FEDERATED INSURANCE®

Debra B. ReMine, Vice President – General Counsel
121 East Park Square; P.O. Box 328 • Owatonna, MN 55060
Phone: (507) 455-5200

File Tiger Oil North 1st

February 5, 1993

Attention: John O. Wietfeld
Site Manager
Department of Ecology
106 South 6th Ave.
YAKIMA WA 98902-3387

SUBJECT: REVIEW OF FEDERATED INSURANCE CLAIM FILES REGARDING TIGER SITES I AND III

Dear Mr. Wietfeld:

At your request, we have reviewed Federated's claims files on Tiger Sites I and III in an effort to supplement the information you have regarding earlier remedial activities at these sites. Unfortunately, much of this early claims file information dated back to the early 1980s and has been destroyed as part of Federated's routine document retention policy (this policy has since been modified and similar documents are now retained indefinitely).

From the information available, it appears that no formal enforcement action was commenced by Ecology at either of these sites and our available file material is therefore quite limited.

TIGER I

We have virtually no pertinent file material regarding Tiger I at 17th and Nob Hill.

TIGER III

We were able to locate limited information on Tiger III at North First Street. (Most of this information appears to have been sent to Ecology and is probably contained in Ecology's files). For your convenience, I have attached the pertinent documents referred to below.

> On May 8, 1985 Soil Exploration Company (SEC) prepared a report with copies to Ecology which recommended limited monitoring of the site in Section 5.0 as follows:

Movement and Fate of Gasoline and Diesel in Ground Water at the Yakima, Washington, Research Site: U.S. Geological Survey Toxic Waste--Ground-Water Contamination Program

Overview

Ground-water contamination caused by petroleum hydrocarbons is recognized as a major problem that is widespread. However, there is a lack of knowledge as to the physical, chemical, and biological processes that affect the movement and fate of these contaminants in a ground-water environment. This knowledge would aid in the evaluation of the long-term impacts of existing or potential contamination problems as well as aid in the development of methodologies for the effective management of petroleum hydrocarbon contamination.

The U.S. Geological Survey, in 1982, began a national thrust program on ground-water contamination and toxic waste. The Geological Survey's Office of Hazardous Waste Hydrology in Reston, Virginia, coordinates this program. As part of the program, interdisciplinary research studies are being established at field research sites. A combined gasoline and diesel spill at Yakima, Washington, was proposed by the Pacific Northwest District as a national research site for the study of the movement and fate of gasoline and diesel through both the unsaturated and saturated zones of a ground-water system. In January 1985, the site was selected by the Office of Hazardous Waste Hydrology

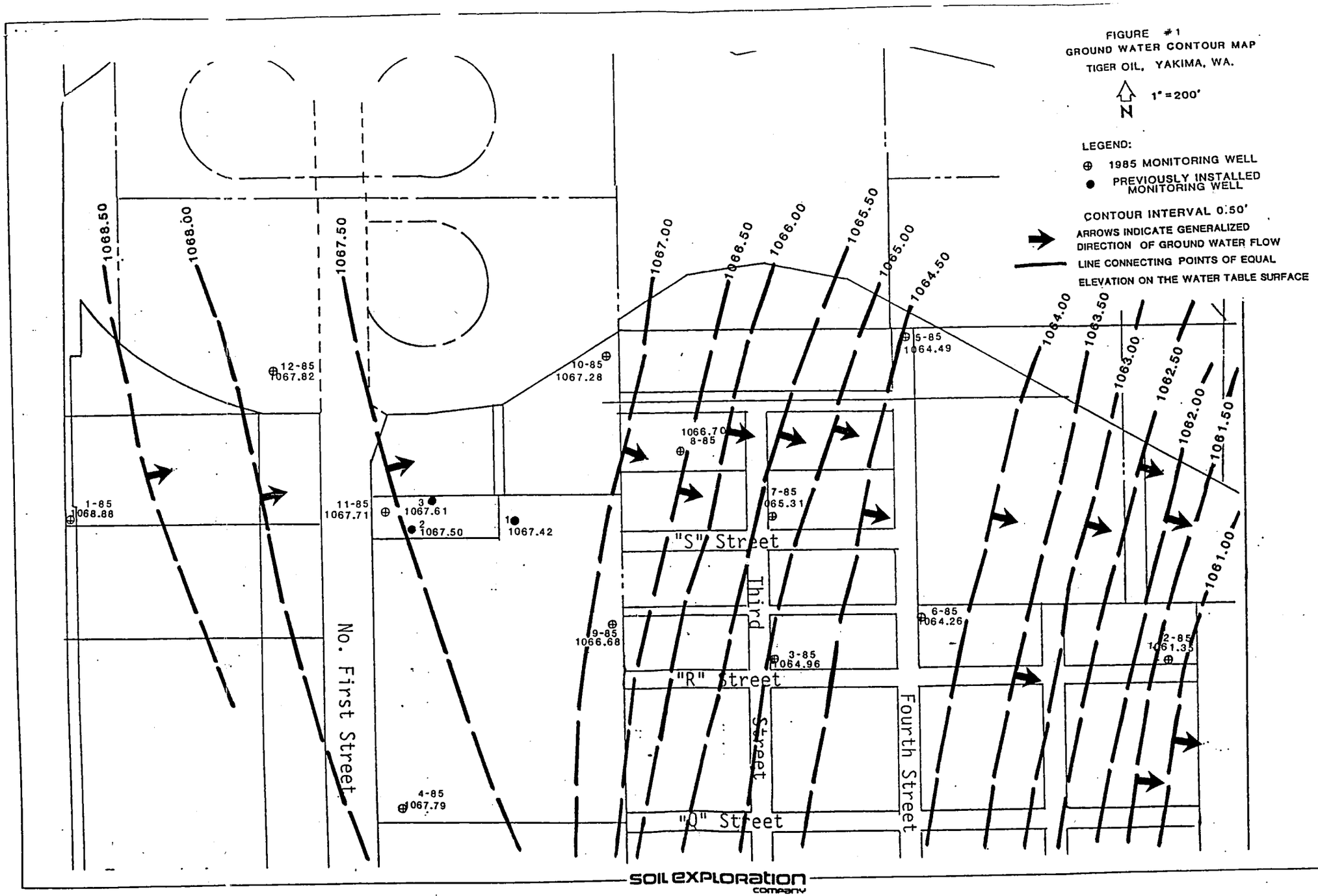


FIGURE #1
GROUND WATER CONTOUR MAP
TIGER OIL, YAKIMA, WA.
N
1" = 200'
LEGEND:
1985 MONITORING WELL
PREVIOUSLY INSTALLED MONITORING WELL
CONTOUR INTERVAL 0.50'
ARROWS INDICATE GENERALIZED DIRECTION OF GROUND WATER FLOW
LINE CONNECTING POINTS OF EQUAL ELEVATION ON THE WATER TABLE SURFACE
1068.50
1068.00
1067.50
1067.00
1066.50
1066.00
1065.50
1065.00
1064.50
1064.00
1063.50
1063.00
1062.50
1062.00
1061.50
1061.00
12-85 1067.82
10-85 1067.28
5-85 1064.49
1066.70 8-85
1-85 1068.88
11-85 1067.71
3 1067.61
2 1067.50
1 1067.42
7-85 065.31
"S" Street
Third Street
9-85 1066.68
6-85 1064.26
3-85 1064.96
2-85 1061.35
"R" Street
Fourth Street
No. First Street
4-85 1067.79
"Q" Street
SOIL EXPLORATION COMPANY

TABLE 2

GROUND WATER ELEVATION DATA

Location	Date	Ground Water Elevation	Reference Elevation*	Depth to Water From Top of 2" PVC Riser	Ground Water Elevation	Change Since (2-21-85)**
1-85	5-10-85	1080.5	1080.34	11.46	68.88	+1.32
2-85	5-10-85	1067.5	1066.98	5.63	61.35	+ .16
3-85	5-11-85	1072.6	1072.18	7.22	64.96	+ .47
4-85	5-11-85	1075.7	1075.74	7.95	67.79	+1.05
5-85	5-10-85	1069.7	1069.38	4.89	64.49	+ .21
6-85	5-10-85	1071.4	1071.13	6.87	64.26	+ .30
7-85	5-11-85	1072.5	1072.15	6.84	65.31	+ .30
8-85	5-11-85	1075.8	1075.66	8.96	66.70	+ .57
9-85	5-11-85	1075.8	1075.48	8.80	66.68	+ .74
10-85	5-11-85	1076.3	1076.03	8.75	67.28	+ .63
11-85	5-11-85	1077.7	1077.21	9.50	67.71	+ .98
12-81	5-10-85	1078.6	1078.24	10.42	67.82	+ .83
1	5-11-85	1078.1	1080.34	12.92	67.42	+ .80
2	5-11-85	1078.0	1080.45	12.95	67.50	+ .93
3	5-11-85	1076.9	1079.49	11.88	67.61	+ .82

* Reference Elevation= Top of 2" PVC Riser ** (+)= Rise in water level (-)= Drop in water level

Table 1

Volatile Analysis (Cont.)

SAMPLE IDENTIFICATION

Tiger Oil
#120-12955-A

Parameter	MW-8-85 TCT # 4779	MW-9-85 TCT # 4780	MW-10-85 TCT # 4781	Field TCT # 4782	MW-11-85 TCT # 4782a	MW-11-85 TCT# 4782b	MW-12-85 TCT # 4783	Knight TCT # 4784	Yochum TCT # 4785	Lower Detectable Limit (ug/L)
Total Hydrocarbons	ND	ND	17	ND	34,000	32,000	ND	ND	17	1
Benzene	ND	ND	ND	ND	1,380	1,090	ND	ND	ND	1
Toluene	ND	ND	2	ND	7,700	4,000	ND	ND	1	1
Xylene	ND	ND	5	ND	12,990	14,900	ND	ND	4	1

For purposes of this sample ug/L = ppb.

ND = Not Detected

Table 1

Volatile Analysis

SAMPLE IDENTIFICATION

Tiger Oil
#120-12955-A

Parameter	Field Blank TCT # 4772	MW-1-85 TCT # 4772	MW-2-85 TCT # 4773	MW-3-85 TCT # 4774	MW-4-85 TCT # 4775	MW-5-85 TCT# 4776	MW-6-85 TCT # 4777	MW-7-85 TCT # 4778	Lower Detectable Limit(ug/L)
Total Hydrocarbons as gasoline	ND	ND	ND	ND	ND	ND	ND	ND	1
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	1
Xylene	ND	ND	ND	ND	ND	ND	ND	ND	1

For purposes of this sample ug/L = ppb

ND - Not Detected

SEC #120-12955-A

TCT No. 4416 86-252.90

If you have any questions regarding the information in this report, or if we can be of additional service, please feel free to contact us.

Very Truly Yours,

Soil Exploration Company

Mark S. Mason
Environmental Geologist/Project Manager

MSM/jr

Encs.

cc: 1 - Washington Department of Ecology
Attn: Mr. Al Newman
1 - IT Corporation
Attn: Mr. John Clark
1 - Zaremba Claims Services
Attn: Mr. Ronald Zaremba
1 - Weeks, Dietzen & Skala
Attn: Mr. Roland Skala

3.0 Water Level Data

Table 2 presents current (May 10 and 11, 1985) water level elevations for all 1985 monitoring wells, and three previously installed monitoring wells. A review of these data indicates that all water levels have risen since our last reading on February 21, 1985.

Figure 1 presents current ground water elevation and flow direction as calculated from our May 10 and 11, 1985, ground water elevations. Using these data, a horizontal gradient of .0028 ft/ft was calculated. The ground water gradient has increased from .0023 ft/ft to .0028 ft/ft since February 21, 1985.

2.0 Hydrocarbon Contamination-Field Observations

Field observations detected a gasoline odor in monitoring well 11-85, and monitoring well 3. A slight gasoline odor was also detected in monitoring well 1.

5.0 Discussion

Results of chemical analyses indicate that monitoring wells 11-85, and 10-85 contained dissolved hydrocarbon concentrations. Previous water samples collected from monitoring well 10-85 did not detect dissolved hydrocarbons. This recently detected contamination may be due to (1) the migrating hydrocarbon plume impacting a new area, or (2) a seasonal water level rise flushing the soils with existing adsorbed hydrocarbon contamination.

6.0 Recommendations

Based on the previously discussed findings, we feel that no additional monitoring other than what was recommended in our Soil Exploration Company May 8, 1985 (#120-12955) report is warranted.

SOIL EXPLORATION COMPANY

662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-6446

a sister corporation to TWIN CITY TESTING AND ENGINEERING LABORATORY INC

June 24, 1985

Federated Insurance Company
129 East Broadway
Owatonna, Minnesota 55060

Attn: Mr. Brad Nesseth

Subj: Gasoline Spill Investigation
Quarterly Report
Tiger Oil Company
Yakima, Washington
#120-12955-A

Gentlemen:

1.0 Introduction

This report presents the results of work performed at the above mentioned site during the month of May, 1985. The following work was completed.

1. Site Inspection.
2. Recording water and product levels in all 1985 monitoring wells, and three previously installed wells.
3. Collecting water samples from monitoring wells 1-85, 2-85, 3-85, 4-85, 5-85, 6-85, 7-85, 8-85, 9-85, 10-85, 11-85, 12-85, the Knight residence and the Yochum residence.

2.0 Results of Chemical Analyses

All water samples collected on May 10, and 11, 1985 were forwarded to our sister corporation, Twin City testing and Engineering Laboratory, Inc. for analysis to determine concentrations of benzene, toluene, xylene, and total hydrocarbons expressed as gasoline concentrations. The results of these analyses are presented in Table 1.A review of these data indicates that dissolved hydrocarbons were detected at monitoring wells 10-85, 11-85, and the Yochum residence.

CRAIG KAUTZ

7.0 REMARKS

The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted engineering practices at this time and location. Other than this, no warranty is implied or intended.

This report was written by: Mark S. Mason

Mark S. Mason
Project Manager/Environmental Geologist

Date: May 8, 1985

This report was reviewed by: Jerry R. Rick

Jerry R. Rick, Manager
Environmental Department

Date: May 8, 1985

with ASTM: D 2487-83. Representative samples were returned to our laboratory for further examination and verification of field classification. Charts illustrating the soil classification procedures and descriptive terminology and symbols used on the soil boring logs are attached in Appendix V.

All borings were put down using a 6" cable tool. Only disturbed composite samples were recovered. Because of this method, our determination of the depth and extent of the various layers of soil and the consistency of cohesive soils are only approximate.

6.2 Monitoring Well Installation

Information regarding monitoring well construction and installation is provided on the attached monitoring well construction sheets (Appendix VI).

6.3 Water Sampling

Ground water samples were collected after a minimum of 3 well volumes of ground water were extracted from the monitoring well. Water samples were collected using dedicated "clean" bottom loading Teflon bailers with virgin rope. All samples were preserved with blue ice and transported to Twin City Testing and Engineering Laboratory, Inc. for analysis before a 14-day holding time elapsed.

Water samples collected from private wells were collected after a non-filtered, non-aereated cold water faucet had been running at a rate of approximately 1 GPM for a 30-minute period. All samples were preserved with blue ice.

We propose to submit factual reports to the Washington Department of Ecology on a quarterly basis. Summary reports will include water level and quality data generated during the quarterly sampling/monitoring interval. Field observations and our interpretation of the data will be included in these reports.

Table 5

Monitoring and Sampling Schedule

Date	Task					
	Water Levels all Monitoring Wells	Sample all 1985 MW	Sample Knights Residence	Sample* Select Private Wells	Qtrly Report	Annual Report
May 1985	X	X	X	X		
June 1985	X		X		X	
July 1985	X		X			
Aug 1985	X	X	X	X		
Sept 1985	X				X	
Oct 1985	X					
Nov 1985	X	X	X	X		
Dec 1985	X				X	
Jan 1986	X					
Feb 1986	X	X	X	X		
March 1986	X					
April 1986	X					X

* Private wells to be sampled will be decided on a quarterly basis.

6.0 METHODS

6.1 Soil Sampling and Classification

As our borings were advanced, composite soil samples were collected when a change in soil conditions or hydrocarbon contamination was noted. All soil samples were visually and manually classified by our geologist in accordance

We should point out that shallow private water supply wells may act as gradient control wells, which may concentrate hydrocarbons locally and produce potable water of unacceptable quality.

5.0 RECOMMENDATIONS

5.1 General

Based on our findings, we feel that a "pocket" of free gasoline does not exist. In view of this, ground water depression for product recovery is not recommended. Due to the high hydraulic conductivity, past efforts to significantly depress the water table failed. Considering this, gradient control should not be used as a feasible alternative to cleaning up hydrocarbon contamination.

As we understand, alternative water supplies (deep wells, city water supply) have been provided for area residents that have wells which have been affected by hydrocarbon contamination. Due to the remedial nature of this action, we recommend that a monitoring program be implemented to document ground water flow and quality over a period of one year before re-evaluating site conditions and possible implementation of other remedial measures.

5.2 Monitoring Program

Table 5 outlines the schedule for monitoring and sampling through April, 1986. Should unusually high hydrocarbon concentrations occur in any of our monitoring wells during this monitoring period, we will evaluate this anomaly accordingly.

4.0 DISCUSSION

Based on the data presented, we feel that low concentrations of dissolved hydrocarbons are present in the surficial aquifer. Water quality data, combined with soil contamination observations, indicate that a vertical zone of residual soil contamination may exist.

During periods of high infiltration (i.e., spring thaw, irrigation season), percolating ground water removes adsorbed hydrocarbons from the soils. Generally, this type of infiltration is usually associated with increased ground water elevations. Dissolved hydrocarbons will in turn be transported and diffused downgradient, which will eventually result in an enlarging plume.

As infiltration decreases, ground water elevations may drop. As the water table drops, some dissolved hydrocarbons will again adsorb to soil particles and be rendered immobile.

This cycling of the water table will produce maximum dissolved hydrocarbon contamination during the mobile phase, and minimal dissolved hydrocarbon contamination during the immobile phase, or low water phase, when water flows through the lower soils that have reduced or no residual hydrocarbon contamination.

This hypothesis is supported by contaminated soils being observed at monitoring well 8-85 (using odor as a criterion) and no dissolved hydrocarbon contamination being detected in the water sample collected at MW-8 on February 21, 1985.

TABLE 4 (cont)

Volatile Analysis

(Sampled March 25, 1985)

Parameter	#3003 Knight (ug/L)	#3004 Yocham (ug/L)	Lower Detectable Limit (ug/L)
Total Hydrocarbons as Gasoline	ND	3120	1
Benzene	ND	28	1
Toluene	ND	680	1
Xylene	ND	980	1

For purposes of these samples ug/L = ppb

ND = Not Detected

TABLE 4 (cont)

Volatile Analysis

(Sampled February 19, 1985)

Parameter	Wilton (ug/L)	Hernand. (ug/L)	Corbin (ug/L)	Tangeman (ug/L)	Yocham (ug/L)	McGohan (ug/L)	Hutson (ug/L)	Suddeth (ug/L)	Knight (ug/L)	Lower Detectable Limit (ug/L)
Total Hydrocarbons as Gasoline	ND	ND	ND	ND	14	ND	ND	ND	ND	1
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Xylene	ND	ND	ND	ND	5	ND	ND	ND	ND	1

For purposes of this sample ug/L = ppb

ND = Not Detected

NOTE: Well locations are shown on Figure 2.

TABLE 4

Volatile Analysis

(Sampled February 21, 1985)

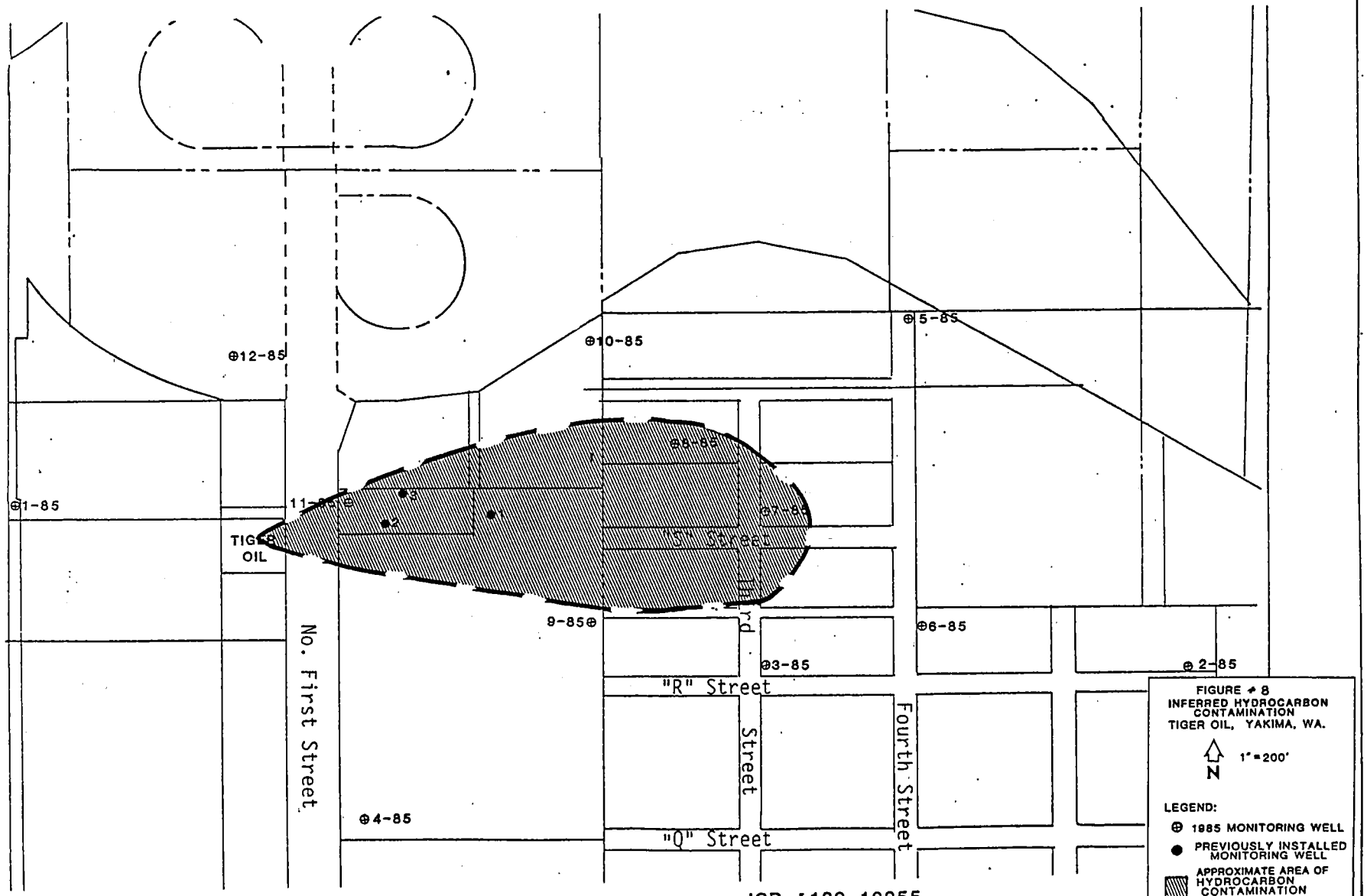
Parameter	MW-1 (ug/L)	MW-2 (ug/L)	MW-3 (ug/L)	MW-4 (ug/L)	MW-5 (ug/L)	MW-6 (ug/L)	MW-7 (ug/L)	MW-8 (ug/L)	MW-9 (ug/L)	MW-10 (ug/L)	MW-11 (ug/L)	MW-12 (ug/L)	Lower Detectable Limit (ug/L)
Total Hydrocarbons as Gasoline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23390	ND	1
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1460	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5300	ND	1
Xylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6260	ND	1

For purposes of these samples ug/L = ppb

ND = Not Detected

SEC 120-12955

Laboratory No 2A-3512



SOIL EXPLORATION COMPANY JOB #120-12955

Examination of Table 3 indicates that residual hydrocarbon contamination of the soils appears to be confined to the areas near borings 11-85 and 8-85 (Figure 8).

3.5 Chemical Analysis Results

Water samples collected on February 19, February 21, and March 25, 1985 were forwarded to our sister company, Twin City Testing and Engineering Laboratory, Inc., for analysis to quantify concentrations of benzene, toluene, xylene and total hydrocarbons expressed as gasoline. Table 4 presents the results for the chemical analysis. Sampling information forms for all samples collected on February 19 and 21, 1985 are located in Appendix II. Chain of custody forms for all samples are attached in Appendix III.

Review of the data presented in Table 4 indicates that monitoring well 11 and the Yocham residence private water supply well contain hydrocarbon contamination. Hydrocarbon contamination of the Yocham well appears to have increased when sampled on March 25, 1985. This may be due to increased ground water infiltration caused by spring thawing. Chemical analysis methodology procedures are included in Appendix IV.

Water level measurements combined with vertical and horizontal controls indicate that potential for ground water flow is generally eastward through the study area (Figure 7). We have calculated the hydraulic gradient to be 0.0023. The local ground water discharge point is the Yakima River, which is approximately 2,500 feet downgradient from the site. We have been informed by Washington Department of Ecology personnel that the hydraulic gradient generally increases during the summer due to irrigation.

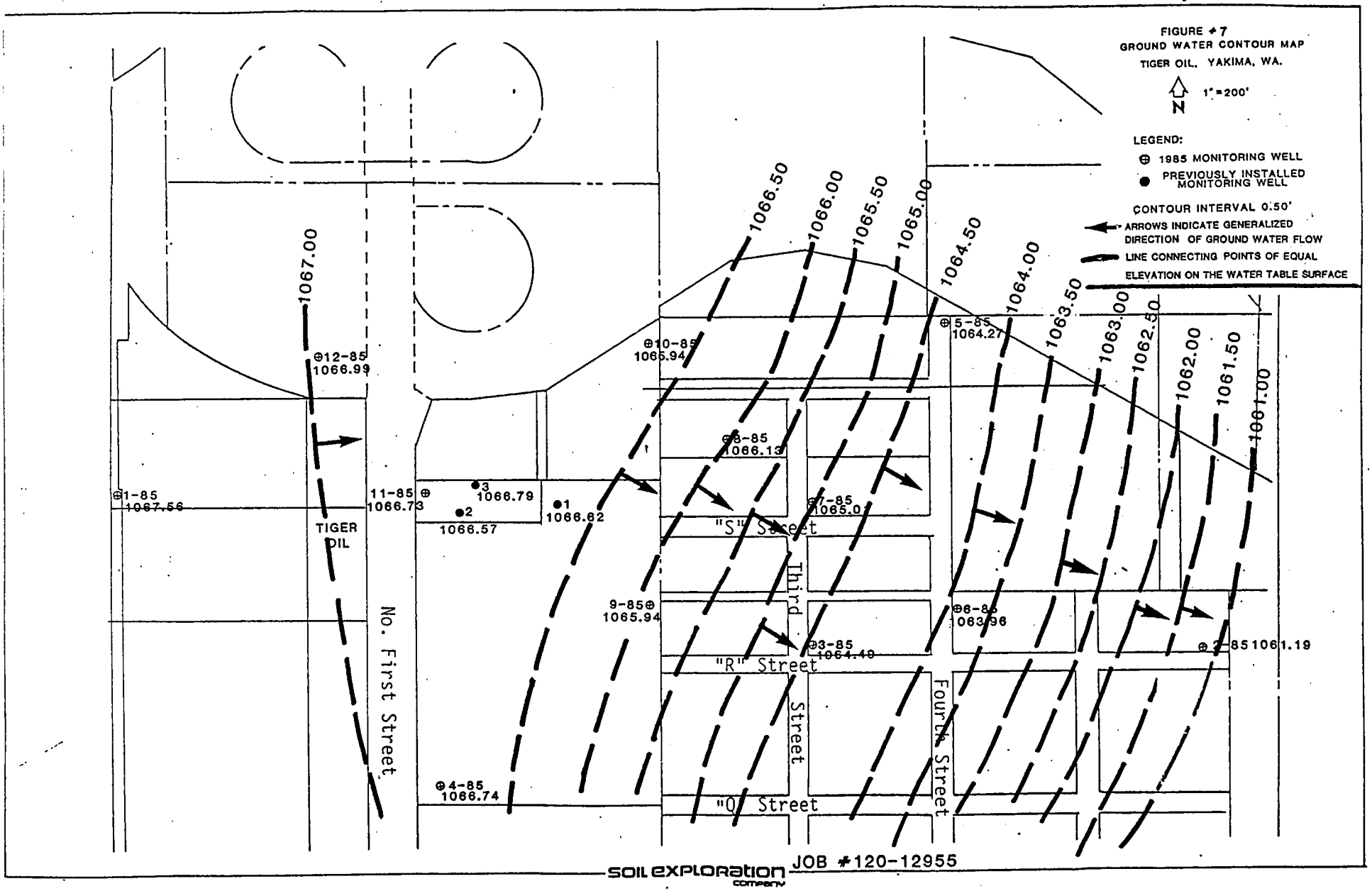
3.4 Petroleum Product Observations

As our borings were advanced, all recovered soil samples were examined for the presence of fuel oil using visual appearance and odor as criteria. Table 3 summarizes the vertical zone of petroleum product contamination as inferred from the boring data.

Table 3

Petroleum Product Observations

Boring #	Interval of Contamination	Comments
1-85	—	Not detected
2-85	—	Not detected
3-85	—	Not detected
4-85	—	Not detected
5-85	—	Not detected
6-85	—	Not detected
7-85	—	Not detected
8-85	Sample designated as 14-22'	Slight gasoline odor
9-85	—	Not detected
10-85	—	Not detected
11-85	6-12'	Strong gasoline odor
	12-18'	Slight gasoline odor
12-85	—	Not detected



SOIL EXPLORATION COMPANY JOB #120-12955

Table 1

Ground Water and Surface Elevation Data (2-20-85)

Location	Date	Ground Elevation	Reference Elevation*	Depth to Water From Top of 2" PVC Riser	Ground Water Elevation
1-85	2-20-85	1080.5	1080.34	--	--
2-85	2-20-85	1067.5	1066.98	5.74	1061.24
3-85	2-20-85	1072.6	1072.18	7.60	1064.58
4-85	2-20-85	1075.7	1075.74	9.00	1066.74
5-85	2-20-85	1069.7	1069.38	5.11	1064.27
6-85	2-20-85	1071.4	1071.13	7.17	1063.96
7-85	2-20-85	1072.5	1072.15	7.11	1065.04
8-85	2-20-85	1075.8	1075.66	9.51	1066.15
9-85	2-20-85	1075.8	1075.48	9.54	1065.94
10-85	2-20-85	1076.3	1076.03	9.38	1066.65
11-85	2-20-85	1077.7	1077.21	10.48	1066.73
12-85	2-20-85	1078.6	1078.24	11.25	1066.99
1	2-20-85	1078.1	1080.34	--	--
2	2-20-85	1078.0	1080.45	--	--
3	2-20-85	1076.9	1079.49	--	--

* Reference Elevation = Top of 2" riser.

All reference and ground surface elevations were surveyed by a local professional land surveyor and referenced to Yakima county datum (same as USC and GS sea level datum).

Table 2

Ground Water and Surface Elevation Data (2-21-85)

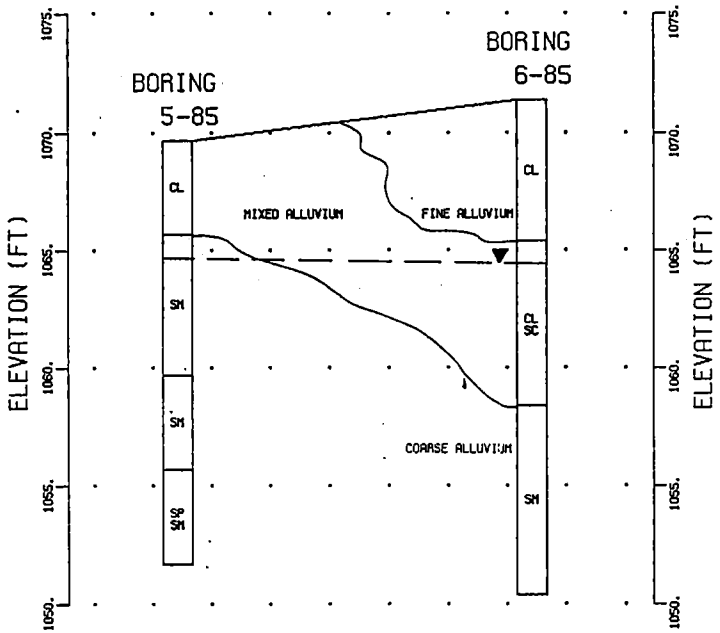
Location	Date	Ground Elevation	Reference Elevation*	Depth to Water From Top of 2" PVC Riser	Ground Water Elevation
1-85	2-21-85	1080.5	1080.34	12.78	1067.56
2-85	2-21-85	1067.5	1066.98	5.79	1061.19
3-85	2-21-85	1072.6	1072.18	7.69	1064.49
4-85	2-21-85	1075.7	1075.74	9.00	1066.74
5-85	2-21-85	1069.7	1069.38	5.10	1064.28
6-85	2-21-85	1071.4	1071.13	7.17	1063.96
7-85	2-21-85	1072.5	1072.15	7.14	1065.01
8-85	2-21-85	1075.8	1075.66	9.53	1066.13
9-85	2-21-85	1075.8	1075.48	9.54	1065.94
10-85	2-21-85	1076.3	1076.03	9.38	1066.65
11-85	2-21-85	1077.7	1077.21	10.48	1066.73
12-85	2-21-85	1078.6	1078.24	11.25	1066.99
1	2-21-85	1078.1	1080.34	13.72	1066.62
2	2-21-85	1078.0	1080.45	13.88	1066.57
3	2-21-85	1076.9	1079.49	12.70	1066.79

* Reference Elevation = Top of 2" PVC riser.

All reference and ground surface elevations were surveyed by a local professional land surveyor and referenced to Yakima county datum (same as USC and GS sea level datum).

D ⟷ D'

CROSS SECTION LOCATIONS SHOWN ON FIGURE #2



NOTE: EXCEPT AT BORING LOCATIONS THE GROUND SURFACE, WATER LEVEL, AND BOUNDARIES BETWEEN SOIL LAYERS ARE INFERRED.

FIGURE #6

SOIL PROFILE
GASOLINE SPILL INVESTIGATION YAKIMA, WASHINGTON W.O. 120-12955
SOIL EXPLORATION COMPANY
SCALE: VERT: 1 IN = 5. FT HORZ: 1 IN = 200. FT

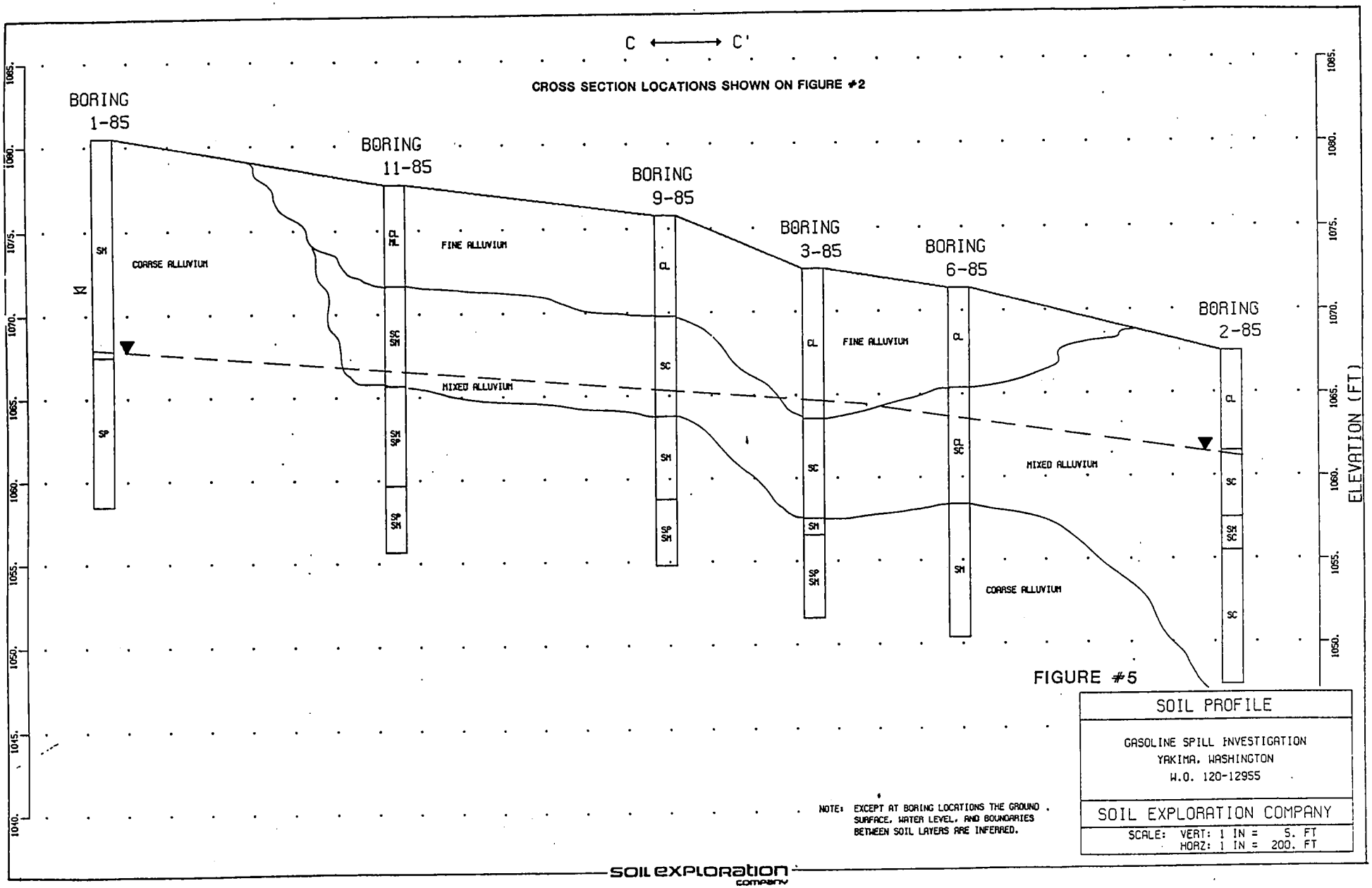


FIGURE #5

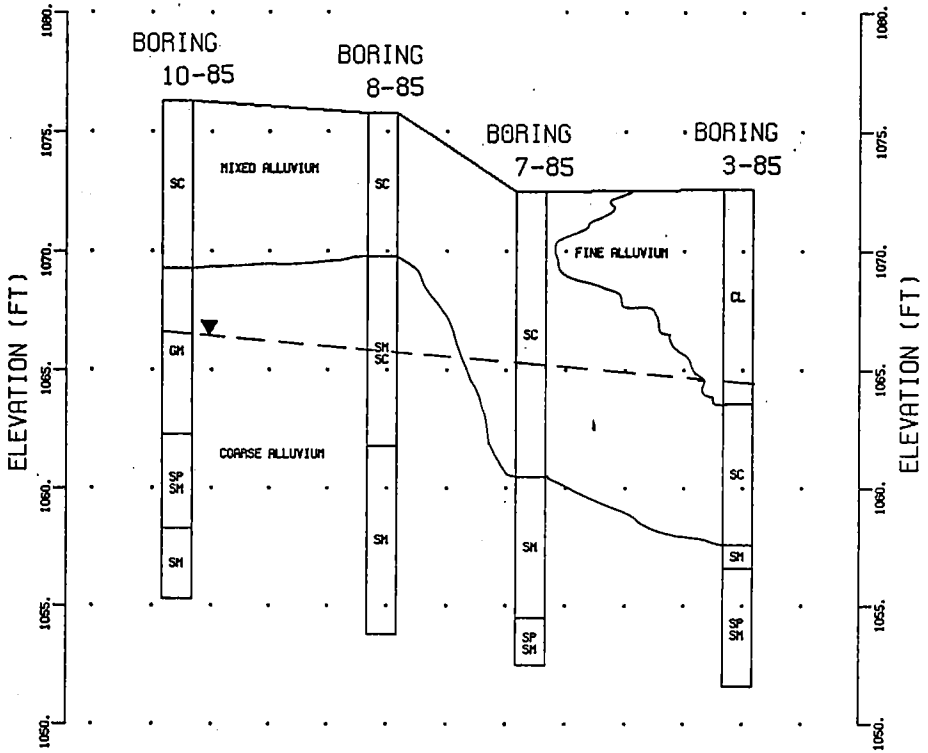
SOIL PROFILE
GASOLINE SPILL INVESTIGATION YAKIMA, WASHINGTON W.O. 120-12955
SOIL EXPLORATION COMPANY
SCALE: VERT: 1 IN = 5. FT HORZ: 1 IN = 200. FT

NOTE: EXCEPT AT BORING LOCATIONS THE GROUND SURFACE, WATER LEVEL, AND BOUNDARIES BETWEEN SOIL LAYERS ARE INFERRED.

SOIL EXPLORATION COMPANY

B ⟷ B'

CROSS SECTION LOCATIONS SHOWN ON FIGURE #2



NOTE: EXCEPT AT BORING LOCATIONS THE GROUND SURFACE, WATER LEVEL, AND BOUNDARIES BETWEEN SOIL LAYERS ARE INFERRED.

FIGURE #4

SOIL PROFILE
GASOLINE SPILL INVESTIGATION YAKIMA, WASHINGTON W.O. 120-12955
SOIL EXPLORATION COMPANY
SCALE: VERT: 1 IN = 5. FT HORZ: 1 IN = 200. FT

May 15, 1987

James Ebbert, Hydrologist
U.S. Department of the Interior
Geological Survey
Water Resources Division
Pacific Northwest District
Washington Office
1201 Pacific Avenue, Suite 600
Tacoma, WA 98402

RE: Gasoline Study

Dear Jim:

Thanks for suppling the additional materials pertaining to the Yakima gasoline study that USGS must now conclude. Continued use of these shallow observation wells is of course attractive for research purposes, and as I have stated I am very sorry to see the GS have to pull out of this one. The possibility of getting some detail on longer term degradation rate seemed very high, and it is certainly something we would like to understand better.

We have no real legitimate use for these wells, either from a water rights management or pollution control management standpoint, in this office, and we do not wish to take over responsibility for any of those wells. You are clear then to remove (abandon) all of them. I believe you indicated that some of them would be given over to the University of Oregon as they may wish to pursue some refinement work on their sampler. Thank you.

Yours truly,

Clar Pratt
Environmental Quality Division

CP:ch
544ceq2

statement

OF INVOICES PREVIOUSLY SENT.

SOIL EXPLORATION COMPANY
662 CROMWELL AVENUE
ST. PAUL, MN. 55114
PHONE
612/645-6446

ACCOUNT NUMBER
31495

DATE	PROJECT OR OTHER IDENTIFICATION	PURCHASE ORDER	INVOICE NO.	PAYMENT—ADJ.	INVOICE AMOUNT
6/27/85	GASOLINE SPILL-TIGER		120-12955		19,683.44

INVOICES NOT PAID WITHIN 30 DAYS OF INVOICE DATE ARE
[illegible] /MONTH 18%/ANNUM INTEREST OR FINANCE CHARGE

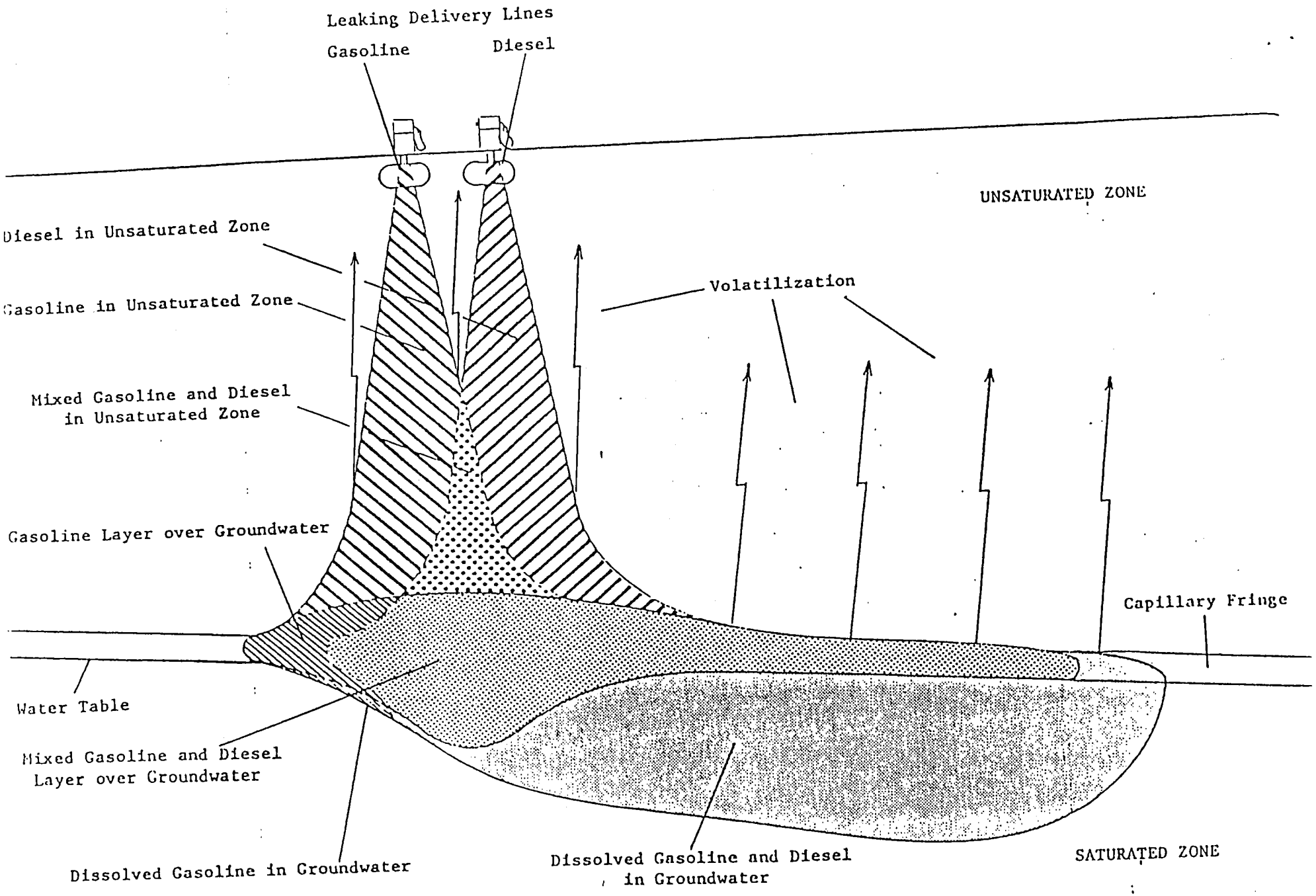
CURRENT	30 - 60 DAYS	60 - 90 DAYS	90 - 120 DAYS	OVER 120 DAYS	TOTAL
19,683.44					19,683.44

TRANSACTIONS AFTER THIS DATE WILL APPEAR ON THE NEXT STATEMENT.

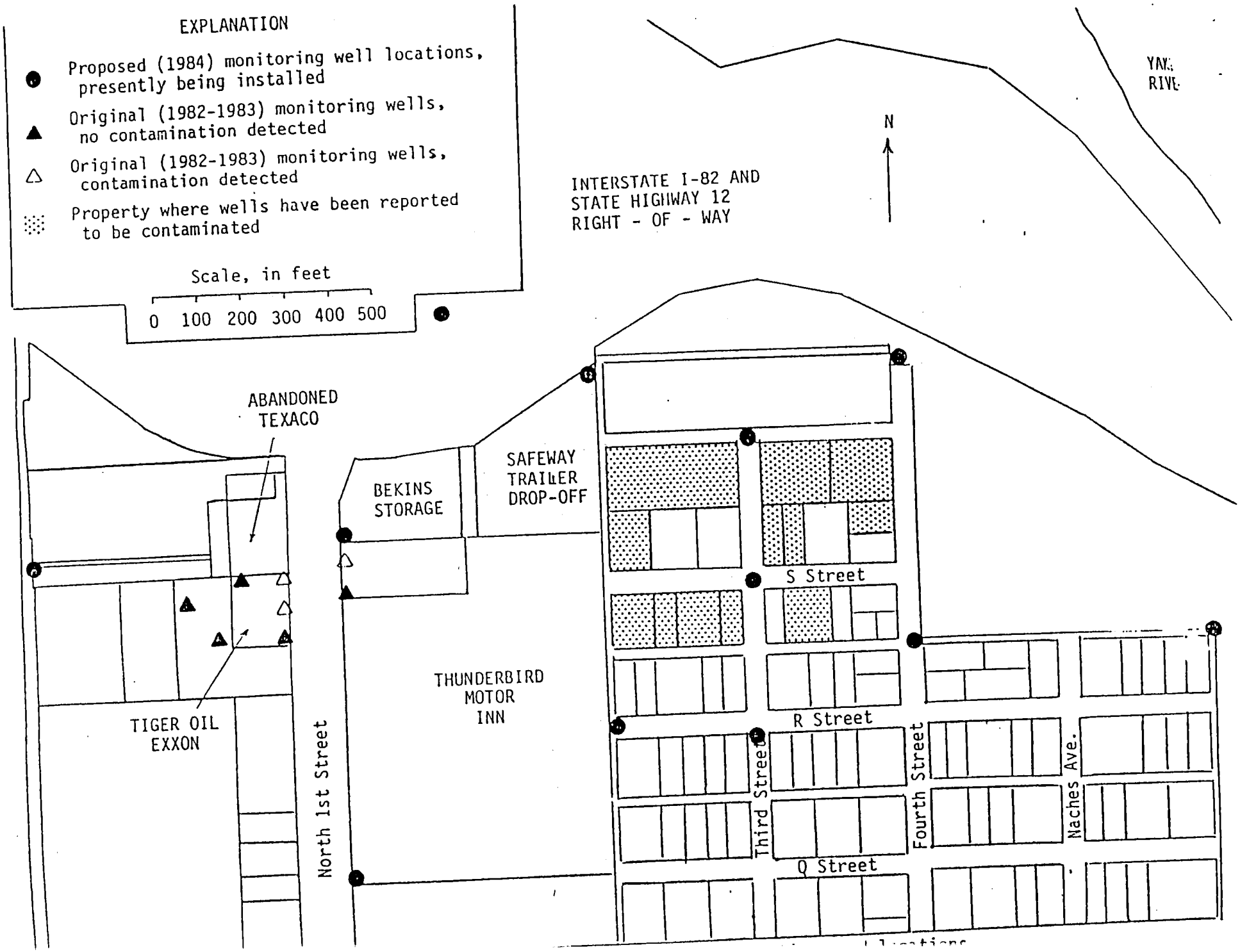
TOTAL DUE AS OF: 6/30/85

FEDERATED INSURANCE CO
129 E BROADWAY
OWATONNA MN 55060

REMOVE THIS STUB BEFORE MAILING



section of combined gasoline and diesel spill.


EXPLANATION
Proposed (1984) monitoring well locations, presently being installed
Original (1982-1983) monitoring wells, no contamination detected
Original (1982-1983) monitoring wells, contamination detected
Property where wells have been reported to be contaminated
Scale, in feet
0 100 200 300 400 500
N
INTERSTATE I-82 AND
STATE HIGHWAY 12
RIGHT - OF - WAY
YAK.
RIVE
ABANDONED
TEXACO
BEKINS
STORAGE
SAFEWAY
TRAILER
DROP-OFF
S Street
THUNDERBIRD
MOTOR
INN
TIGER OIL
EXXON
North 1st Street
R Street
Third Street
Fourth Street
Naches Ave.
Q Street

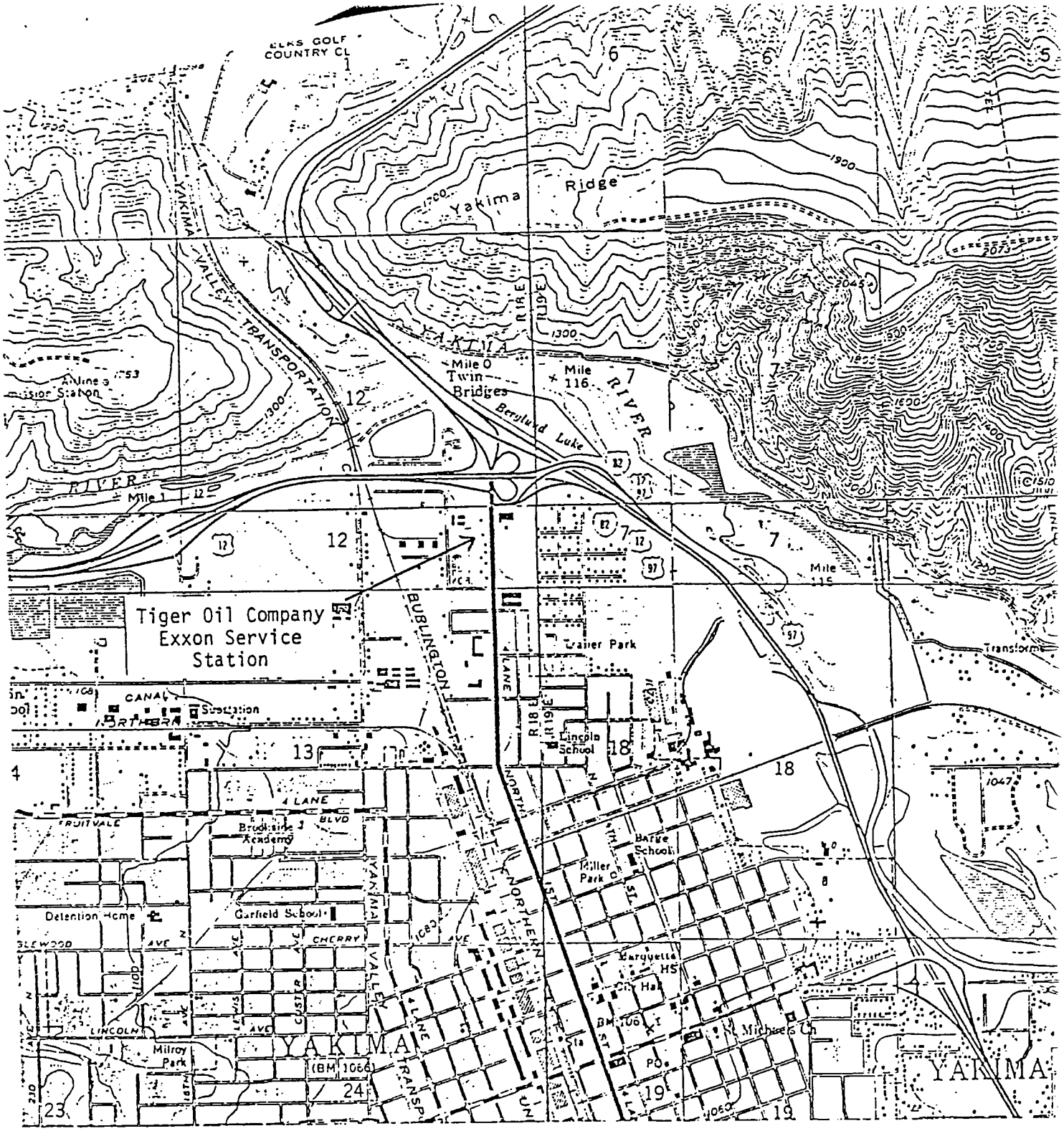


Fig.2-- Location of Tiger Oil Company's gasoline and diesel spill site in Yakima, Washington.

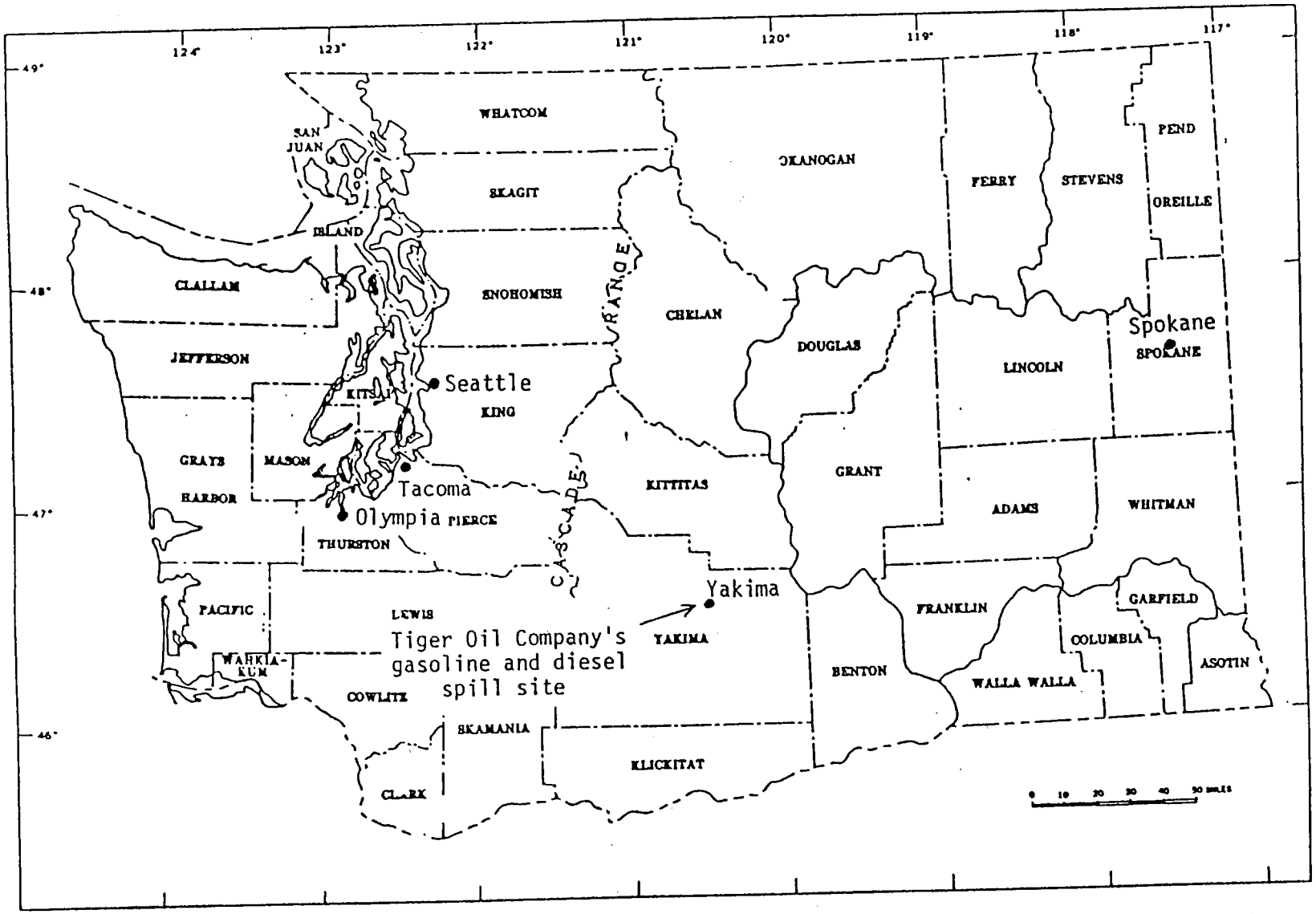


Fig.1-- Index map of Washington showing location of Tiger Oil Company's gasoline and diesel spill site.

methods of detecting gasoline and diesel and their components, may need to be developed. Other items to consider are monitoring well construction and materials, test drilling procedures, water-quality sampling procedures, water-sample processing, and water-sampling equipment. Finally, the evaluation and use of existing, and the development of new, geophysical techniques to define the gasoline and diesel contamination will be an important aspect of the study.

The initial efforts of the study will be to define the geohydrology of the site as precisely as possible. Even though the site was chosen (partly) because of the relatively simple geology and hydrology, the detailed research to be conducted at the site will require characterization of the ground-water flow at the site and vicinity as well as relating the geohydrology of the site to the regional geohydrologic setting. A detailed ground-water flow model of the site will be a major part of this initial effort to aid in understanding and establishing the geohydrologic framework and to begin the preliminary solute transport model development. Also, a comprehensive data-collection network will be established that will integrate the needs of the various researchers and groups involved in the study.

The importance of each process depends upon where the process occurs. In the unsaturated zone sorption, volatilization, and physical retention of free product probably are the predominant processes. Recharge events may affect these three processes in the unsaturated zone at the spill site and also may cause some dissolution to occur. Once the free product forms a plume on the water table, abiotic and biotic degradation will be important, as will sorption and volatilization to the unsaturated zone. Physical retention as the plume moves (both laterally and vertically, with the water table), will occur, but is less of a factor than in the unsaturated zone. The dissolved component in the saturated zone is controlled primarily by solubility. Abiotic and biotic degradation, sorption, and volatilization will also occur in the saturated zone, but are not as important as in the other two components.

All of these processes and their relationships to various components of the spill suggest complex mass-transfer and mass-balance relationships. The development and application of multiphase-flow and solute-transport theories will be dependent upon the understanding of these processes.

A very important aspect of the study is an evaluation of existing methods and the development of new methods needed to study the movement and fate of gasoline and diesel in a ground-water environment. In order for data to be reliable and representative, methods used to collect the data must be compatible with the chemistry and physical nature of gasoline and diesel, especially with regard to their volatile nature. New analytical methods, as well as new

The research to be conducted in the study will focus on the following processes:

1) Biotic and abiotic degradation, specifically the alteration of the chemical structure of individual gasoline and diesel components.

2) Volatilization of gasoline and diesel components from free products (gasoline and diesel fluid phase) and from the fraction dissolved in ground water.

3) Sorption of gasoline and diesel components to mineral grains. This may include sorption from both the free product and the fraction dissolved in ground water.

4) Solubility (or dissolution) of gasoline and diesel components in the ground water.

5) Physical retention of gasoine and diesel in the aquifer material by capillary and other forces.

The interrelationship of these processes as related to a gasoline and diesel spill is not completely understood, but concepts presently are being developed. There are three basic components of the spill where these processes are occuring to various degrees; the free product (gasoline and diesel in a fluid phase) in the unsaturated zone, the plume of free product on the surface of the water table, and the plume of dissolved fractions of the gasoline and diesel in the saturated zone. Figure 4 is a diagrammatic cross section illustrating present concepts of these components.

data. At the request of the Department of Ecology, the insurance company in 1984 proposed 12 locations (fig. 3) for monitoring wells to aid in defining the plume and plume movement. Presently, the monitoring wells are being installed.

Product Recovery: An attempt was made in 1982-83 to recover the product. Eight monitoring wells (fig. 3) and two recovery wells were installed. Three of the monitoring wells (fig. 3) intercepted the plume and contained several inches of free product in each well. After several months effort, the recovery operation was discontinued. Only 40 gallons of product was recovered at a reported cost of $100,000.

Synopsis of Study

The research program at the Yakima, Washington, site will provide an opportunity to better understand the physical, chemical, and biological processes that control the transport and fate of gasoline and diesel in a surficial, alluvial type ground-water environment. Ultimately, this understanding could lend to the development of predictive transport models of the behavior of gasoline and diesel contamination.

Spill Volumes: The inventory records of the service station were reviewed for the period of September 1981 to October 1982. This audit showed a product loss of 5,972 gallons of gasoline and 1,738 gallons of diesel, or an average total loss of about 550 gallons per month. If the 1980 air pressure test is correct, a potential product loss of 12,100 gallons could have occurred during the 22 month period from the pressure test to the correction of the leaks. If the pressure test was unreliable, then the product loss could have been as much as 22,000 gallons during the 40 month period from tank and delivery line installation to the correction of the leaks. The insurance company representing Tiger Oil Company arranged to have the audit at the request of the Washington State Department of Ecology. A complete audit (if records are available) should provide a more precise definition of spill volume.

Plume Definitions: The properties where wells have been reported to be contaminated are shown on fig. 3. Reports by property owners were based on taste and odor. Subsequently, the insurance company for Tiger Oil Company arranged for water samples to be analyzed. Water for the chemical analyses was obtained from taps, and not from the well heads. The chemical analyses were limited to determinations of benzene, toluene, and xylene. Apparently, no attempt was made to differentiate diesel and gasoline. Also, the presence or absence of free product in the wells is not known. However, this information does indicate that the plume is large, at least 1,000 feet in length. The exact length, width, and thickness of the plume cannot be determined at this time because of insufficient

Cause of Spill:

The cause for the spill was traced to leaks in the delivery lines from the product storage tanks to the dispensers.

Timing of Spill:

The tanks and delivery lines at the service station owned by Tiger Oil Company, were installed in May and June 1979. Leak tests were reported to have been performed at this time, and no leaks were found. In December 1980, an air pressure test of the system was conducted and no leaks were found. Hydrostatic pressure tests were conducted in September 1982 and leaks were detected in the delivery lines and repaired. Most of the parties involved with the spill suspect that the delivery lines have been leaking since installation based on the following:

1) Air pressure tests can be unreliable;
2) Gasoline contamination was reported in 1980, before the air pressure test was conducted;
3) And, leaks have been detected at two other service stations owned by Tiger Oil Company. Tanks and delivery lines at all three stations may have been installed at roughly the same time, with the same contractor.

the v. .ey.

Geology: The site and vicinity are underlain by recent alluvial deposits consisting of course gravel, sand, silt, and some clay, probably greater than 100 feet in thickness. These deposits are underlain by the Ellensburg formation which consists of volcanic sediments, conglomerates, tuffaceous sandstones, and lava flows. The Ellensburg formation is several hundred feet thick in places. Domestic wells near the site penetrate about 20 to 70 feet of alluvial materials, are cased the entire depth, and are open-ended.

Hydrology: Water is encountered in the alluvium about 15-20 feet below land surface. Static water levels in domestic wells are reported to be about 10 feet below land surface. Monitoring wells at the site have water levels 10-13 feet below land surface. The flow path of the ground water in the alluvium at the site generally is to the east.

Spill Description

Discovery of Spill: In 1980, 1981, and 1982, the presence of gasoline in water from privately owned wells was reported to the Washington State Department of Ecology (fig. 3). The Department of Ecology investigated the reports and determined that a spill probably occurred at the Exxon Service Station, owned by Tiger Oil Company, on North First Street in Yakima, Washington.

4) The site should have a simple, well-defined flow system.

5) Contamination should be well documented, continuous, with known quantities.

6) The site should be easily accessible.

A combined gasoline and diesel spill site in Yakima, Washington, was found to suitable for the development of a viable research program based on available information.

Site Description

Site Location: Yakima, WA; Yakima County; Tiger Oil Company (Exxon Service Station), 2808 North First Street, T.13N.,R.18E.,Sec.12 SE1/4 SE1/4 (figs. 1 and 2)

Setting: Site is located on North First Street at the northern edge of Yakima, approximately 0.2 miles south of U.S. Highway 12, and U.S. Highway's 82 and 97 interchange. The site is in the Moxee Valley, about 0.5 miles south of the confluence of the Yakima and Naches River. The land surface slopes east-southeast, having a gradient of 20 feet per mile in this part of

for study. The locations of the other national research sites that have been established and the groundwater contaminant(s) under investigation are: Bemidji, Minnesota, crude-oil; Cape Cod, Massachusetts, sewerage; Pensacola, Florida, wood-preserving chemicals; and the Tooele Army Depot, Utah, chlorinated hydrocarbons. Because combined gasoline and diesel contamination is common, the knowledge gained from a study of the Yakima, Washington, site will have transfer value elsewhere.

Site Selection

Site selection was conducted from mid-November 1984 through January 1985. A list of approximately 750 hazardous waste sites was compiled for Washington and Oregon. These sites were identified by the United States Environmental Protection Agency (EPA), the Washington State Department of Ecology, and the Oregon Department of Environmental Quality. Of these hazardous waste sites, about 130 were related to petroleum hydrocarbons. The Western Oil and Gas Association, which is sponsored by the major oil companies, indicated that all known petroleum-related spills are available in EPA and respective state agency files. Therefore, the list of potential sites for study was complete for Washington and Oregon through January 1985. The following criteria were used to evaluate and compare sites:

1) Petroleum hydrocarbons should be the sole organic-type contamination.

2) Contamination should not be a problem to water supplies to eliminate possible corrective actions.

3) The unsaturated zone should be 20-50 feet.

NORMA BEATTY RINNER
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

File. N. 1st Exxon Spill Yak. Co.

March 13, 1986

Mr. David S. Peterson
U.S. Geological Survey
1201 Pacific Ave., Suite 600
Tacoma, WA 98402

Dear Mr. Peterson:

This is in response to your March 10, 1986, request for a variance to the Minimum Standards for Construction and Maintenance of Water Wells (Chapter 173-160 WAC) relating to the construction of monitoring wells in the City of Yakima area. The wells are needed to define the extent of an oil and gasoline spill near North First Street.

In accordance with WAC 173-160-020(2), a variance is hereby granted to complete the monitoring wells by placing a surface seal to a depth less than the required minimum 18-foot depth. This will facilitate your construction plans that propose to set the 2-inch diameter PVC schedule 40 pipe and screens less than the 18-foot minimum depth and closer than the 5-foot minimum depth below static water levels, depicted on the diagrams you enclosed.

I would like to bring your attention to the following:

1. Drilling must be done by or under the direct supervision of a driller licensed in the State of Washington.

2. If the monitoring wells are abandoned, they must be abandoned in accordance with WAC 173-160-290.

3. The construction and abandonment must be recorded and reported to the department. In this instance, the Central Regional Office at Yakima, 3601 West Washington.

GASOLINE LOSS INVESTIGATION

QUARTERLY MONITORING

TIGER OIL #3

824-19

NORTH FIRST STREET

YAKIMA, WASHINGTON

#120 86-602

AUGUST 15, 1986

CRAIG KAUTZ

Enclosed for your use are water well report forms.

Your attention to these laws and regulations is appreciated. Please contact me if you have any questions.

Sincerely,

William H. Miller

William H. Miller, Administrator
Washington Water Well
Construction Program

WHM:dmt

Attachments

cc: Kirk Cook, Central Regional Office w/attachments
George Krill

twin city testing
corporation

662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612 645 3601

August 15, 1986

State of Washington
Department of Ecology
3601 West Washington Avenue
Yakima, Washington 98903

Attn: Mr. Al Newman

Subj: Gasoline Loss Investigation
Quarterly Monitoring
Tiger Oil #3
North First Street
Yakima, Washington
#120 86-602
Claim #82U-021

Gentlemen:

Twin City Testing Corporation has summarized all data collected at the above site since our last report dated December 3, 1985.

If you have any questions regarding the attached data, please feel free to contact me at (612) 641-9372.

Very truly yours,

Twin City Testing Corporation

Mark S. Mason
Environmental Geologist/Project Manager

MSM/jr

Encs

cc: 1 - Federated Insurance Company
Attn: Mr. Craig Kautz
1 - IT Corporation
Attn: Mr. John Clark
1 - Weeks, Dietzen & Skala
Attn: Mr. Roland Skala
1 - United States Geological Survey
Attn: Mr. Gary Turney

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GASOLINE LOSS INVESTIGATION

QUARTERLY MONITORING

TIGER OIL #3

NORTH FIRST STREET

YAKIMA, WASHINGTON

#120 86-602

1.0 INTRODUCTION

This report presents the results of work performed at the above site since our last report dated December 3, 1985 report. All work completed is in accordance with the Twin City Testing Corporation (TCT) report dated May 8, 1985 (#120 86-12955). The monitoring program has consisted of the following.

1. Site inspection.
2. Recording ground water and product levels in all 1985 monitoring wells.
3. Collecting representative ground water samples from monitoring wells 7-85, 8-85, 9-85, 10-85, 11-85 and from the Knight residence.

2.0 BACKGROUND INFORMATION

Table 1 presents monitoring well water level data for October, November and December, 1985 while Table 2 presents monitoring well water level data for January, February and March, 1986. A review of the water level data

TABLE #1

GROUND WATER ELEVATION DATA

Location	Depth to Ground Water Date 10-85	11-85	12-85	Reference Elevation	Ground Water Elevation 12-85
1-85	10.78	11.73	12.56	1,083.34	1070.78
2-85	4.96	5.81	Snowed in	1,066.98	Not Available
3-85	6.13	6.82	7.62	1,072.18	1064.56
4-85	7.14	8.13	8.94	1,075.74	1066.80
5-85	4.39	4.95	5.11	1,069.38	1064.27
6-85	6.28	7.50	7.63	1,071.13	1063.50
7-85	6.11	7.13	7.37	1,072.15	1064.78
8-85	8.42	9.03	9.33	1,075.66	1066.33
9-85	8.16	8.92	9.23	1,075.48	1066.25
10-85	7.38	7.86	8.21	1,076.03	1067.82
11-85	9.01	9.81	10.46	1,077.21	1066.75
12-85	9.86	10.60	11.26	1,078.24	1066.98

*Reference Elevation = Top of 2" PVC riser.

Note: All measurements in feet.

TABLE #2

GROUND WATER ELEVATION DATA

Location	Date Depth to Ground Water 1-86	2-86	3-86	Reference Elevation	Ground Water Elevation 3-86
1-85	12.11	11.86	11.46	1,083.34	1071.88
2-85	5.58	5.39	5.19	1,066.98	1061.79
3-85	7.72	7.50	7.38	1,072.18	1064.80
4-85	8.73	8.62	8.19	1,075.74	1067.55
5-85	4.77	4.62	4.57	1,069.38	1064.81
6-85	7.26	6.98	6.87	1,071.13	1064.26
7-85	6.85	6.78	6.66	1,072.15	1065.49
8-85	9.21	9.11	8.77	1,075.66	1066.89
9-85	9.38	9.25	8.91	1,075.48	1066.57
10-85	8.89	8.83	8.49	1,076.03	1067.54
11-85	10.19	9.98	9.52	1,077.21	1067.69
12-85	10.89	10.72	10.27	1,078.24	1067.97

*Reference Elevation = Top of 2" PVC riser.

Note: All measurements are in feet.

indicates that ground water elevations have increased during the Spring, 1986. The rise in water level elevations may be due to increased seasonal recharge.

Figures 1 and 2 present the ground water elevations and flow directions as calculated from the December, 1985 and March, 1986 water level elevations. Using these data, the December, 1985 hydraulic gradient is .0034 ft/ft, and the March, 1986 hydraulic gradient is .0035 ft/ft. The March, 1986 water level at monitoring well 10-85 reflects a higher water level than would be expected. We suspect that this anomaly may be due to infiltration and local recharge from an adjacent ditch.

3.0 CHEMISTRY RESULTS

All collected water samples were submitted to the TCT chemistry laboratory for analysis to determine benzene, toluene, xylene and total hydrocarbons expressed as gasoline concentrations. The results of these analyses are presented in Tables 3 and 4. A review of these tables indicates the presence of dissolved hydrocarbons at monitoring well 11-85. Since August, 1985, dissolved hydrocarbon concentrations at monitoring well 8-85 have decreased from 12 parts per million (ppm) total hydrocarbons to 0 ppm total hydrocarbons. Chemistry methodologies are attached in Appendix A.

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GROUNDWAT
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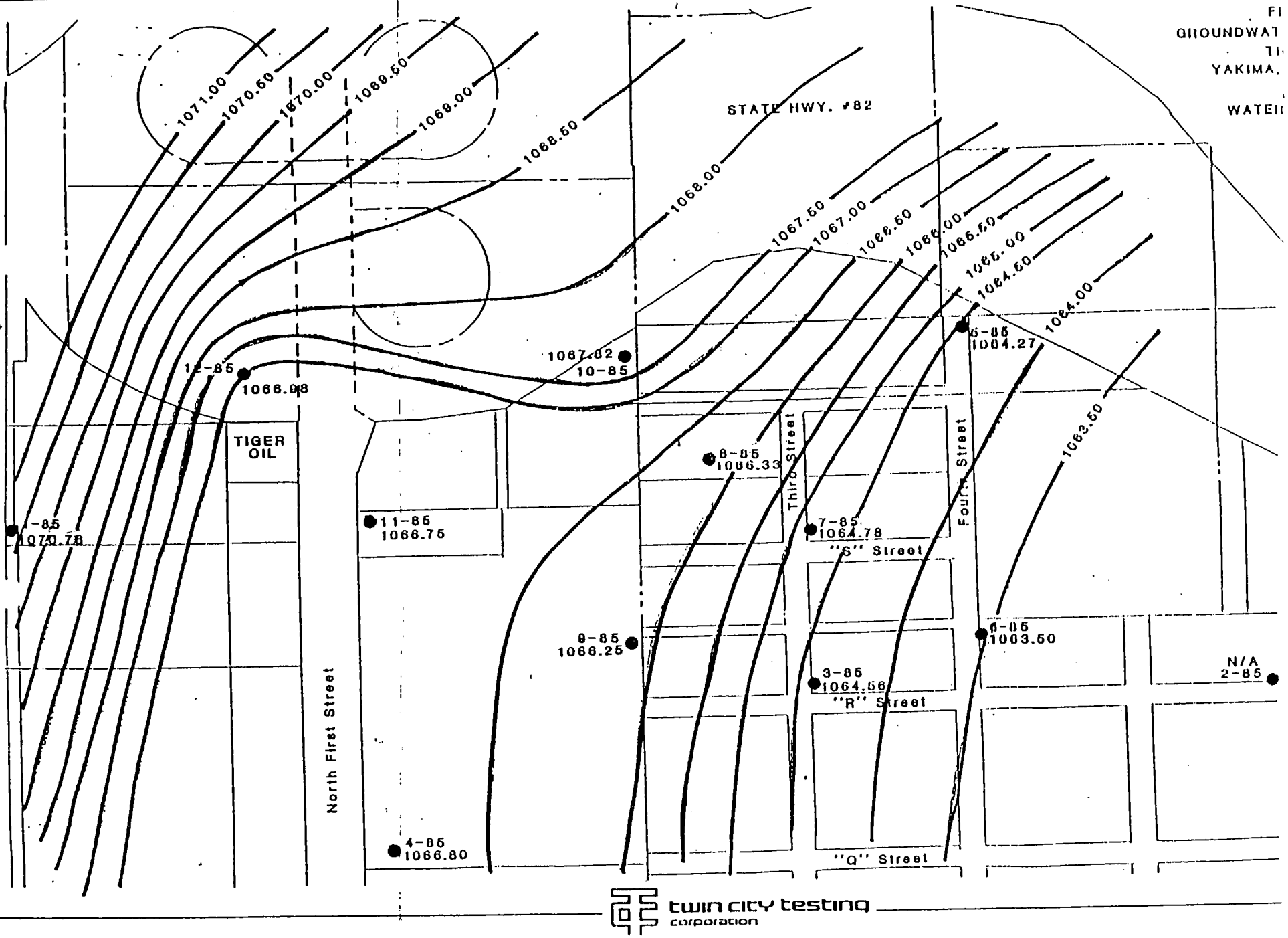

twin city testing
corporation

FIG
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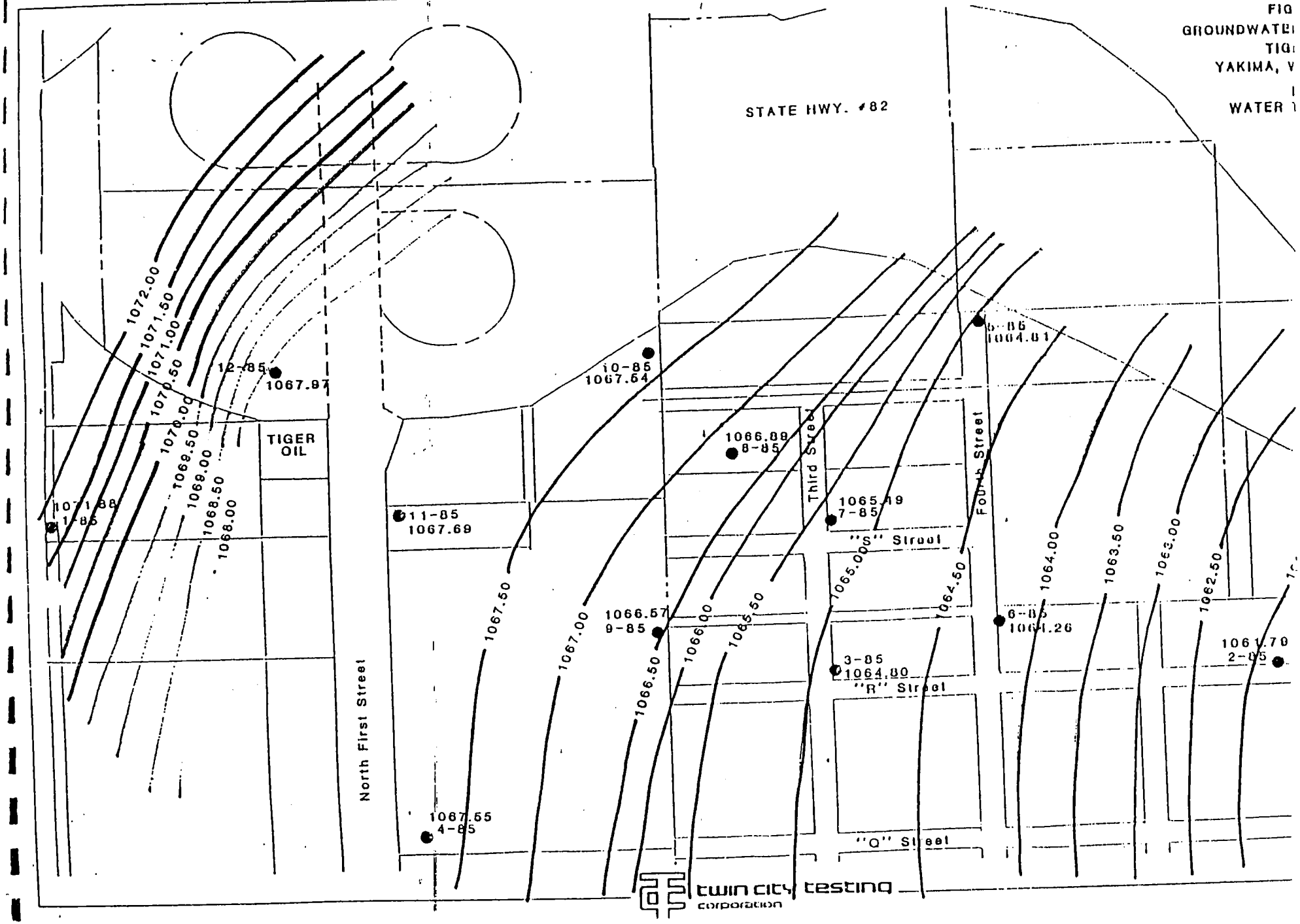
YAKIMA, V

WATER



twin city testing corporation

TABLE #3

VOLATILE ANALYSIS

DECEMBER 16, 1985

Parameter	Knight Residence (ug/L	MW-7 (ug/L)	MW-9 (ug/L)	MW-10 (ug/L)	MW-11 (ug/L)
Total Hydrocarbons as Gasoline	ND	ND	ND	ND	28,000
Benzene	ND	ND	ND	ND	710
Toluene	ND	ND	ND	ND	1,100
Xylene	ND	ND	ND	ND	750

For purposes of this analysis, ug/L = ppb

ND = Not Detected

TABLE #4

VOLATILE ANALYSIS

JUNE 20, 1986

Parameter	Knight Residence ug/L	MW-7 ug/L	MW-8 ug/L	MW-9 ug/L	MW-10 ug/L	MW-11 ug/L
Total Hydrocarbons as Gasoline	ND	ND	ND	ND	ND	45,000
Benzene	ND	ND	ND	ND	ND	680
Toluene	ND	ND	ND	ND	ND	7,000
Xylene	ND	ND	ND	ND	ND	18,000

For purposes of this analysis, ug/L = ppb

ND = Not Detected

4.0 DISCUSSION

Based on the data presented, downgradient (MW-8-85) hydrocarbon contamination has decreased. However, the higher level of dissolved hydrocarbon concentrations at MW-11-85 may be explained by local irrigation solubilizing previously immobile hydrocarbons. Water level information for June, 1986 will be provided on our next report.

5.0 RECOMMENDATIONS

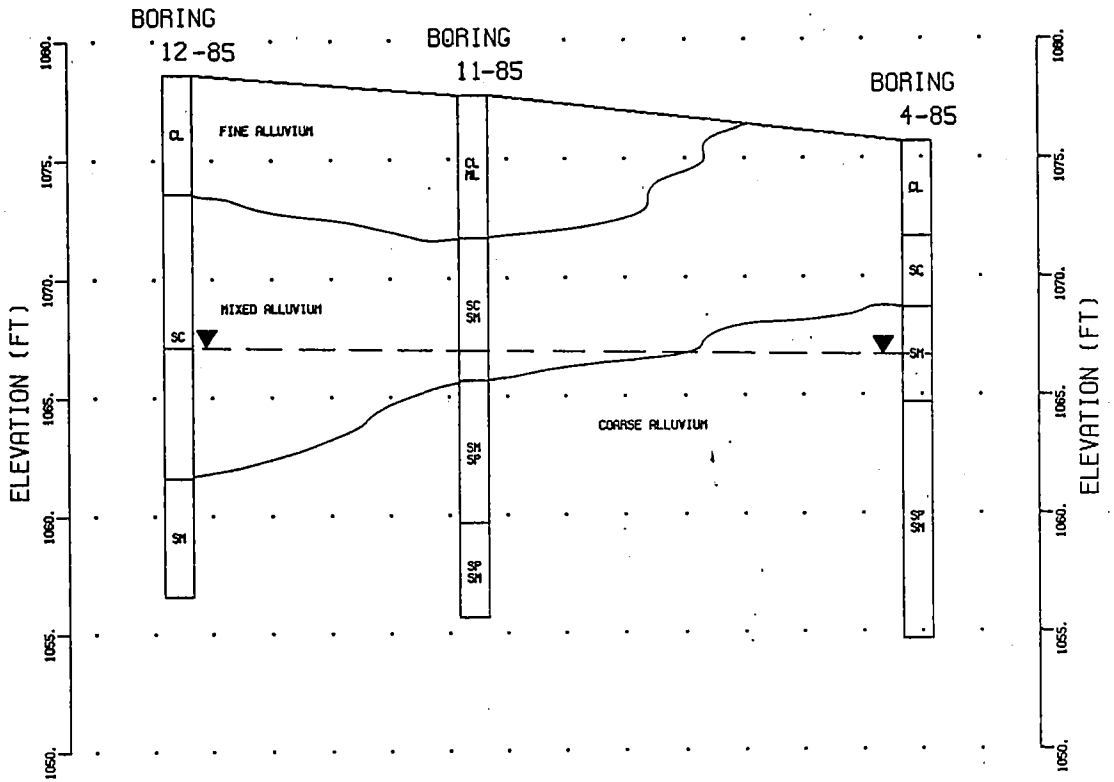
Mr. Gary Turney of the United States Geological Survey (U.S.G.S.) has recently notified TCT of the survey's plans to install additional site monitoring wells. In view of the thorough site study being completed by the U.S.G.S., TCT, on behalf of Tiger Oil, requests permission from the State of Washington, Department of Ecology to discontinue site monitoring.

6.0 REMARKS

The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted engineering and hydrogeologic practices at this time and location. Other than this, no warranty is implied or intended.

A ⟷ A'

CROSS SECTION LOCATIONS SHOWN ON FIGURE #2



NOTE: EXCEPT AT BORING LOCATIONS THE GROUND SURFACE, WATER LEVEL, AND BOUNDARIES BETWEEN SOIL LAYERS ARE INFERRED.

FIGURE #3

SOIL PROFILE
GASOLINE SPILL INVESTIGATION YAKIMA, WASHINGTON W.O. 120-12955
SOIL EXPLORATION COMPANY
SCALE: VERT: 1 IN = 5. FT HORZ: 1 IN = 200. FT

Figures 3, 4, 5 and 6 present cross-sectional illustrations of soil conditions inferred from our boring logs.

3.2 Monitoring Wells

Two inch diameter flush thread schedule 40 PVC monitoring wells were installed in all borings. All monitoring wells are equipped with 15' of screen. The final screening interval was decided in the field after depth to ground water data was available. All wells with the exception of 2-85 and 5-85 are installed such that 10' of screen extends below the water table and 5' extends above the static water table on the day that they were installed. Monitoring wells 2-85 and 5-85 are screened such that approximately 11' of screen extends into the water table. This decision was based on depth to ground water data of approximately 6' and a minimum criteria of one foot of filter sand above the screen before the grout seal. All monitoring wells were filter packed with coarse sand.

3.3 Ground Water

Stabilized ground water elevations and surface elevation data are presented on Tables 1 and 2. A review of these tables indicates that depth to ground water varies from 5.43' below the surface at monitoring well 5-85 to 12.96' below the surface at monitoring well 1. Figure 7 presents a ground water contour map generated from the water level data recorded on February 20, 1985.

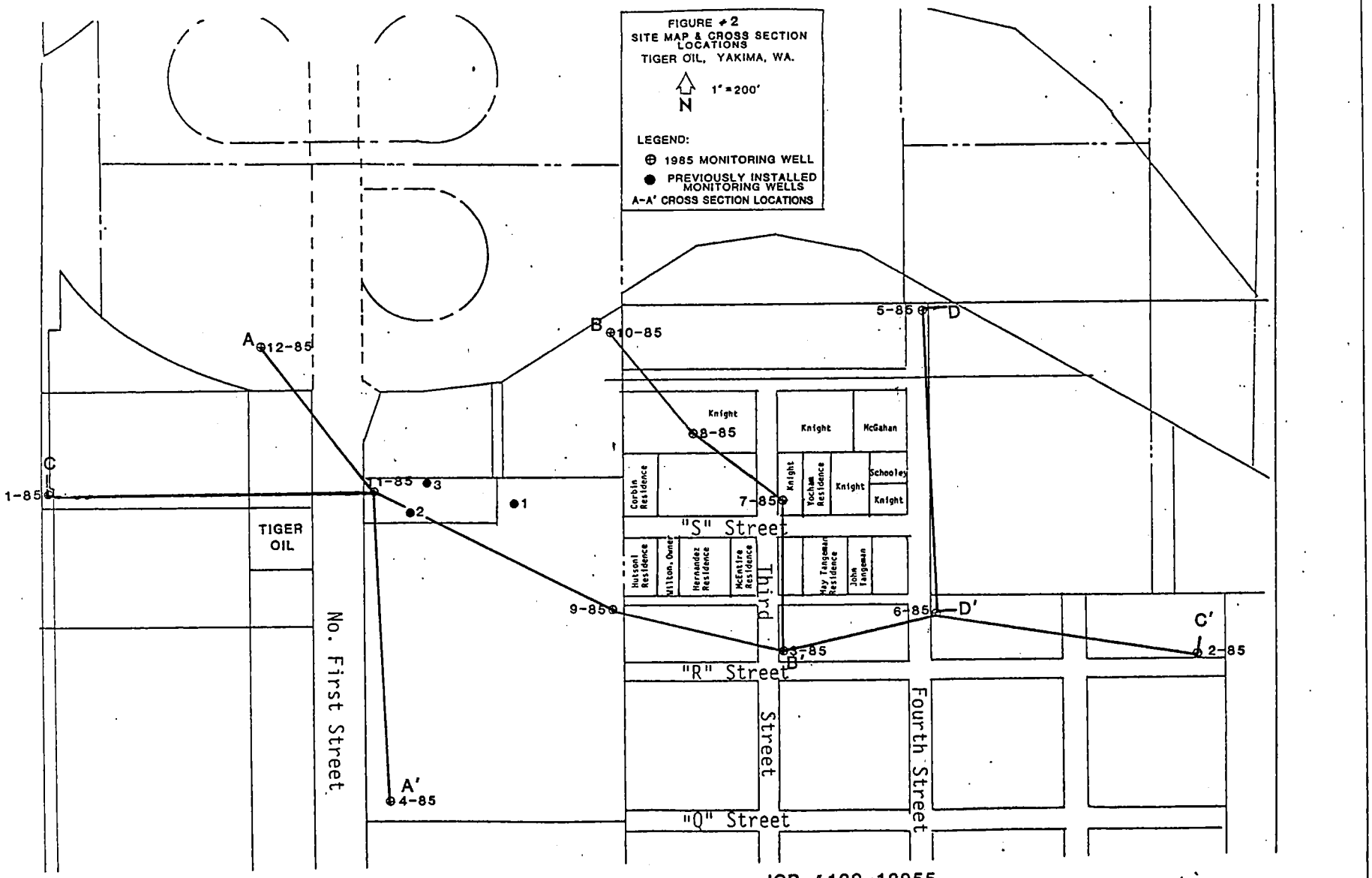


FIGURE #2
SITE MAP & CROSS SECTION LOCATIONS
TIGER OIL, YAKIMA, WA.
N
1" = 200'
LEGEND:
⊕ 1985 MONITORING WELL
● PREVIOUSLY INSTALLED MONITORING WELLS
A-A' CROSS SECTION LOCATIONS
A
12-85
B
10-85
5-85
D
C
1-85
1-85
3
1
2
7-85
8-85
9-85
6-85
D'
C'
2-85
3-85
B'
A'
4-85
Knight
McGahan
Schooley
Corbin Residence
Yochum Residence
Hutsonl Residence
Wilton, Owner
Hernandez Residence
McEntire Residence
Hay Tangeman Residence
John Tangeman
TIGER OIL
No. First Street
"S" Street
Third Street
"R" Street
Fourth Street
"Q" Street

2.2 Site Information

The Tiger Oil Exxon station is located in a business/residential district on North First Street, Yakima, Washington (Figure 2). U.S. Highway 12 is located approximately 850' north of the station. The station is constructed on the alluvial floodplain of the Yakima River. Parent material for the alluvium is derived from the surrounding basaltic bluffs. Local relief on the floodplain is minimal, with a low gradient maintained toward the Yakima River. The Yakima River is approximately 1000' NE of the Tiger Oil station, and is the local ground water discharge point.

3.0 PROJECT RESULTS

3.1 Soil Conditions

Twelve additional soil borings were drilled at this site between November 17, 1984, and February 20, 1985 (Figure 2). All soil borings were finished as monitoring wells. A W-22 Bucyrus Erie cable tool drilling rig was used to advance all borings. Using this method, only composite samples were recovered.

The results of the soil borings are presented on the attached logs in Appendix 1. A review of these logs indicates that the upper 21' of soil are primarily alluvial deposits consisting of lean clay to silty clay, with a little gravel from 0'-6'. In all borings the clays were underlain by coarse alluvium consisting of silty sand with a little gravel. Cobbles and boulders were encountered at all depths.

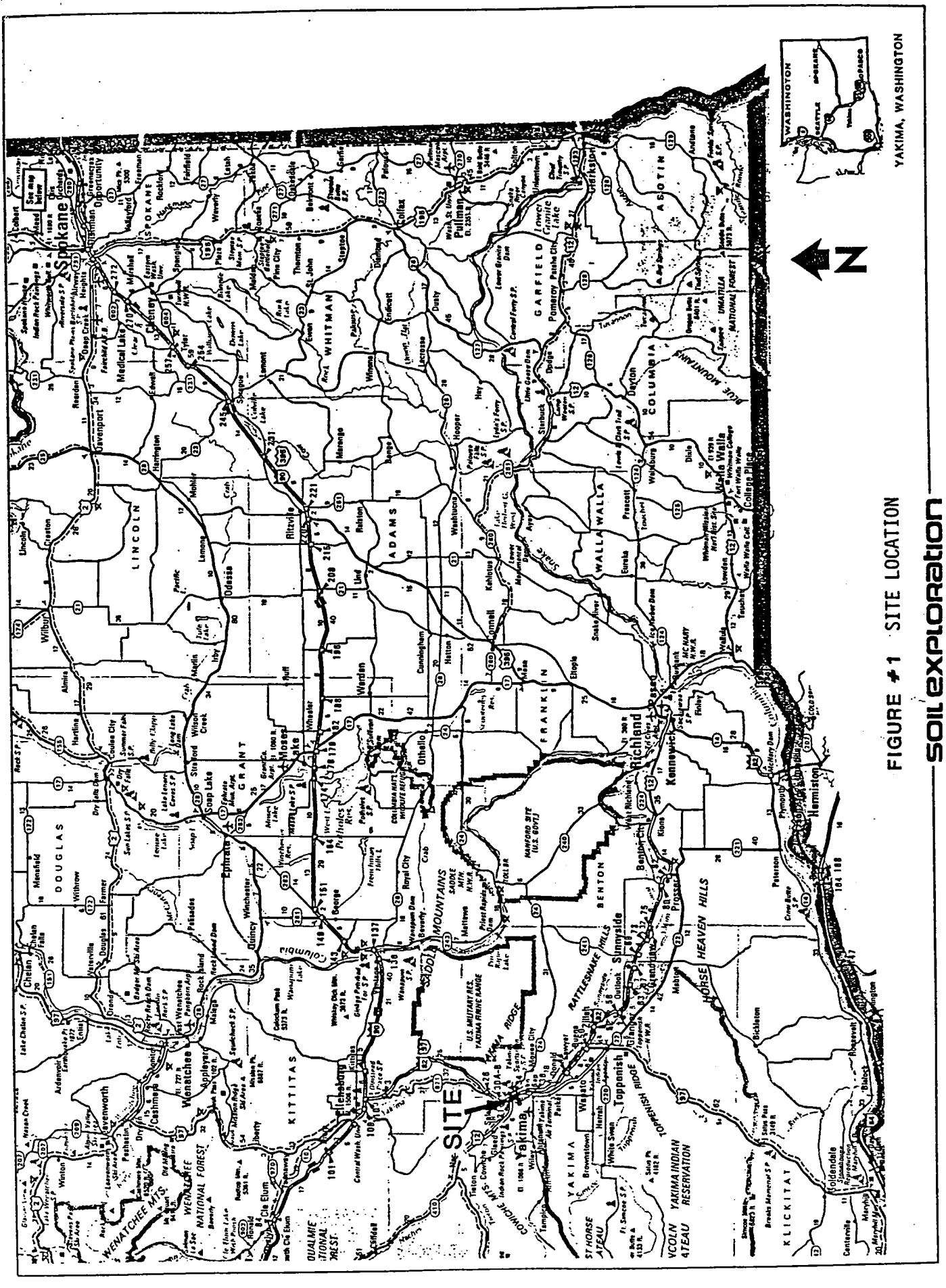


FIGURE #1 SITE LOCATION

YAKIMA, WASHINGTON

SOIL EXPLORATION COMPANY

2.0 BACKGROUND INFORMATION

2.1 Project History

The Tiger Oil Exxon station is located on North First Street, Yakima, Washington (Figure 1). As we understand, the station was constructed in May and June, 1979. Regular, premium, unleaded and diesel petroleum products are stored below ground and distributed.

Hydrostatic testing of all dispenser lines was conducted during September, 1982. At that time, all lines produced a positive test (indicating leakage). All lines were subsequently replaced.

An environmental consultant from Seattle was retained by Tiger Oil to assess the environmental impact of the lost petroleum products. Fourteen monitoring wells were installed as part of their effort. At that time, petroleum product contamination appeared to be confined locally, and two recovery wells and one injection well were drilled to facilitate free product removal. Approximately 40 gallons of gasoline were recovered. Pumpage exceeded 100 GPM and minimal drawdown in the recovery well was achieved.

An additional three monitoring wells were later installed to further delineate the extent of hydrocarbon contamination (May 9, 1983). This extended study concluded that hydrocarbon migration was still limited to an area approximately 250' downgradient from the Tiger Oil station.

Due to unknown monitoring well construction details and previous monitoring well abandonment, only three of the seventeen monitoring wells were included in our study.

HYDROGEOLOGIC EVALUATION

GASOLINE SPILL INVESTIGATION

TIGER OIL

YAKIMA, WASHINGTON

120-12955

1.0 INTRODUCTION

The purpose of our work performed at this site was to define hydrogeologic conditions influencing the movement and migration of petroleum products and to provide information relative to evaluating the horizontal and vertical distribution of petroleum product contamination.

The scope of our services provided on this project consisted of the following.

1. Mobilizing to the site on November 30, 1984, to evaluate site conditions, and meet with local representatives and the Washington Department of Ecology.
2. Installing 12 monitoring wells for providing water level and water quality information.
3. Pumping all monitoring wells at a rate of 7 GPM for a minimum of 10 minutes or until clear discharge water was observed.
4. Collecting water samples from the previously mentioned monitoring wells and 9 private residences.
5. Analyzing all water samples for the presence of total hydrocarbons expressed as gasoline, benzene, toluene and xylene concentrations.
6. Preparing a final report which presents information regarding ground water remediation.

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TABLE OF CONTENTS

SOIL EXPLORATION COMPANY

662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-6446

a sister corporation to TWIN CITY TESTING AND ENGINEERING LABORATORY INC.

May 8, 1985

Federated Insurance Company
129 East Broadway
Owatonna, Minnesota 55060

Attn: Mr. Brad Nesseth

Subj: Hydrogeologic Evaluation
Gasoline Spill Investigation
Tiger Oil
Yakima, Washington
#120-12955

Gentlemen:

We have completed our subsurface investigation for the above referenced site as verbally authorized by Mr. Brad Nesseth on November 16, 1984. We are transmitting five copies of our report to you. Additional copies will be forwarded as noted below.

All the samples received from our test borings will be held at this office for a period of three months following the date of this report. The samples will then be discarded unless we are notified to hold them for a longer period of time.

We appreciate the opportunity to have served you in regard to this project. If you have any questions regarding the information in this report, or if we can be of additional service, please contact us.

Very truly yours,

Soil Exploration Company

Mark S. Mason
Project Manager/Environmental Geologist

MSM/pp

Encs.

cc: 1 - Washington Department of Ecology
Attn: Mr. Al Newman
1 - IT Corporation
Attn: Mr. John Clark
1 - Zaremba Claims Services
Attn: Mr. Ronald Zaremba
1 - Weeks, Dietzen & Skala
Attn: Mr. Roland Skala

HYDROGEOLOGIC EVALUATION
GASOLINE SPILL INVESTIGATION
TIGER OIL
YAKIMA, WASHINGTON

May 8, 1985

#120-12955

SOIL EXPLORATION
COMPANY

We have no real legitimate use for these wells, either from a water rights management or pollution control management standpoint, in this office, and we do not wish to take over responsibility for any of those wells. You are clear then to remove (abandon) all of them. I believe you indicated that some of them would be given over to the University of Oregon as they may wish to pursue some refinement work on their sampler. Thank you.

SUMMARY

From the few available documents, the following chronology appears:

1. By 1985, the clean up contractor had determined that active remediation and gradient control were not feasible alternatives and instead recommended implementation of a monitoring program.

2. The USGS selected this site as the subject of a long term petroleum degradation study.

3. In light of the USGS study and its desire to take over the monitoring activities, the cleanup contractor on behalf of Tiger Oil requested permission from Ecology to discontinue site monitoring.

4. The USGS site monitoring continued until May, 1987, at which time, Ecology granted the USGS permission to discontinue monitoring and abandon the monitoring wells.

I hope that the foregoing summary and the attached documentation is of some assistance to you in your further consideration of these sites. Please note that as Federated has not been named as a PLP, all communcations from your office regarding the site should be directed to Wally Meyers and/or Mark Watson, legal counsel for our insured.

Sincerely,

Debra B. ReMine

Debra B. ReMine
Vice President - General Counsel
Federated Service Insurance Company

Enclosures

pc: Mr. Ronald E. Bailey

> Due to the high hydraulic conductivity, past efforts to significantly depress the water table failed. Considering this, gradient control should not be used as a feasible alternative to cleaning up hydrocarbon contamination.
>
> * * * * *
>
> Due to the remedial nature of this action, we recommend that a monitoring program be implemented to document ground water flow and quality over a period of one year before re-evaluating site conditions and possible implementation of other remedial measures.

Soil Exploration Company's subsequent report dated June 24, 1985 with a copy to Ecology repeated the recommendation that no additional monitoring was warranted.

In January, 1985 the U.S. Geological Survey (USGS) selected this site as part of a long-term government study on petroleum contamination. A copy of the USGS study proposal is attached which details the extensive involvement contemplated by the USGS under this study.

On March 13, 1986 Ecology, through William H. Miller, granted the USGS a variance under the standards for construction and maintenance of water wells to allow the construction of monitoring wells at the project. The wells were used by the USGS to define the extent of the gasoline spill and to provide a monitoring network.

In light of the USGS' desire to take over the monitoring wells, Twin City Testing (TCT) (which had acquired Soil Exploration Company) prepared a report on August 15, 1986 which recommended under Section 5.0 that: "In view of the thorough site study being conducted by the USGS, TCT, on behalf of Tiger Oil, requests permission from the State of Washington, Department of Ecology to discontinue site monitoring."

The USGS study continued until 1987. Thereafter, the USGS requested approval to discontinue monitoring and to abandon the monitoring wells. On May 15, 1987 Clar Pratt at Ecology allowed the USGS to abandon the wells and discontinue monitoring:

This report was prepared by: Mark S. Mason

Mark S. Mason
Environmental Geologist/Project Manager

Dated: August 15, 1986

This report was reviewed by: Kevin D. Krueger

Kevin D. Krueger
Project Manager

Dated: August 15, 1986

Proofread by: P. Wright

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. .....
Permit No. G425049P

(1) OWNER: Name Glen Below Address 1937 Davidson

(2) LOCATION OF WELL: County ..... SE ¼ NW ¼ Sec 14 T 10 N., R 27 W.M.
Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☑ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) .....
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 65 ft. Depth of completed well 61 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from +1 ft. to 56 ft.
Threaded ☐ ..." Diam. from ... ft. to ... ft.
Welded ☒ ..." Diam. from ... ft. to ... ft.

Perforations: Yes ☐ No ☒
Type of perforator used .....
SIZE of perforations ... in. by ... in.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

Screens: Yes ☒ No ☐ Johnson
Manufacturer's Name
Type Stainless Model No.
Diam. 6 Slot size .012 from 56 ft. to 61 ft.
Diam. ... Slot size ... from ... ft. to ... ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: .....
Gravel placed from ... ft. to ... ft.

Surface seal: Yes ☒ No ☐ To what depth? 20 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ... Depth of strata ...
Method of sealing strata off .....

(7) PUMP: Manufacturer's Name .....
Type: ... H.P. ...

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 40 ft. below top of well Date .....
Artesian pressure ... lbs. per square inch Date .....
Artesian water is controlled by ... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom? .....
Yield: ... gal./min. with ... ft. drawdown after ... hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test .....
Bailer test 35 gal./min. with 9 ft. drawdown after 3 hrs.
Artesian flow ... g.p.m. Date .....
Temperature of water ... Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:
Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Top Soil	0	1
Gravel 6" Minus + Silt	1	3
Gravel 4" Sand Gray	3	14
Sand Silty Gray 2" Gravel	14	31
Gravel 6" + Sand Compact	31	49
Sand + Gravel 2" minus Ringold formation water Bearing	49	61
Ringold Cemented	61	65

RECEIVED
JUL 26 1978
DEPARTMENT OF ECOLOGY
OLYMPIA, WASHINGTON

Work started 3-21, 19 77 Completed 3-23, 19 77

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Nelson Well Drilling
(Person, firm, or corporation) (Type or print)
Address 10036 West Agnes Road
[Signed] James Nelson
(Well Driller)
License No. 361 Date 3-25, 19 77

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71)
ECY-070-28

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