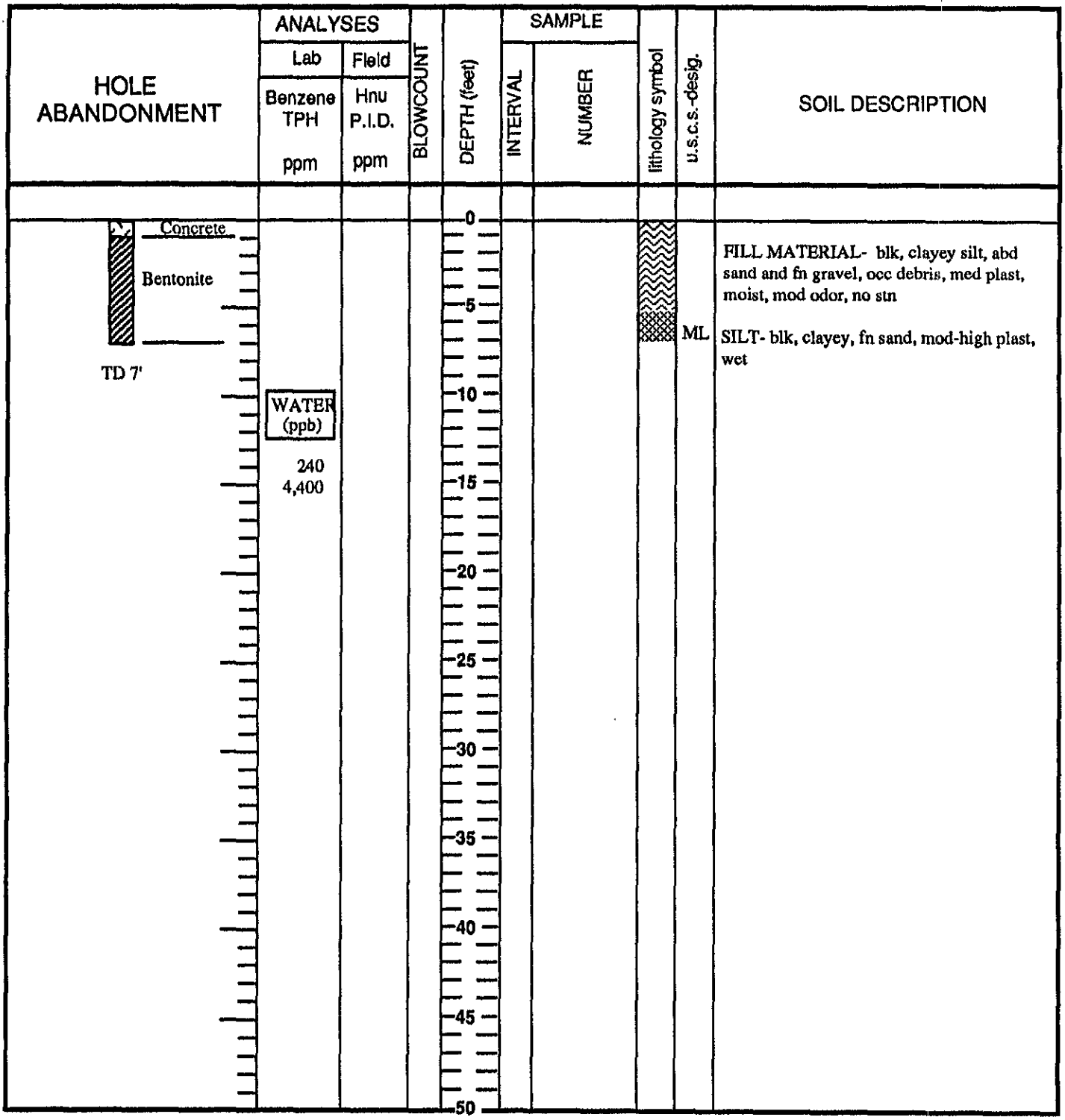
GROUNDWATER RESOURCES, INC.
(805)835-7700
environmental/geotechnical services

PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING B-15

PLATE
19
page 1 of 1



SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 7 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 5 ft

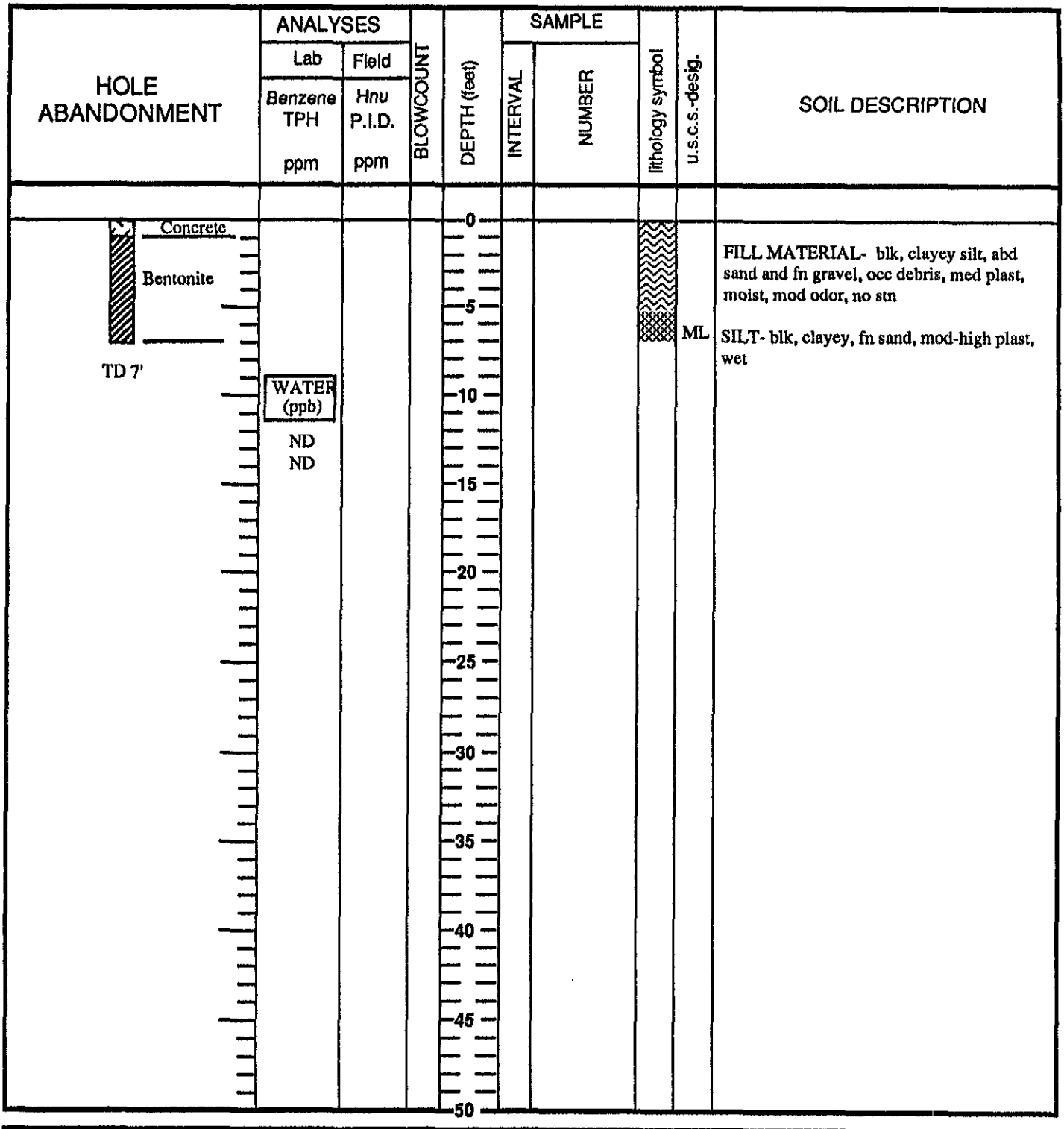
GROUNDWATER RESOURCES, INC.
(805)835-7700
environmental/geotechnical services

PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING B-16

PLATE
20
page 1 of 1



SURFACE ELEVATION: 10 ft
TOTAL DEPTH: 7 ft
DATE DRILLED: 6-13-90

LOGGED BY: TCR
SUPERVISED BY: RJY
DIAMETER of BORING: Six inch
WATER ENCOUNTERED AT: 5 ft

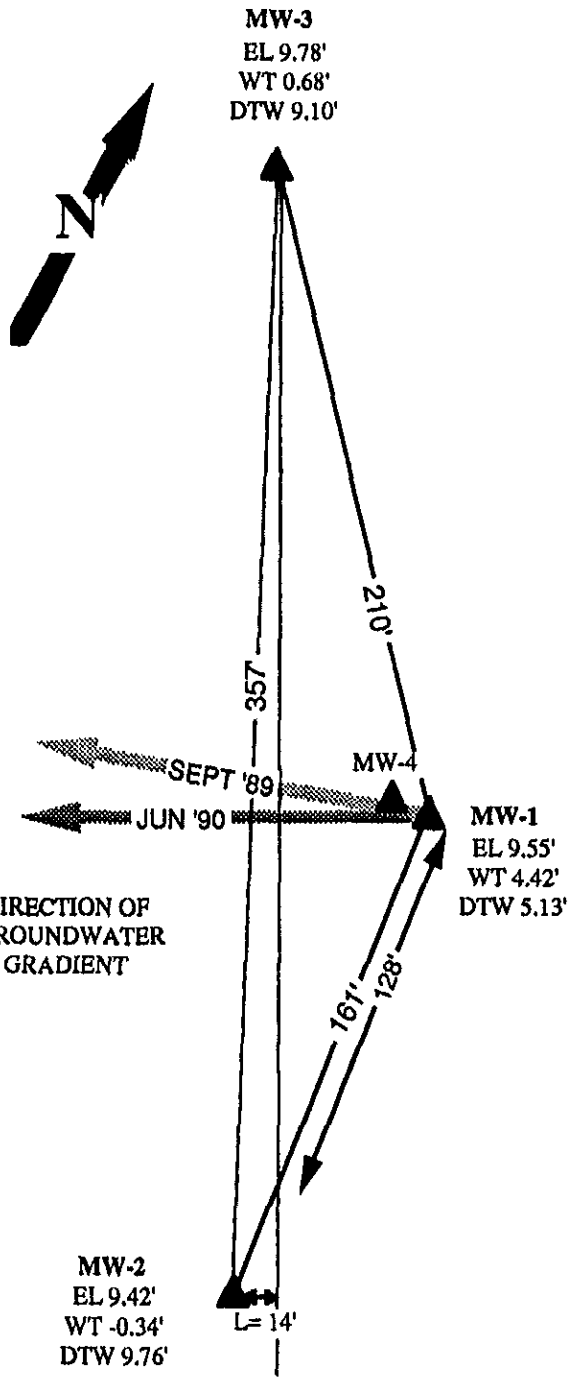
GROUNDWATER RESOURCES, INC.
(805)835-7700
environmental/geotechnical services

PROJECT NUMBER: 390-3

LOCATION:
MGP OAKLAND - RACE TRACK

LOG OF BORING B-17

PLATE
21



CALCULATIONS

GRADIENT

$$\frac{0.68' + 0.34'}{14'}$$

$$\frac{h_i}{L} = \frac{1.02'}{14'} = \frac{7.28'}{100'}$$

DIRECTION

$$\frac{4.42' - .68'}{X} = \frac{4.42' + 0.34'}{161'}$$

X = 128'

LEGEND

▲ MONITORING WELL LOCATION

SCALE
(feet)

0 50 100

groundwater resources, Inc.

environmental/geotechnical services

Project Number: 390-3

7-10-90

MALIBU FUN CENTER
8000 S. COLISEUM DR
OAKLAND, CA

GRADIENT MAP

PLATE
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APPENDIX A

Laboratory Analytical Reports

SMC Laboratory

Analytical Chemistry

Client Name: Groundwater Resources, Inc.
Address : 5400 Aldrin Court
Bakersfield, CA 93313

Date samples received : 06/15/90 Project #: 390-3
Date analysis completed: 06/18/90 P.O. #: 4406-G
Date of report : 06/25/90

Laboratory No. 1931 through 1960

RESULTS OF ANALYSIS

#1931 ID: MW-8-5	ugm/gm	MDL, ugm/gm
Benzene	.55	0.1
Toluene	.15	0.1
Ethylbenzene	.52	0.1
p-Xylene	.60	0.1
m-Xylene	.63	0.1
o-Xylene	.60	0.1
Isopropylbenzene	.10	0.1
TPH (Gasoline)	16	1.0

Method of Analysis for BTX/TPH (Gasoline): 3810/8020 (FID)
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/gm = micrograms per gram (parts per million)
ND = Not detected

Stan Comer
Laboratory Manager

3155 Pegasus Drive • Bakersfield, CA 93308 • (805) 393-3597
P.O. Box 80835 • Bakersfield, CA 93380 • FAX (805) 393-3623

Laboratory No. 1931 through 1960

RESULTS OF ANALYSIS

#1932 ID: MW-10-5	ugm/gm	MDL, ugm/gm
Benzene	ND	0.1
Toluene	ND	0.1
Ethylbenzene	ND	0.1
p-Xylene	ND	0.1
m-Xylene	ND	0.1
o-Xylene	ND	0.1
Isopropylbenzene	ND	0.1
TPH (Gasoline)	ND	1.0

#1933 ID: B-10-3	ugm/gm	MDL, ugm/gm
Benzene	20	0.1
Toluene	10	0.1
Ethylbenzene	6.4	0.1
p-Xylene	4.0	0.1
m-Xylene	1.5	0.1
o-Xylene	3.2	0.1
Isopropylbenzene	3.8	0.1
TPH (Gasoline)	550	1.0

#1934 ID: B-11-3	ugm/gm	MDL, ugm/gm
Benzene	85	0.1
Toluene	26	0.1
Ethylbenzene	61	0.1
p-Xylene	88	0.1
m-Xylene	81	0.1
o-Xylene	33	0.1
Isopropylbenzene	19	0.1
TPH (Gasoline)	2,400	1.0

Method of Analysis for BTX/TPH (Gasoline): 3810/8020 (FID)
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/gm = micrograms per gram (parts per million)
ND = Not detected

Stan Comer
Laboratory Manager

Laboratory No. 1931 through 1960

RESULTS OF ANALYSIS

#1935 ID: B-12-3	ugm/gm	MDL, ugm/gm
Benzene	1.7	0.1
Toluene	.12	0.1
Ethylbenzene	.14	0.1
p-Xylene	1.1	0.1
m-Xylene	2.6	0.1
o-Xylene	ND	0.1
Isopropylbenzene	13	0.1
TPH (Gasoline)	29	1.0

#1936 ID: B-13-3	ugm/gm	MDL, ugm/gm
Benzene	51	0.1
Toluene	44	0.1
Ethylbenzene	9.9	0.1
p-Xylene	9.8	0.1
m-Xylene	20	0.1
o-Xylene	8.6	0.1
Isopropylbenzene	.60	0.1
TPH (Gasoline)	720	1.0

#1937 ID: B-14-3	ugm/gm	MDL, ugm/gm
Benzene	.35	0.1
Toluene	.10	0.1
Ethylbenzene	.29	0.1
p-Xylene	ND	0.1
m-Xylene	ND	0.1
o-Xylene	ND	0.1
Isopropylbenzene	ND	0.1
TPH (Gasoline)	5.3	1.0

Method of Analysis for BTX/TPH (Gasoline): 3810/8020 (FID)
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/gm = micrograms per gram (parts per million)
ND = Not detected

Stan Comer
Laboratory Manager

Laboratory No. 1931 through 1960

RESULTS OF ANALYSIS

#1938 ID: B-15-3	ugm/gm	MDL, ugm/gm
Benzene	.41	0.1
Toluene	ND	0.1
Ethylbenzene	ND	0.1
p-Xylene	ND	0.1
m-Xylene	.12	0.1
o-Xylene	ND	0.1
Isopropylbenzene	ND	0.1
TPH (Gasoline)	9.4	1.0

Method of Analysis for BTX/TPH (Gasoline): 3810/8020 (FID)
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/gm = micrograms per gram (parts per million)
ND = Not detected

Stan Comer
Stan Comer
Laboratory Manager

SMC Laboratory

Analytical Chemistry

Client Name: Groundwater Resources, Inc.
Address : 5400 Aldrin Court
Bakersfield, CA 93313

Date samples received : 06/15/90
Date analysis completed: 06/22/90
Date of report : 06/25/90

Project #: 390-3
P.O. #: 4406-G

Laboratory No. 1939 through 1960

RESULTS OF ANALYSIS

#1939 ID: B-6	ugm/L	MDL, ugm/L
Benzene	15	0.5
Toluene	.55	0.5
Ethylbenzene	3.0	0.5
p-Xylene	1.1	0.5
m-Xylene	3.3	0.5
o-Xylene	.84	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	160	50

Method of Analysis for BTX/TPH (Gasoline): 5030/8020
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/L = micrograms per liter (parts per billion)
ND = Not detected

Stan Comer
Laboratory Manager

3155 Pegasus Drive • Bakersfield, CA 93308 • (805) 393-3597
P.O. Box 80835 • Bakersfield, CA 93380 • FAX (805) 393-3623

Laboratory No. 1939 through 1960

RESULTS OF ANALYSIS

#1940 ID: B-7	ugm/L	MDL,ugm/L
Benzene	.76	0.5
Toluene	ND	0.5
Ethylbenzene	2.5	0.5
p-Xylene	.90	0.5
m-Xylene	.50	0.5
o-Xylene	1.9	0.5
Isopropylbenzene	1.6	0.5
TPH (Gasoline)	380	50

#1941 ID: B-8	ugm/L	MDL,ugm/L
Benzene	43	0.5
Toluene	ND	0.5
Ethylbenzene	130	0.5
p-Xylene	39	0.5
m-Xylene	3.2	0.5
o-Xylene	6.4	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	7,900	50

#1942 ID: B-9	ugm/L	MDL,ugm/L
Benzene	ND	0.5
Toluene	ND	0.5
Ethylbenzene	ND	0.5
p-Xylene	ND	0.5
m-Xylene	ND	0.5
o-Xylene	ND	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	ND	50

Method of Analysis for BTX/TPH (Gasoline): 5030/8020
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/L = micrograms per liter (parts per billion)
ND = Not detected

Stan Comer
Laboratory Manager

Laboratory No. 1939 through 1960

RESULTS OF ANALYSIS

#1943 ID: B-11

	ugm/L	MDL, ugm/L
Benzene	6,100	0.5
Toluene	6,500	0.5
Ethylbenzene	4,900	0.5
p-Xylene	4,500	0.5
m-Xylene	7,000	0.5
o-Xylene	2,700	0.5
Isopropylbenzene	520	0.5
TPH (Gasoline)	120,000	50

#1944 ID: B-12

	ugm/L	MDL, ugm/L
Benzene	2,100	0.5
Toluene	140	0.5
Ethylbenzene	180	0.5
p-Xylene	950	0.5
m-Xylene	1,500	0.5
o-Xylene	380	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	19,000	50

#1945 ID: B-13

	ugm/L	MDL, ugm/L
Benzene	23,000	0.5
Toluene	24,000	0.5
Ethylbenzene	6,800	0.5
p-Xylene	8,500	0.5
m-Xylene	15,000	0.5
o-Xylene	8,700	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	290,000	50

Method of Analysis for BTX/TPH (Gasoline): 5030/8020
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/L = micrograms per liter (parts per billion)
ND = Not detected

Stan Comer
Laboratory Manager

Laboratory No. 1939 through 1960

RESULTS OF ANALYSIS

#1946 ID: B-14	ugm/L	MDL, ugm/L
Benzene	12,000	0.5
Toluene	8,400	0.5
Ethylbenzene	7,600	0.5
p-Xylene	9,200	0.5
m-Xylene	16,000	0.5
o-Xylene	8,300	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	230,000	50

#1947 ID: B-15	ugm/L	MDL, ugm/L
Benzene	120	0.5
Toluene	3.1	0.5
Ethylbenzene	3.9	0.5
p-Xylene	1.4	0.5
m-Xylene	3.6	0.5
o-Xylene	2.2	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	1,300	50

#1948 ID: B-16	ugm/L	MDL, ugm/L
Benzene	240	0.5
Toluene	28	0.5
Ethylbenzene	180	0.5
p-Xylene	81	0.5
m-Xylene	150	0.5
o-Xylene	28	0.5
Isopropylbenzene	85	0.5
TPH (Gasoline)	4,400	50

Method of Analysis for BTX/TPH (Gasoline): 5030/8020
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/L = micrograms per liter (parts per billion)
ND = Not detected

Stan Comer
Laboratory Manager

Laboratory No. 1939 through 1960

RESULTS OF ANALYSIS

#1949 ID: B-17	ugm/L	MDL, ugm/L
Benzene	ND	0.5
Toluene	ND	0.5
Ethylbenzene	ND	0.5
p-Xylene	ND	0.5
m-Xylene	ND	0.5
o-Xylene	ND	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	ND	50

#1950 ID: MW-1	ugm/L	MDL, ugm/L
Benzene	.66	0.5
Toluene	ND	0.5
Ethylbenzene	1.3	0.5
p-Xylene	2.3	0.5
m-Xylene	4.4	0.5
o-Xylene	1.9	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	210	50

#1951 ID: MW-2	ugm/L	MDL, ugm/L
Benzene	ND	0.5
Toluene	ND	0.5
Ethylbenzene	ND	0.5
p-Xylene	ND	0.5
m-Xylene	ND	0.5
o-Xylene	ND	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	ND	50

Method of Analysis for BTX/TPH (Gasoline): 5030/8020
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/L = micrograms per liter (parts per billion)
ND = Not detected

Stan Comer
Laboratory Manager

Laboratory No. 1939 through 1960

RESULTS OF ANALYSIS

#1952 ID: MW-3	ugm/L	MDL, ugm/L
Benzene	.90	0.5
Toluene	4.0	0.5
Ethylbenzene	ND	0.5
p-Xylene	ND	0.5
m-Xylene	ND	0.5
o-Xylene	ND	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	ND	50

#1953 ID: MW-4	ugm/L	MDL, ugm/L
Benzene	200	0.5
Toluene	3.7	0.5
Ethylbenzene	1.2	0.5
p-Xylene	2.8	0.5
m-Xylene	5.3	0.5
o-Xylene	1.4	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	660	50

#1954 ID: MW-5	ugm/L	MDL, ugm/L
Benzene	ND	0.5
Toluene	ND	0.5
Ethylbenzene	ND	0.5
p-Xylene	ND	0.5
m-Xylene	ND	0.5
o-Xylene	ND	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	ND	50

Method of Analysis for BTX/TPH (Gasoline): 5030/8020
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/L = micrograms per liter (parts per billion)
ND = Not detected

Stan Comer
Laboratory Manager

Laboratory No. 1939 through 1960

RESULTS OF ANALYSIS

#1955 ID: MW-6	ugm/L	MDL, ugm/L
Benzene	73	0.5
Toluene	ND	0.5
Ethylbenzene	17	0.5
p-Xylene	9.0	0.5
m-Xylene	14	0.5
o-Xylene	6.7	0.5
Isopropylbenzene	11	0.5
TPH (Gasoline)	1,800	50

#1956 ID: MW-7	ugm/L	MDL, ugm/L
Benzene	.84	0.5
Toluene	ND	0.5
Ethylbenzene	1.2	0.5
p-Xylene	ND	0.5
m-Xylene	ND	0.5
o-Xylene	1.8	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	58	50

#1957 ID: MW-8	ugm/L	MDL, ugm/L
Benzene	680	0.5
Toluene	36	0.5
Ethylbenzene	150	0.5
p-Xylene	480	0.5
m-Xylene	330	0.5
o-Xylene	250	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	13,000	50

Method of Analysis for BTX/TPH (Gasoline): 5030/8020
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/L = micrograms per liter (parts per billion)
ND = Not detected

Stan Comer
Laboratory Manager

Laboratory No. 1939 through 1960

RESULTS OF ANALYSIS

#1958 ID: MW-9	ugm/L	MDL, ugm/L
Benzene	12	0.5
Toluene	.78	0.5
Ethylbenzene	4.5	0.5
p-Xylene	1.6	0.5
m-Xylene	.94	0.5
o-Xylene	ND	0.5
Isopropylbenzene	88	0.5
TPH (Gasoline)	3,200	50

#1959 ID: MW-10	ugm/L	MDL, ugm/L
Benzene	20	0.5
Toluene	.69	0.5
Ethylbenzene	4.3	0.5
p-Xylene	2.6	0.5
m-Xylene	3.9	0.5
o-Xylene	1.2	0.5
Isopropylbenzene	2.3	0.5
TPH (Gasoline)	400	50

#1960 ID: Travel Blank	ugm/L	MDL, ugm/L
Benzene	ND	0.5
Toluene	ND	0.5
Ethylbenzene	ND	0.5
p-Xylene	ND	0.5
m-Xylene	ND	0.5
o-Xylene	ND	0.5
Isopropylbenzene	ND	0.5
TPH (Gasoline)	ND	50

Method of Analysis for BTX/TPH (Gasoline): 5030/8020
MDL = Minimum Detection Level
TPH = Total Petroleum Hydrocarbons
ugm/L = micrograms per liter (parts per billion)
ND = Not detected

Stan Comer
Stan Comer
Laboratory Manager

APPENDIX B

Chain of Custody

groundwater resources, inc.

5400 Aldrin Court
Bakersfield, California 93313
Telephone: (805) 835-7700
Tele-Fax: (805) 835-7717

CHAIN OF CUSTODY RECORD

LAB DESTINATION: SMC

PROJECT NUMBER: 350-3

P.O. NUMBER 44066

PROJECT CONTACT: TIM REED

SAMPLER(S): (Signature) Tim Reed

COUNTY: ALAMEDA

LAB NUMBER	SAMPLE NUMBER	DATE	TIME	SAMPLE LOCATION	CONDITION ON RECEIPT	ANALYSIS REQUESTED	SAMPLE TYPE	CONTAINER TYPE
1956	MW-7	6-14-90	11:11		GOOD/SEALED BUT	BTXE, TPH (GASOLINE) ODNS LEFT	WATER	VOA
1957	MW-8	"	12:05			"	"	"
1958	MW-9	"	12:00			"	"	"
1959	MW-10	"	11:57			"	"	"
1960	TRAVEL BLANK							

SPECIAL INSTRUCTIONS: WATER SAMPLES PRESERVED W/ HCl 1:1

POSSIBLE SAMPLE HAZARDS:

1. Relinquished by: Tim Reed Date/Time: 6-15-90/11:15 Received by: B. J. Thomas Date/Time: 1115 Am 6-15-90
1. Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
1. Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
1. Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____

CCR (Rev. 10/89) WHITE: LABORATORY PINK: JOB FILE YELLOW: SAMPLE LOG

groundwater resources, inc.

5400 Aldrin Court
Bakersfield, California 93313
Telephone: (805) 835-7700
Tele-Fax: (805) 835-7717

CHAIN OF CUSTODY RECORD

LAB DESTINATION: SMC

PROJECT NUMBER: 390-3

P.O. NUMBER 4406 G

PROJECT CONTACT: TIM REED

SAMPLER(S): (Signature) Tim Reed

COUNTY: ALAMEDA

LAB NUMBER	SAMPLE NUMBER	DATE	TIME	SAMPLE LOCATION	CONDITION ON RECEIPT	ANALYSIS REQUESTED	SAMPLE TYPE	CONTAINER TYPE
1943	B-10	6-13-90	14:06		COLD/SEALED BUT	BTX&E, TAI (GASOLINE) BOHS LUFT	WATER	VOA
1944	B-12	"	17:15			"	"	"
1945	B-13	"	17:49			"	"	"
1946	B-14	"	17:45			"	"	"
1947	B-15	"	17:50			"	"	"
1948	B-16	"	18:15			"	"	"
1949	B-17	"	18:24			"	"	"
1950	MW-1	6-14-90	12:10			"	"	"
1951	MW-2	"	10:30			"	"	"
1952	MW-3	"	11:23			"	"	"
1953	MW-4	"	12:15			"	"	"
1954	MW-5	"	11:34			"	"	"
1955	MW-6	"	10:55			"	"	"

SPECIAL INSTRUCTIONS: WATER SAMPLES PRESERVED W/ HCl 1:1

POSSIBLE SAMPLE HAZARDS:

1. Relinquished by: Tim Reed Date/Time: 6-15-90/11:15 Received by: B. Thorp Date/Time: 1115 6-15-90
1. Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
1. Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
1. Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____

CCR (Rev. 10/89) WHITE: LABORATORY PINK: JOB FILE YELLOW: SAMPLE LOG

groundwater resources, inc.

5400 Aldrin Court
Bakersfield, California 93313
Telephone: (805) 835-7700
Tele-Fax: (805) 835-7717

CHAIN OF CUSTODY RECORD

LAB DESTINATION: SMC

PROJECT NUMBER: 350-3

P.O. NUMBER 44066

PROJECT CONTACT: JIM REED

SAMPLER(S): (Signature) Jim Reed

COUNTY: ALAMEDA

LAB NUMBER	SAMPLE NUMBER	DATE	TIME	SAMPLE LOCATION	CONDITION ON RECEIPT	ANALYSIS REQUESTED	SAMPLE TYPE	CONTAINER TYPE
1931	MW-8-5	6-13-90	9:53		COLD / SEALED BUT	BTXE, TPH (GASOLINE) DOHS LUFT	SOIL	BRASS
1932	MW-10-5	"	14:20			"	"	"
1933	B-10-3	"	16:08			"	"	"
1934	B-11-3	"	16:22			"	"	"
1935	B-12-3	"	17:04			"	"	"
1936	B-13-3	"	17:32			"	"	"
1937	B-14-3	"	17:22			"	"	"
1938	B-15-3	"	17:52			"	"	"
1939	B-6	6-12-90	15:00			"	WATER	VOA
1940	B-7	"	14:50			"	"	"
1941	B-8	"	15:05			"	"	"
1942	B-9	"	15:15			"	"	"

SPECIAL INSTRUCTIONS: WATER SAMPLES PRESERVED W/ HCl 1:1

POSSIBLE SAMPLE HAZARDS:

1. Relinquished by: Jim Reed Date/Time: 6-15-90 11:15 Received by: [signature] Date/Time: 1115 AM 6-15-90
1. Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
1. Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
1. Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____

CCR (Rev. 10/89) WHITE: LABORATORY PINK: JOB FILE YELLOW: SAMPLE LOG

APPENDIX C

Sampling Protocol

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5400 ALDRIN CT.
BAKERSFIELD, CALIFORNIA 93313
General Engineering Contractor
Class A/Haz License No. 520768

SAMPLING PROTOCOL

MAILING ADDRESS: P.O. BOX 9383, BAKERSFIELD, CA 93389 (805) 835-7700
LOS ANGELES (213) 724-3147

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TEST BORING PROCEDURES

I. Soil Sampling Protocol

The following procedures are following during soil sampling operations utilizing the hollow stem auger drilling technique.

A. Hollow Stem Auger

1. Soil borings drilled by the hollow stem auger utilize continuous flight hollow stem augers.

2. Augers, samplers and all downhole equipment are steam cleaned prior to use. In the field steam cleaning is done between borings to minimize the potential for cross-contamination.

3. A G.R.I. geologist observes the work, visually logs the soils, and collects samples at appropriate intervals.

4. The Unified Soils Classification System is utilized to classify soils encountered. Additional geological observations are noted as appropriate.

5. Soil samples destined for laboratory analysis are collected by a modified California Split Spoon. This sampler uses three, six inch long, by two and one-half inch diameter (o.d.) tubes.

Various tubes can be utilized to accommodate the type of analysis necessary:

Brass	-	All organics and general analyses (not to be used for copper or zinc analysis)
Stainless Steel	-	All organics and metals analyses for copper and zinc (not to be used for chrome or nickel analyses)
Plastic	-	All metals analyses (not to be used for organics)

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TEST BORING PROCEDURES
(Cont'd)

6. The tubes are cleaned and prepared in the G.R.I. laboratory. Tubes are scrubbed, inside and outside, with a brush and TSP, rinsed, dryed, and packed in clean containers with seals. Tubes are delivered to the drilling site in these closed containers to preserve the state of cleanliness.

7. After the sample(s) have been removed from the sampler, the sampler is completely disassembled and scrubbed in TSP and tap water. It is then rinsed in clean tapwater and reassembled with three clean tubes.

8. Dirty tubes are field washed in TSP solution, rinsed with water, and reused.

9. The sampler is driven by a 140 pound hammer with a 30 inch free fall. Blow counts are recorded as number of blows per inch of drive.

10. The sampler is driven 18 inches at each sampling interval. The first (or lowest) tube is generally retained as the sample for analysis. The other two tubes are retained for back-up or split samples.

11. A sand catcher is used in the sampler where loose soils are anticipated. This will prevent the soil from falling out of the sampler.

12. After retrieval, the sample is visually logged and immediately sealed with aluminum foil lined caps, labeled, and chilled. Clean ice chests and chemical ice ("blue ice") are used to keep the samples cold until delivered to the chemical laboratory. Teflon seals are also available for field samples.

13. Samples are delivered to the laboratory the same day they are taken, if physically possible. If the samples must be held until the next day, they are kept chilled in a secure location at the G.R.I. facility.

14. Sample control is maintained by a Chain of Custody form which accompanies the sample. The form documents the time, date, and responsible person during each step in the transportation process.

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MONITORING WELL SAMPLING PROTOCOL

II. Groundwater Sampling

A. All equipment that is used in a monitoring well for purging, sampling, or depth measurement is decontaminated by steam cleaning or a TSP wash and rinse procedure prior to use and before re-using when more than one sample is collected.

B. Purge Volume Determination

The following procedure is followed to determine the appropriate purging volume prior to well sampling.

1. The depth-to-water is measured by a clean, electric level indicator. Measurement datum is the top of well protector.

2. Depth to the bottom of the well is measured by a clean tape and plumb bob. If possible, this is compared to the well construction log to determine inconsistencies, i.e. damaged casing, sediment in casing, etc.

3. Water volume is calculated by using the total water depth and the inside diameter of the casing.

C. Well Purging and Sampling

1. Prior to sampling, a minimum of three to five well volumes are purged from each well to ensure that water sampled is representative of the groundwater within the formation.

2. Measurements of pH, conductivity and temperature are taken at frequent intervals during the purge. Stabilization of these values indicates that representative formation fluids are being removed from the well.

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MONITORING WELL SAMPLING PROTOCOL
(Cont'd)

3. In the event that the well is pumped dry, and alternate procedure will be followed. Once a well is pumped dry, the water that enters the well during recovery is, by definition, representative formation water. The well will, therefore, be pumped dry and allowed to recover to 80% or more of the original water level.

4. Purge water is pumped directly into barrels on site until the proper method of disposal is determined.

5. Samples are pumped or poured from a bailer into sampling bottles prepared by a state certified laboratory contracted for the particular job and placed in refrigerated coolers for transport to the laboratory.

6. Samples are delivered by courier, directly to the lab on the same day of sampling, whenever practical. If next day delivery is necessary, the samples are kept refrigerated at 4 degrees C overnight and delivered to the laboratory the following morning.

7. Samples are accompanied by a Chain of Custody form which documents the time, date and responsible person during each step of the transportation process.

8. The G.R.I. coded sample numbering system allows identification of sample and client to G.R.I., while not revealing the client to anyone else.