Jack Walstad Oil Company, Inc.

Lovington Facility

3rd Interim Hydrogeologic Investigation Report

for

Jack Walstad Oil Co., Inc.
and
New Mexico Environment Department

by

Billings & Associates, Inc.
June, 1993

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LOVINGTON FACILITY

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1.0
Executive Summary

Jack Walstad Oil, Co. has retained Billings & Associates, Inc. to provide environmental consulting services in relation to a facility in Lovington, New Mexico. The present task is to complete a hydrogeologic investigation satisfactory to the New Mexico Environment Department (NMED). This investigation has progressed in stages since June, 1992. Reports were filed in June and September of 1992 documenting the status of work at those times. Subsequent to workplan approval by the NMED, the latest group of field operations was completed on May 26, 1993. This report details those efforts. Based on the recent information, along with historical trends, the following conclusions and recommendations are put forth:

- Five additional ground-water monitoring wells have been installed. These 5 wells, along with 5 existing wells, were sampled for laboratory analysis.

- Water table elevation data on three occasions reveals a consistent ground-water flow direction from northwest to southeast, with an average velocity of 60 ft/year.

- Water quality in wells W-4 and W-8 has degraded since August, 1992.

- A marked increase in contamination was detected since August, 1992 in the deep-screened well V-1. This is likely due to seepage of free-phase product into the well. As such, the well should be properly abandoned.

- The horizontal extent of dissolved-phase contamination in the area has been substantially bounded.

- The existence of at least one other source of contamination has been identified. The NMED should take steps toward identification and assessment of other sources.

- On-site reclamation should proceed at the Walstad facility to eliminate its contribution

to ground-water contamination.

• Free-phase hydrocarbon product has not been observed in any wells other than the three originally identified (W-1, 2, and 3).

2.0
Introduction

Billings & Associates, Inc. (BAI) has been contracted by Jack Walstad Oil, Co. (Walstad Oil) of Hobbs, NM to provide environmental consulting services in relation to a facility in Lovington, New Mexico. Following the progression of corrective action as recommended by the New Mexico Environment Department's Underground Storage Tank Bureau (NMED/USTB), the present task is to develop a hydrogeologic investigation report to fulfill obligations under §1210C of the UST Corrective Action Regulations (USTR).

The original scope of work was limited to on-site activities. The first Interim Hydrogeologic Investigation Report (On-Site) was submitted to the NMED in June 1992 describing those on-site operations and the relevant data obtained to that point. Contamination had been observed during field activities prepatory to that report which indicated legal access to off-site areas was required to fully define the extent and possible sources of such contamination. The 2nd Interim Hydrogeologic Investigation Report (submitted September, 1992) described additional activities (both on and off-site) performed during late-August, 1992. The extent of ground-water contamination was not sufficiently defined by the August activities, necessitating additional monitoring well installation.

Formal implementation of the Ground Water Protection Act with respect to reimbursement for corrective action began in September, 1992. Workplans for NMED approval to continue with the investigation were initially submitted in October, 1992 and BAI received written notification of approval on May 7, 1993. Field operations as

described in the approved Phase 1 workplan were conducted May 24-26, 1993. Though this report will reiterate and update information contained in the two prior interim reports; the three documents should be considered together as parts of a complete investigation pursuant to USTR §1210C.

3.0
Background

The site under investigation is a closed Phillips 66 station at the Northwest corner of Main Street and NM 83 (Avenue D) in Lovington, New Mexico. A map of the area showing the location of various monitoring wells is presented in Figure 1. Previous to BAI involvement, work had been done at the facility by AEI Tank, Inc. of Clovis, NM beginning July 30, 1991. A report of those activities was presented by AEI to Walstad Oil and the NMED in April of 1992.

A brief synopsis of the prior work performed by AEI is as follows: A set of shallow bores (<15 feet) were advanced around the site on July 30 - 31, 1991 which revealed soil contamination in excess of state action levels. Beginning in early November, 1991 four or five (report unclear) underground storage tanks were removed which previously stored unleaded gasoline of various grades and diesel. The associated piping and dispensers were then removed and an over-excavation process proceeded apparently in response to the presence of contaminated soils. In December, 1991, a single soil boring was advanced somewhere on the site to a depth of 40 feet. Soil samples obtained during the boring operation were analyzed in excess of action levels. On February 5, 1992, a single monitoring well was installed and a water sample was obtained which was contaminated above state standards. On March 13, 1992, two more wells were installed. Ground water from those wells was also found to exceed standards.

Beginning on June 8, 1992, BAI began work at the site to obtain sufficient information

for the filing of a hydrogeologic investigation report. Free phase hydrocarbon product with a thickness in excess of 30 inches was observed in each of the existing monitoring wells (W's-1, 2, and 3). Six soil borings were advanced at on-site locations to a maximum depth of approximately 40 feet using an auger-type drilling rig. Split spoon samples were taken for headspace and laboratory analysis from various depths in each of the borings. A sandstone layer encountered at a depth of 40 feet was impenetrable by the auger rig, precluding the installation of ground water monitoring wells at that time. Soils contaminated above the state action level of 100 ppm were observed. The soil contamination diminished below the action level in all borings except that nearest the former south dispenser island at depths shallower than 40 feet.

Due to the auger's inability to penetrate the deep sandstone layer, a variance was obtained from NMED for use of an air rotary drilling rig for the installation of necessary monitoring wells. Three on-site monitoring wells (W's-4, 5, and 6) were installed on June 23, 1992. Subsequent sampling and lab analysis of ground water from each of those wells revealed the presence of benzene in excess of state standards in all three samples. The concentration of toluene in water from W-6 was also found in excess of standard.

Beginning on August 27, 1992 free product recovery operations were initiated in the three existing wells which had evidence of product. In addition, eight additional monitoring wells (W's-7 through 13 and V-1) were installed in the area on August 27 and 28, 1992 in an attempt to define the horizontal and vertical extent of ground water contamination. Dissolved-phase hydrocarbon contamination in excess of state standards was found by laboratory analysis in six of the new wells. No contamination was detected in the two wells (W-7 and 13) located in nominally upgradient directions.

As such, locations for five more monitoring wells (W-14 through 18) were proposed and subsequently approved. Installation of the new wells was completed May 25, 1993. Sampling of these newest wells, along with five of the existing site-associated

wells was completed May 26, 1993. In addition, measurements of depth to water, dissolved oxygen concentration, and water headspace readings were taken on all site wells not containing free-phase product. Product removal and recovery testing was also accomplished on the three wells with product (W-1, 2, and 3).

4.0
Hydrogeology

The ground-water system in question is likely part of the greater Ogallala Aquifer consisting of medium to fine grained sands in its upper portion. The top of these sands begin at an average depth of approximately 55 to 60 feet in the Lovington area. Overlying the sandy aquifer are beds predominately consisting of caliche of varied hardness and permeability, mixed with occasional and inconsistent sand and sandstone layers. Depth to water in the immediate area is between 56 and 57 feet below ground surface. Boring logs for the latest five wells (W-14 through 18) can be found in Appendix A. Similar logs for the remaining site wells emplaced under BAI supervision can be found in the previous interim reports. Well detail sheets showing completion information for these same five wells are in Appendix B. Such information for the older wells can be found in the prior reports.

The relative top of casing elevations of all wells have been surveyed to the nearest one-hundredth of one foot. The top of casing elevation for well W-1 was arbitrarily set at 100.00 feet, and all other well elevations are indexed to that well. Static depths to water were measured in those wells not containing free product prior to sampling. Relative well elevation, historic depths to water, and computed water table elevation information can be found in Appendix C. A map depicting the potentiometric surface based on the latest data is presented as Figure 2. The observed potentiometric gradient based on the 5/25-26/93 data continues to trend southeast at an average rate of 0.0036 ft/ft. The observed gradient based on the 6/24/92 data was 0.0029 ft/ft. The gradient from the 8/28-29/92 sampling event was 0.0033 ft/ft. Both prior trend directions

showed ground water flowing southeast.

Aquifer characteristics beneath the site were quantified by performing slug injection testing on monitoring well W-5 on June 24, 1992. A description of this test along with subsequent analysis was provided in the first interim report and will not be repeated here. That analysis yielded an estimated average value of transmissivity for the upper portion of the aquifer of 8 ft^2/day. The average storativity was determined to be 0.02. The hydraulic conductivity of the aquifer in the immediate vicinity of the monitoring well was estimated to be 1 ft/day (4×10^{-4} cm/sec).

Based on the most recent gradient data, an estimate of general ground-water flow velocity (v) can be made utilizing a derivation of the Darcy equation. Using an average hydraulic gradient (i) of 0.0036 ft/ft, an effective porosity (n) of 20%, and an average hydraulic conductivity (k) of 1 ft/day, the ground-water velocity is estimated to be:

$$v = [k \times i]/n = 0.181 \text{ ft/day} = 66 \text{ ft/year}$$

Estimates of ground-water velocity using the two historic gradients (0.145 ft/day for the 6/92 data, and 0.165 ft/day for the 8/92 data) combine with the recent data for an average velocity of 0.164 ft/day or 60 ft/year with a maximum scatter of 11.6% from the mean.

5.0
Water Quality

Each of the five newest wells was developed after completion by bailing until formation fines were no longer observed in the water. The wells were then allowed to stabilize for 24 hours before sampling. Water quality sampling was performed on the newest wells (W-14 through 18) along with validation sampling on five previously existing wells (V-1, W-4, 7, 8, and 9) In excess of three bore volumes of ground water was removed from each well using disposable bailers immediately prior to obtaining the

laboratory sample. Each sample was gathered from the bottom of the bailer into two clean 40 ml volatile organic analysis bottles provided by the laboratory. Prior to filling, each bottle was spiked with two drops of a 4 molar solution of mercuric chloride ($HgCl_2$) in distilled water as a preservative. The bottles were then capped with a septum top and carefully checked for the presence of any air bubbles. They were then labeled and refrigerated until they reached the lab with appropriate chain of custody.

The water samples were analyzed for benzene, toluene, ethylbenzene, total xylenes (BTEX), and methyl tertiary butyl ether (MTBE, a gasoline oxygenating additive) by Hall Environmental Analysis Lab in Albuquerque. A tabular compilation of the historic organic water quality data is presented as Appendix D. Copies of the actual laboratory water analysis report for the latest sampling event can be found in Appendix E.

In reviewing the information contained in Appendix D for those wells previously sampled, several points should be noted. The total BTEX concentration in water table wells W-4 and W-8 have increased since their last sampling in August of 1992. Dissolved-phase contamination in W-9 has remained relatively stable over the same period. Ground-water contamination in upgradient well W-7 remains non-detectable. Laboratory analysis of water from the deep-screened vertical well (V-1) reveals a more than 16-fold increase in total BTEX contamination in 9 months, and makes this well the "dirtiest" thus sampled.

The location of this deep-screened well (for the determination of the vertical extent of ground-water contamination) is in the southeast portion of the property where free product exists, and thus by inference the highest dissolved-phase contamination. The screen interval of this well is situated at 75 to 80 feet below ground surface, which provides a sample from minimally 18 feet below the current water table. BAI has had a strong concern that the magnitude of product in that area presents a difficulty in the drilling and completion of a deep well through the product while still being able to acquire a representative sample from deeper in the saturated aquifer. Seepage of

product through the threaded casing joints may be influencing the water quality data from this well. A hydrocarbon sheen was noted when first bailing the well. As such, this well should be abandoned and plugged with grout.

Figure 3 spatially presents a map of the highest dissolved-phase benzene concentrations for each well. Figure 4 presents a similar map of highest total dissolved-phase BTEX. Perimeter wells W-13, 7, 15, and 17 have all been analyzed with non-detectable levels of BTEX and MTBE. W-18 was analyzed to contain very minor amounts of benzene, toluene, and total xylenes at levels well below the state standard for each constituent. Based on this data, the horizontal extent of the dissolved-phase contaminant plume could be considered bounded, with the exception of directions due south of the site. Ground water from W-16 contained detectable levels of ethylbenzene and total xylenes less than standard, but a concentration of benzene at 52 ppb.

Based on the trend in concentrations, installation of one more monitoring well south and slightly west of W-16 should reveal "clean" ground water, assuming a single source. In BAI's opinion, indications are that there exist multiple sources associated with this plume. Olfactory indications of soil contamination were found in a fine-grained sand at depths from 35 to 45 feet below ground surface during drilling of W-16, which is immediately adjacent a Bell Fina station (see Boring Logs). Olfactory indications of soil contamination were found in the caliche at depths of 10 to 15 feet during drilling of W-14 at the Allsups convenience store adjacent to their dispenser island. The olfactory data is reported as the air rotary drilling process strongly effects the retained volatility of contaminated soils such that headspace analysis would be questionable. Provisions were not made within the budget for the cost of split spoon sampling.

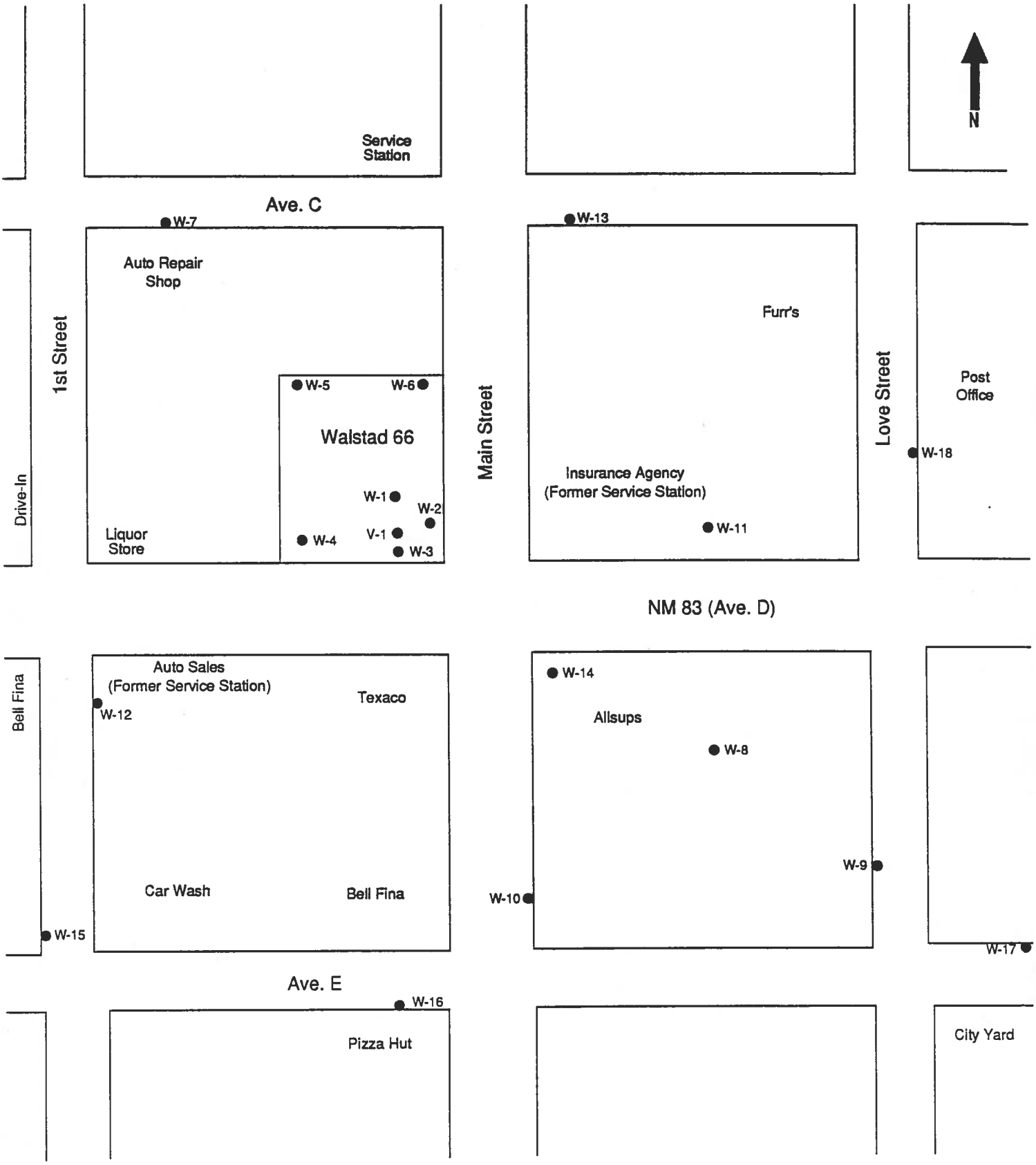
The ground-water contamination found in W-14 is substantially less (50%) that observed in W-8. The Walstad site, W-14, Allsups, and W-8 all lie in a line parallel to the ground-water gradient. It is BAI's opinion that a release at the Allsups (or other

source) has impacted wells W-10, 16, 14, 8, 9, 11, and 18.

As mentioned previously, water headspace and dissolved oxygen (DO) data were also obtained for every site well. Figure 5 is a map showing the distribution of water headspace data in ppm-v. These data generally mimics the distribution of benzene and total BTEX given in Figures 3 and 4, including the increase in contamination from W-14 to W-8. Figure 6 presents the DO data in mg/l (ppm) for all wells. DO can be used as a general field measure of water quality, as indigenous microorganisms will deplete the available oxygen for metabolizing hydrocarbon. Again the distribution fits the laboratory data. The comparative measurements of wells W-4, 5, 6, 14 and 8 shows a very strong break in DO. This would tend to suggest a "cleaner" area of ground water between the Walstad site and Allsups.

These data indicate a need for further investigation work to define off-site sources. BAI strongly recommends that the NMED initiate appropriate actions to investigate the potential sources. Nonetheless, design and implementation of on-site reclamation should be initiated at the Walstad facility to eliminate its contribution to the ground-water problem. This course of action had been previously suggested by Steve Wild of the NMED in August, 1992 under §1215.C of the USTRs.

Figures



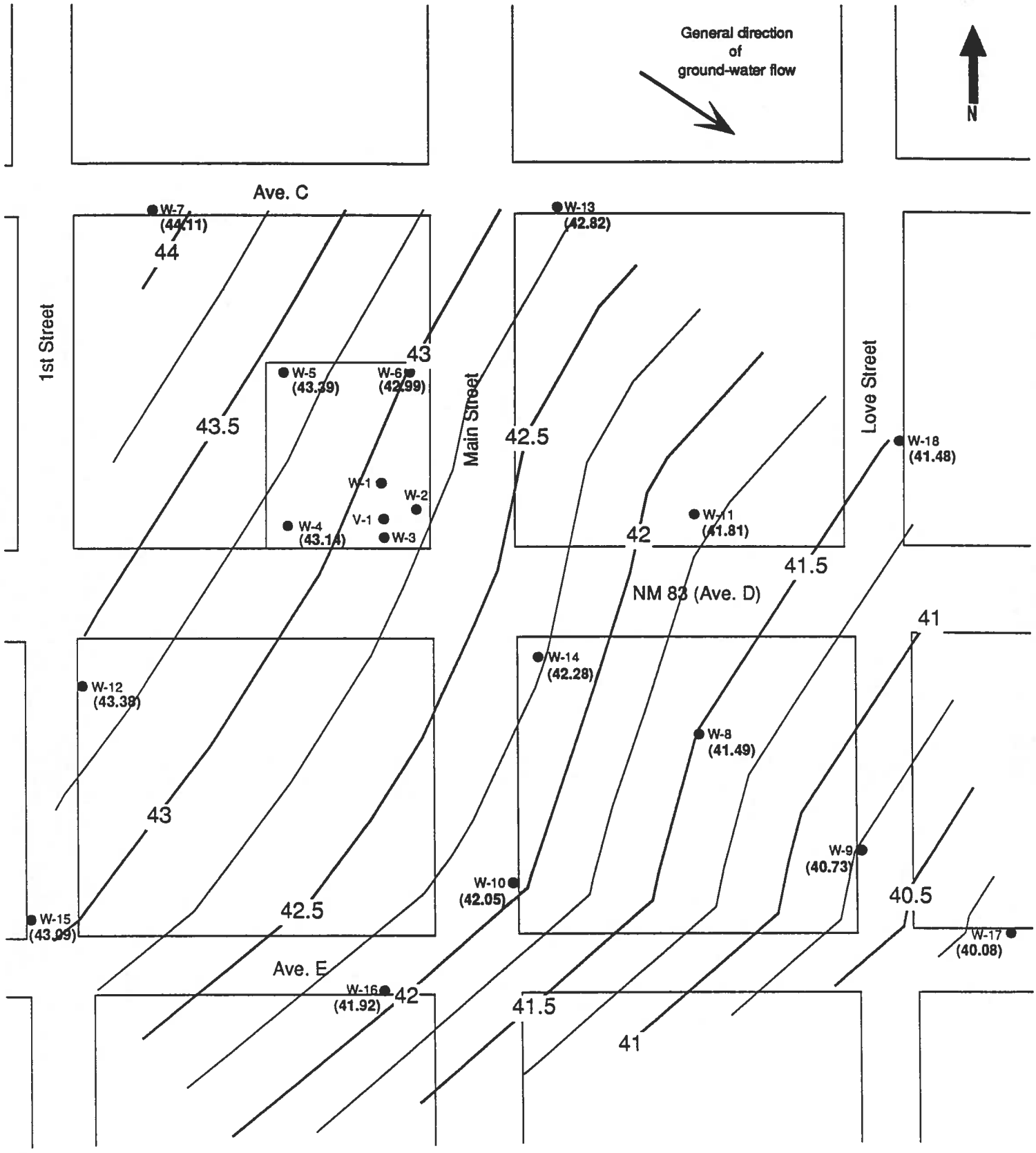
Scale (feet)

0 50 100 200

● monitoring well location

FIGURE 1

Base Map
Walstad Oil: Lovington, NM
Billings & Associates, Inc. June, 1993



Scale (feet)

0 50 100 200

● monitoring well location

(42.82) relative water table elevation in feet

FIGURE 2

Potentiometric Surface Map-5/93
Walstad Oil: Lovington, NM
Billings & Associates, Inc. June, 1993

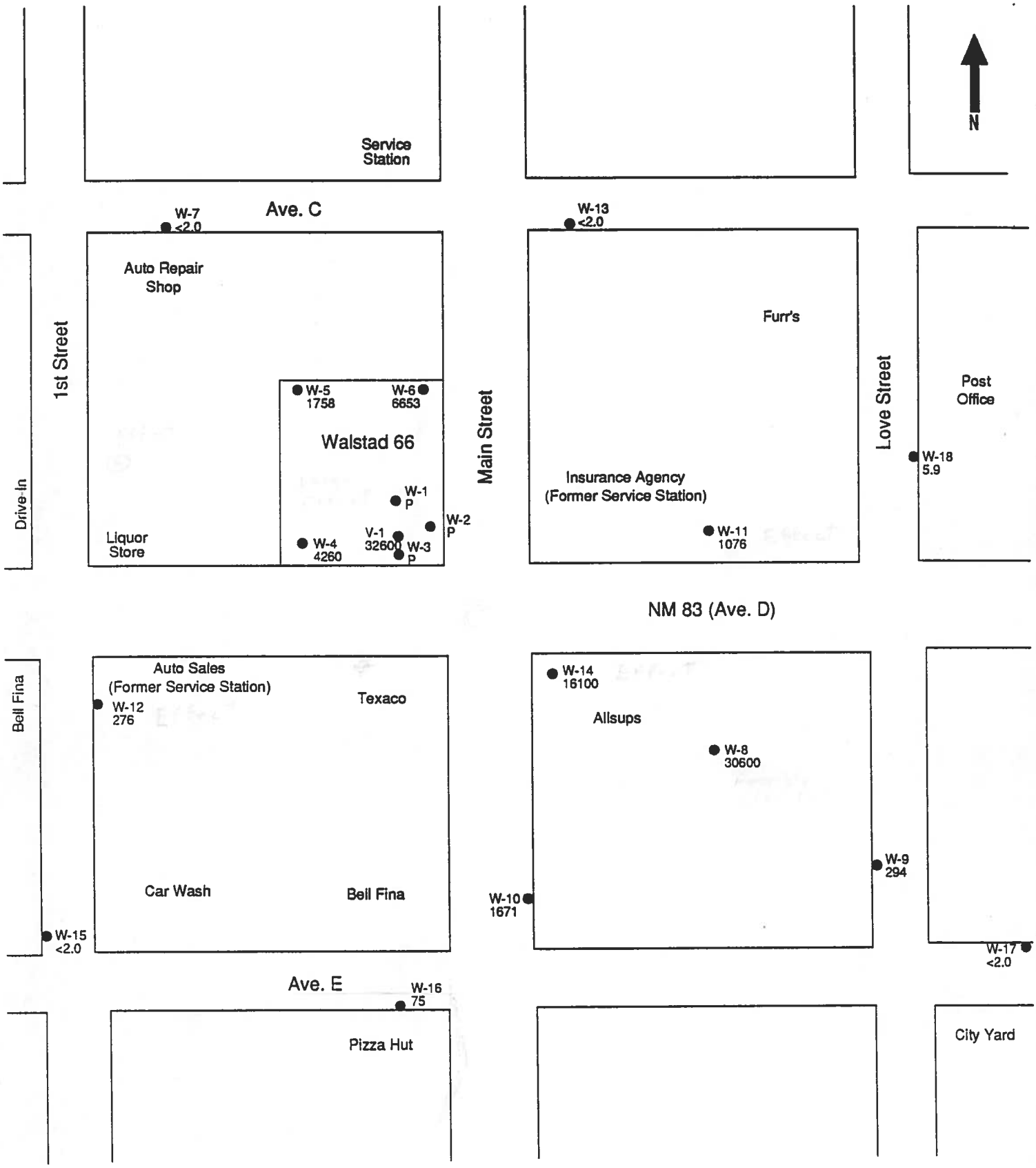
Scale (feet)

0 50 100 200

W-16 Monitor well
52 Dissolved-phase benzene in ppb

FIGURE 3

Highest Benzene Concentrations
Walstad Oil: Lovington, NM
Billings & Associates, Inc. June, 1993



Scale (feet)

0 50 100 200

W-16 Monitor well
52 Dissolved-phase BTEX in ppb

FIGURE 4

Highest Total BTEX
Walstad Oil: Lovington, NM
Billings & Associates, Inc. June, 1993

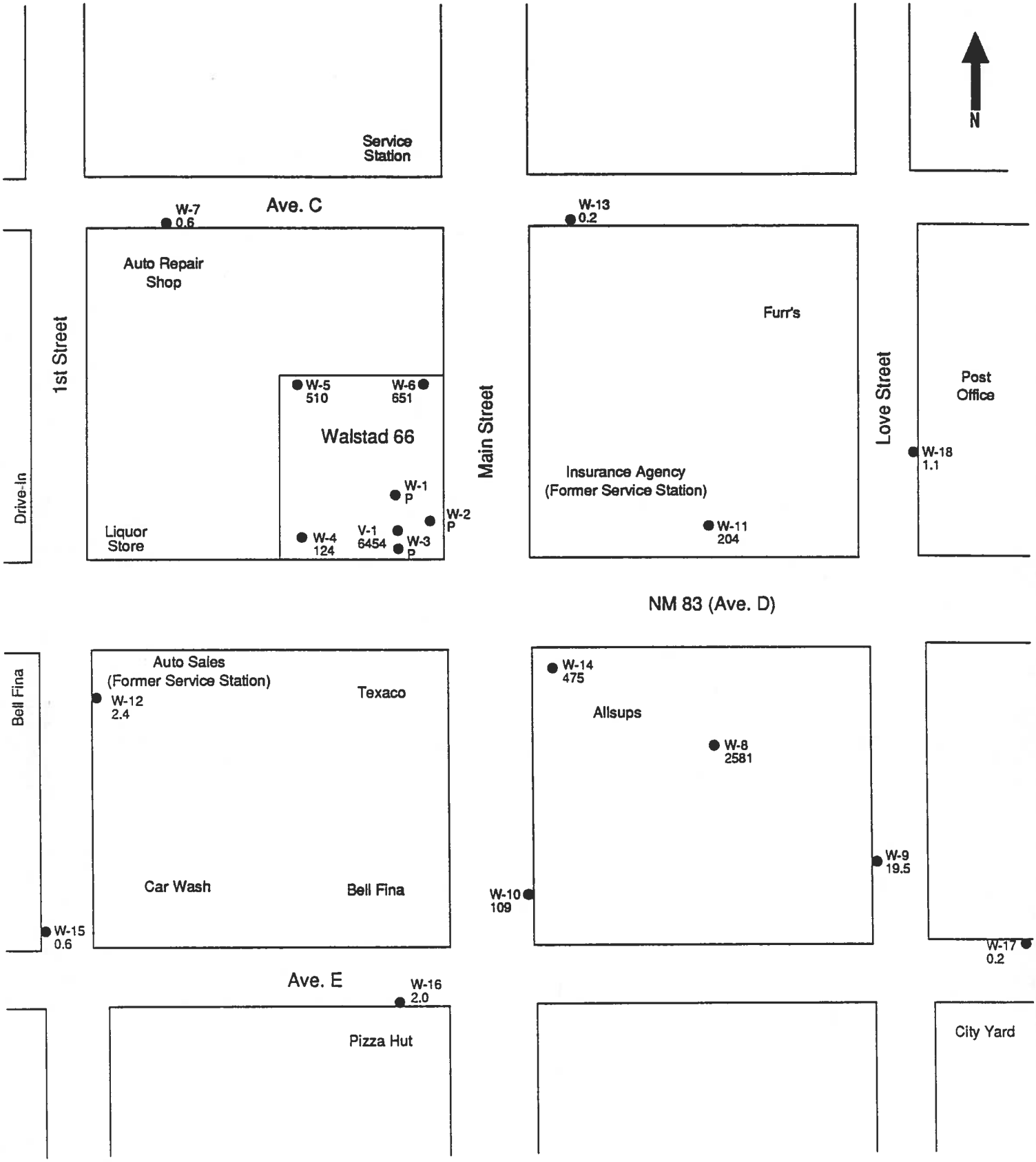


FIGURE 5

Water Headspace
Walstad Oil: Lovington, NM
Billings & Associates, Inc. June, 1993

Scale (feet)

0 50 100 200

W-16 Monitor well
52 Dissolved oxygen in mg/l

FIGURE 6

Dissolved Oxygen Concentrations
Walstad Oil: Lovington, NM
Billings & Associates, Inc. June, 1993

Appendices

Appendix A

Boring Logs

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-14
Location: SE corner of Main and NM 83

Installation Date: 5/25/93
Completion Depth: 67 ft. BGS
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
		*N			CONCRETE
0.5		*N			TOPSOIL, dark brown
2					
		*Y			CALICHE, soft, off-white mild HCA, 10-15'
30					CALICHE, hard, off-white
		*N			
38					SAND lens, lt. brown, fine grained
39		*N			
		*N			CALICHE, hard, off-white to tan
55					
		*N			SAND, medium to fine, lt brown

* Field Monitoring Point

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-15
Location: NW corner of 1st street and Ave E.

Installation Date: 5/25/93
Completion Depth: 67 ft. BGS
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
		*N			ASHPALT
0.3					
		*N			CALICHE, soft, off-white
25		*N			CALICHE, hard, off-white
30		*N			SAND, fine grained, lt. brown with <20% hard caliche
34		*N			CALICHE, very hard, slow drilling
38		*N			CALICHE, soft, off-white
39		*N			CALICHE, hard
41		*N			CALICHE, soft, white to tan
57		*N			SAND, medium to fine grained, lt. brown
67					

* Field Monitoring Point

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-16
Location: SW corner of Main and Ave E.

Installation Date: 5/25/93
Completion Depth: 67 ft. BGS
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
		*N			ASHPALT
0.3					
					CALICHE, soft, off-white
		*N			
15					
		*N			ROCK
16					
		*N			CALICHE, soft, off-white
26					
		*N			CALICHE, hard
28					
		*N			CALICHE, soft, off-white with 10% fine grained sand, lt. brown
35					
		*Y			SAND, fine grained angular, medium brown light "sweet" HCA
45					
		*N			CALICHE, hard and rock
50					
		*N			CALICHE, tan
54					
		*N			
		*N			SAND, medium to fine grained, lt. brown
67					

* Field Monitoring Point

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-17
Location: NE corner of Love and NM 83

Installation Date: 5/25/93
Completion Depth: 76 ft. BGS
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
		*N			CALICHE, soft, off-white
22		*N			CALICHE, hard
31		*N			CALICHE, soft, with 10% tan fine sand
36		*N			CALICHE, hard
45		*N			SAND, fine grained, lt. brown
48		*N			CALICHE, hard
51		*N			SAND, fine, lt. brown
52		*N			CALICHE, hard
53		*N			CALICHE, with 20% fine sand
59		*N			SAND, med. to fine grained sand, lt brown
67					

* Field Monitoring Point

Billings & Associates, Inc.

BORING LOG

Project No.: Walstad
Boring No.: W-18
Location: NE corner of Love and NM 83

Installation Date: 5/25/93
Completion Depth: 67 ft. BGS
By: Jim Griswold

Depth (ft)	Profile Sketch	Odor (y/n)	PID Field Data (ppm)	Lab Data TPH (ppm)	Description
0		*N			ASPHALT
0.3					
		*N			CALICHE, off-white
3					
		*N			CALICHE, with 15% fine sand, lt. brown
21					
		*N			CALICHE, off-white to tan
37					
		*N			CALICHE, hard, stringers
42					
		*N			SAND, fine grained, lt. brown
45					
					CALICHE, soft, tan
		*N			
56					
					SAND, fine to medium grained, lt brown
		*N			
67					

* Field Monitoring Point

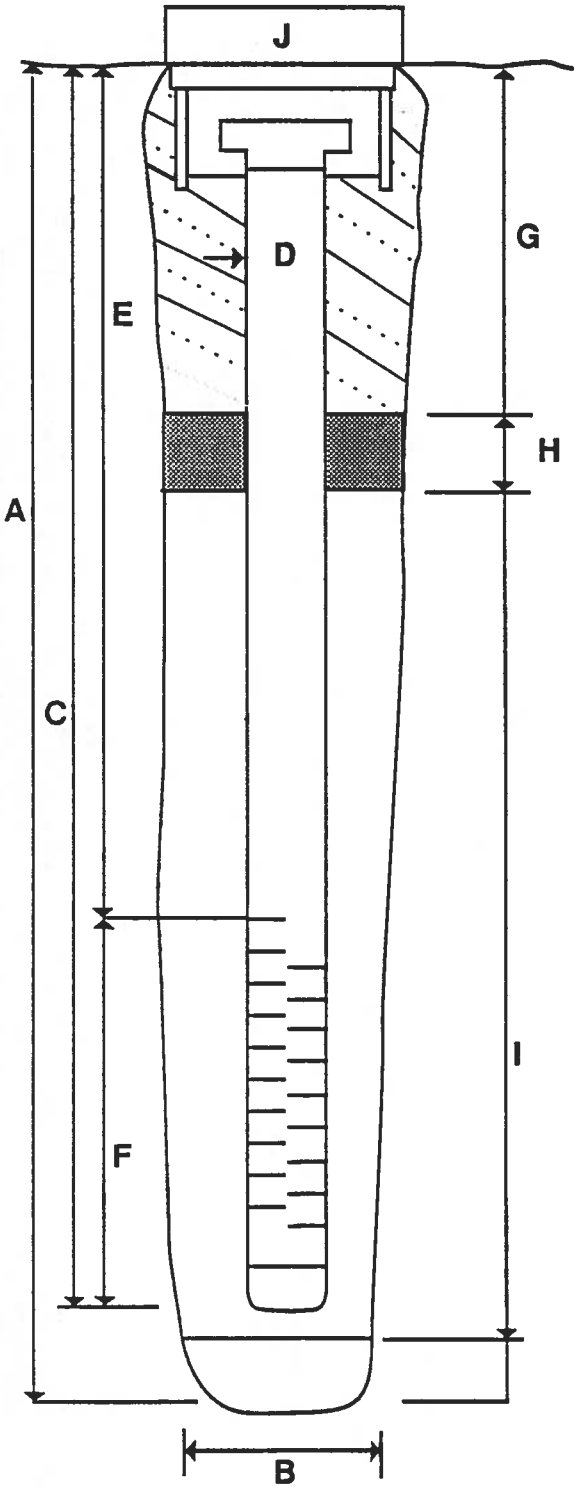
Well Details

Billings & Associates, Inc.

WELL DETAILS

Project Name: Walstad
Well No.: W-14

Casing Elevation: 98.54
Completion Date: 5/25/93
By: Jim Griswold



A. Total depth: 67 feet

B. Boring Diameter: 4.25 inches

Drilling method: Air Rotary

C. Casing Length: 64.5 feet

Material: PVC Flush thread

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 feet

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 7 feet

Seal Material: Grout

H. Pack Seal: 52 feet-54 feet

Seal Material: Bentonite

I. Gravel Pack: 54 feet to 67 feet

Pack Material: Silica sand

Size: 10-18 mesh

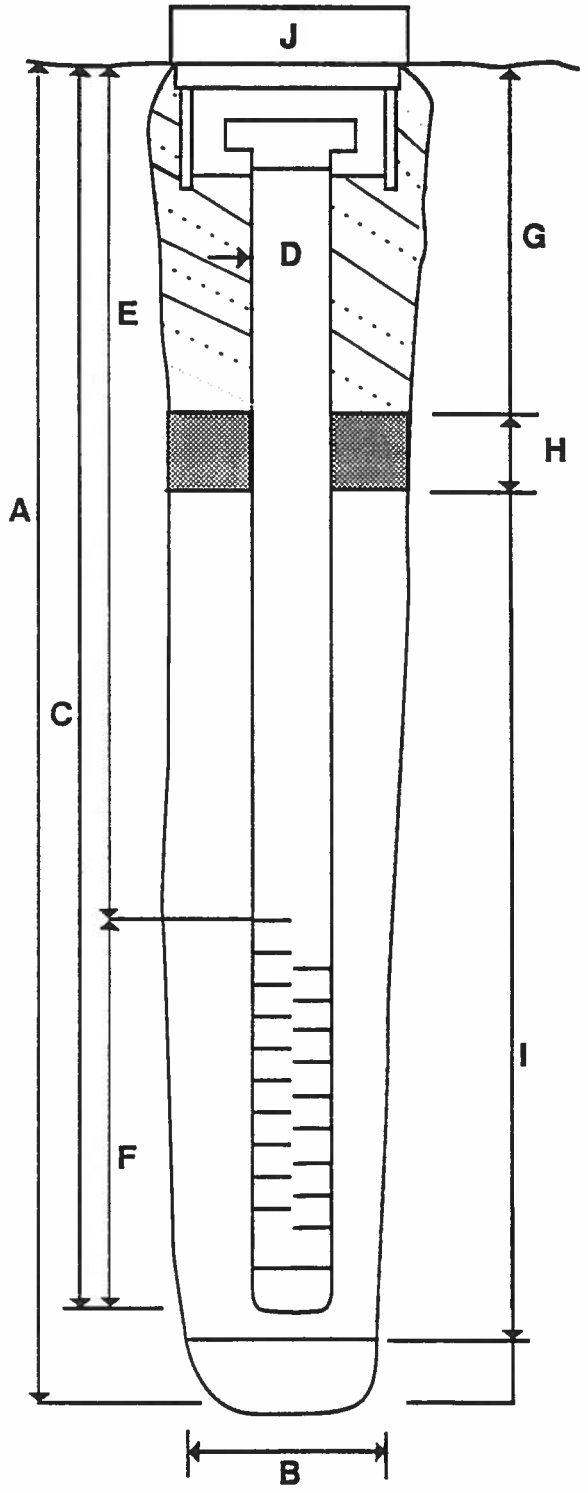
J. Surface Mount: 8 inch Flush mount

Billings & Associates, Inc.

WELL DETAILS

Project Name: Walstad
Well No.: W-15

Casing Elevation: 98.49
Completion Date: 5/25/93
By: Jim Griswold



A. Total depth: 67 feet

B. Boring Diameter: 4.25 inches

Drilling method: Air Rotary

C. Casing Length: 64.5 feet

Material: PVC Flush thread

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 feet

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 6.5 feet

Seal Material: Grout

H. Pack Seal: 52 feet-54 feet

Seal Material: Bentonite

I. Gravel Pack: 54 feet to 67 feet

Pack Material: Silica sand

Size: 10-18 mesh

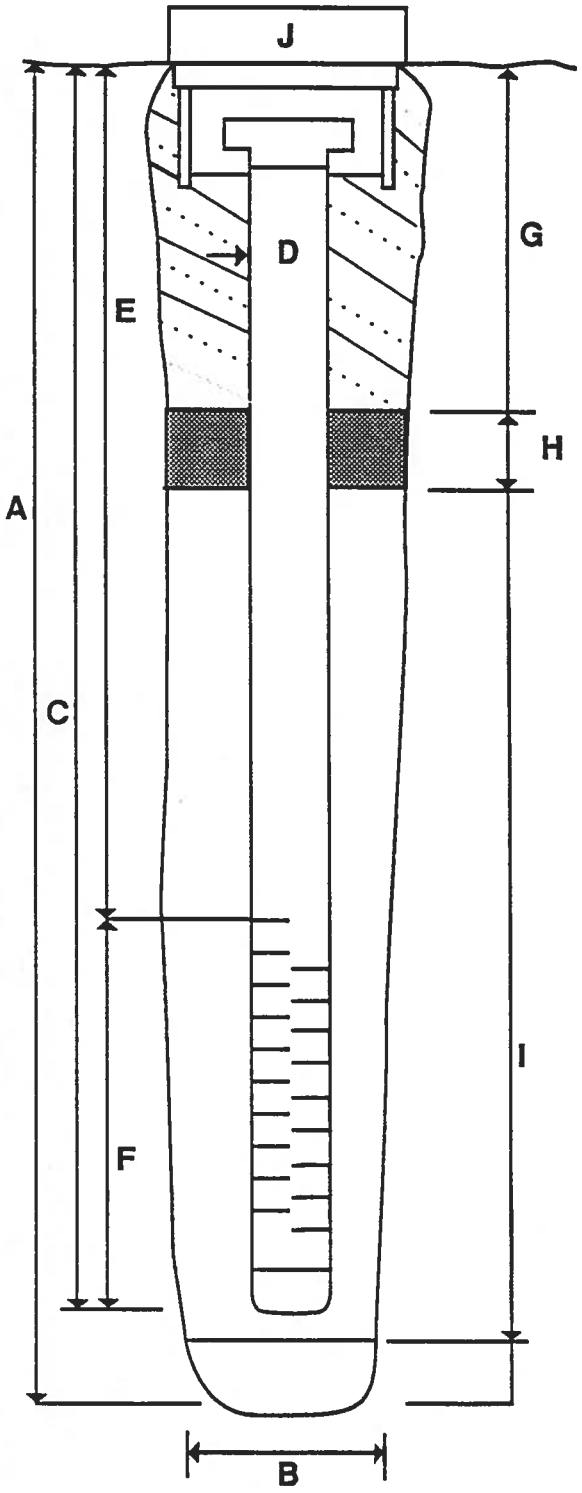
J. Surface Mount: 8 inch Flush mount

Billings & Associates, Inc.

WELL DETAILS

Project Name: Walstad
Well No.: W-16

Casing Elevation: 97.44
Completion Date: 5/25/93
By: Jim Griswold



A. Total depth: 67 feet

B. Boring Diameter: 4.25 inches

Drilling method: Air Rotary

C. Casing Length: 64.5 feet

Material: PVC Flush thread

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 feet

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 7 feet

Seal Material: Grout

H. Pack Seal: 51 feet-53 feet

Seal Material: Bentonite

I. Gravel Pack: 53 feet to 67 feet

Pack Material: Silica sand

Size: 10-18 mesh

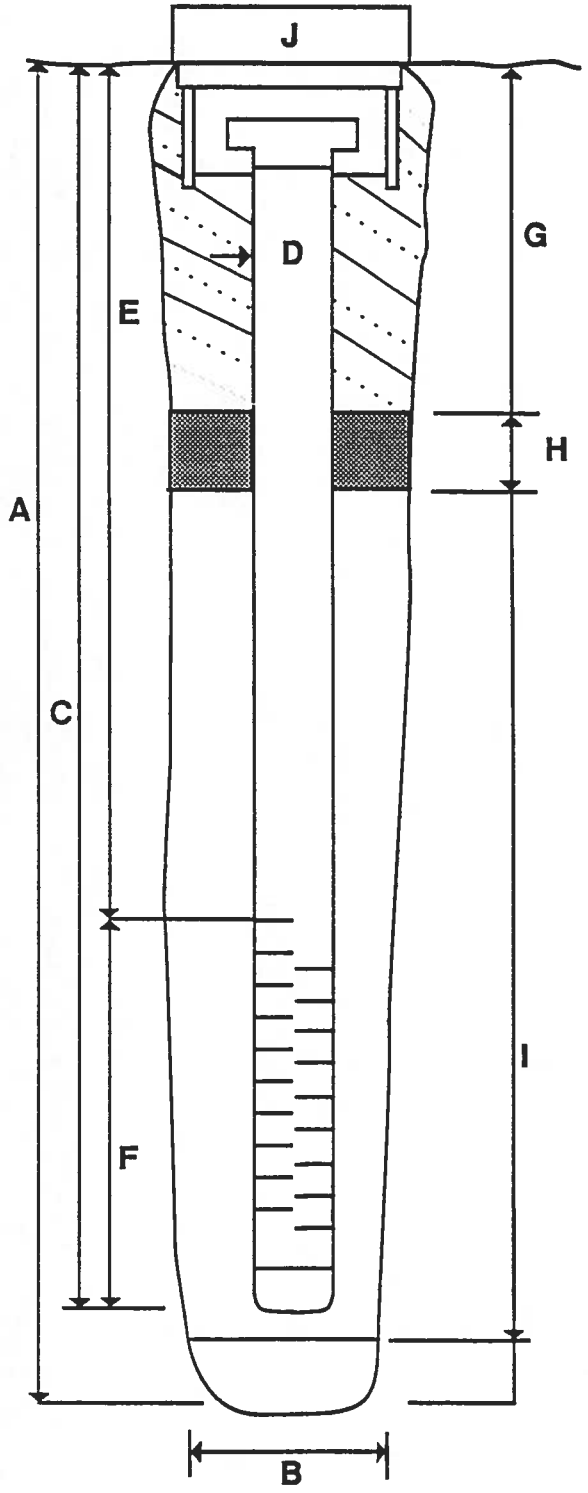
J. Surface Mount: 8 inch Flush mount

Billings & Associates, Inc.

WELL DETAILS

Project Name: Walstad
Well No.: W-17

Casing Elevation: 96.94
Completion Date: 5/25/93
By: Jim Griswold



A. Total depth: 67 feet

B. Boring Diameter: 4.25 inches

Drilling method: Air Rotary

C. Casing Length: 64.5 feet

Material: PVC Flush thread

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 feet

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 7 feet

Seal Material: Grout

H. Pack Seal: 52 feet-54 feet

Seal Material: Bentonite

I. Gravel Pack: 54 feet to 67 feet

Pack Material: Silica sand

Size: 10-18 mesh

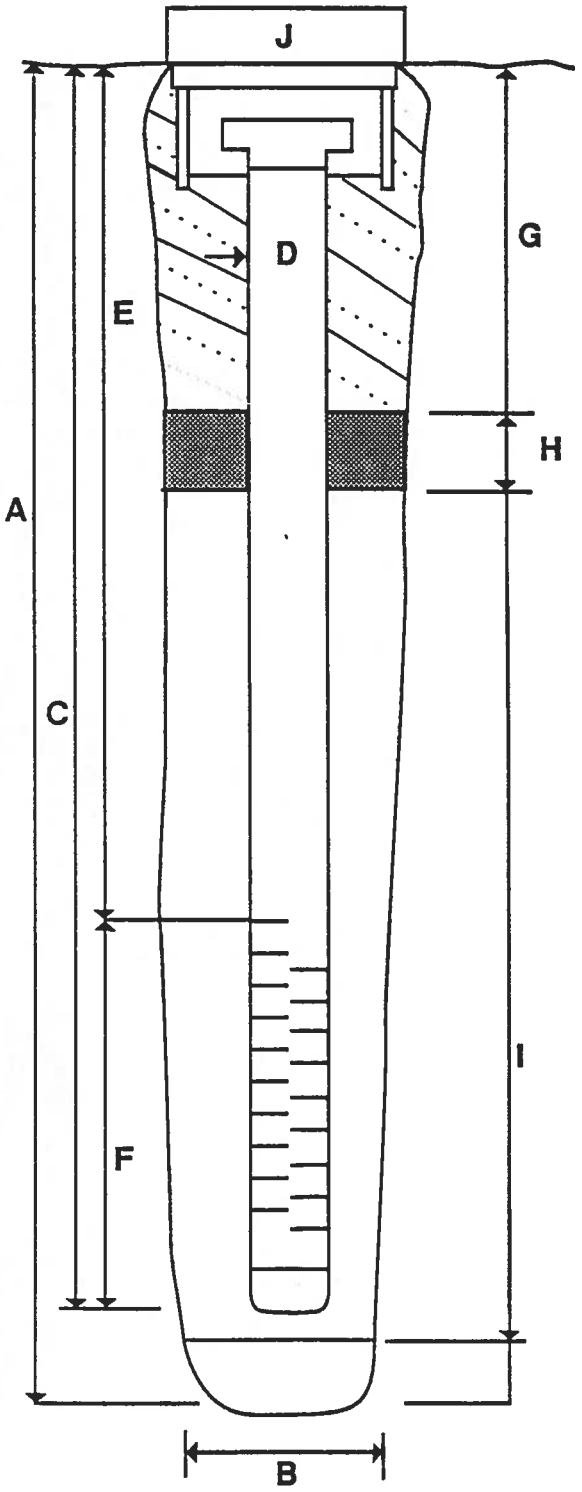
J. Surface Mount: 8 inch Flush mount

Billings & Associates, Inc.

WELL DETAILS

Project Name: Walstad
Well No.: W-18

Casing Elevation: 98.26
Completion Date: 5/25/93
By: Jim Griswold



A. Total depth: 67 feet

B. Boring Diameter: 4.25 inches

Drilling method: Air Rotary

C. Casing Length: 64.5 feet

Material: PVC Flush thread

D. Casing Diameter: 2 inch

E. Depth to Perforations: 55 feet

F. Perforated Length: 10 feet

Perforated Interval: 55 feet to 65 feet

Perforation Type: Factory slot

Perforation Size: .020

G. Surface Seal: 0 foot to 6 feet

Seal Material: Grout

H. Pack Seal: 52 feet-54 feet

Seal Material: Bentonite

I. Gravel Pack: 54 feet to 67 feet

Pack Material: Silica sand

Size: 10-18 mesh

J. Surface Mount: 8 inch Flush mount

Water Table Elevation Data

Water Table Elevation Data
Walstad Oil
Lovington, NM

Well	Date	TOC Elevation (feet)	Depth to Water (feet)	Water Table Elevation (feet)
W-1	6/24/92	100.00	product	
	8/28/92		product	
	5/24/93		product	
W-2	6/24/92	99.12	product	
	8/28/92		product	
	5/24/93		product	
W-3	6/24/92	99.13	product	
	8/28/92		product	
	5/24/93		product	
W-4	6/24/92	99.62	57.04	42.58
	8/28/92		56.69	42.93
	5/25/93		56.48	43.14
W-5	6/24/92	100.41	57.59	42.82
	8/28/92		57.24	43.17
	5/26/93		57.02	43.39
W-6	6/24/92	99.48	56.97	42.51
	8/28/92		56.64	42.84
	5/26/93		56.49	42.99
W-7	8/28/92	100.07	56.29	43.78
	5/25/93		55.96	44.11
W-8	8/28/92	98.69	57.24	41.45
	5/25/93		57.20	41.49
W-9	8/28/92	97.47	56.76	40.71
	5/25/93		56.74	40.73
W-10	8/28/92	97.85	56.18	41.67
	5/26/93		55.80	42.05
W-11	8/28/92	98.66	56.82	41.84
	5/26/93		56.85	41.81

Water Table Elevation Data (page 2)
Walstad Oil
Lovington, NM

Well	Date	TOC Elevation (feet)	Depth to Water (feet)	Water Table Elevation (feet)
W-12	8/29/92	99.34	56.28	43.06
	5/26/93		55.96	43.38
W-13	8/29/92	99.07	56.36	42.71
	5/26/93		56.25	42.82
W-14	5/26/93	98.54	56.26	42.28
W-15	5/26/93	98.49	55.40	43.09
W-16	5/26/93	97.44	55.52	41.92
W-17	5/26/93	96.94	56.86	40.08
W-18	5/26/93	98.26	56.79	41.48
V-1	8/29/92	99.37	56.68	42.69
	5/25/93		56.74	42.63

TOC - Top of Casing

All elevations are relative to monitoring well W-1, which was arbitrarily set to to an elevation of 100.00 feet.

Organic Water Quality

Organic Water Quality Data
Walstad Oil
Lovington, NM

All values are in parts per billion (ppb)

Well	Date	Benzene	Toluene	Ethyl-benzene	Total Xylenes	MTBE
W-4	6/24/92	200	53	21	40	<5.0
	8/28/92	1400	430	95	300	<2.5
	5/25/93	2500	980	310	470	<63
W-5	6/24/92	470	250	41	290	<10
	8/28/92	850	400	58	450	3.3
W-6	6/24/92	1400	1200	48	500	<25
	8/28/92	3000	2700	93	860	<2.5
W-7	8/28/92	<0.5	<0.5	<0.5	<0.5	<2.5
	5/25/93	<0.5	<0.5	<0.5	<0.5	<2.5
W-8	8/28/92	8000	9500	690	5200	<2.5
	5/25/93	12000	8300	1500	8800	<250
W-9	8/28/92	130	8.2	16	140	<2.5
	5/25/93	100	6.3	2.5	170	<5.0
W-10	8/28/92	1100	11	120	440	<2.5
W-11	8/28/92	770	13	13	280	<2.5
W-12	8/29/92	87	6.1	2.6	180	<2.5
W-13	8/29/92	<0.5	<0.5	<0.5	<0.5	<2.5
W-14	5/26/93	6600	4300	1200	4000	<125
W-15	5/26/93	<0.5	<0.5	<0.5	<0.5	<2.5
W-16	5/26/93	52	<0.5	7.9	15	<2.5
W-17	5/26/93	<0.5	<0.5	<0.5	<0.5	<2.5
W-18	5/26/93	1.6	1.8	<0.5	2.0	<2.5
V-1	8/29/92	250	680	240	810	<2.5
	5/25/93	5000	14000	3000	10000	600

Recent Laboratory Analysis Report

Hall Environmental Analysis Laboratory

Hall Environmental Analysis Laboratory
2403 San Mateo N.E., Suite P-13
Albuquerque, N.M. 87110
(505) 880-1803

6/2/93

Billings and Associates, Inc.
3816 Academy Parkway N.E.
Albuquerque, N.M. 87109

Dear Mr. Jim Griswold,

Enclosed are the results for the analyses that were requested. These were done according to E.P.A. procedures or the equivalent.

Please don't hesitate to contact me for any additional information or clarifications.

Sincerely,

Scott Hallenbeck 6/2/93

Scott Hallenbeck, Lab Manager

Project: Walstad

Results for sample : V-1

Date collected: 5/25/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-1
Project Manager: Jim Griswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	600	PPB (UG/L)
Benzene	5,000	PPB (UG/L)
Toluene	14,000	PPB (UG/L)
Ethyl Benzene	3,000	PPB (UG/L)
Total Xylene	10,000	PPB (UG/L)

BFB (Surrogate) Recovery = 112 %

Dilution Factor = 5

Results for sample : W-4

Date collected: 5/25/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-2
Project Manager: Jim Griswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<63	PPB (UG/L)
Benzene	2,500	PPB (UG/L)
Toluene	980	PPB (UG/L)
Ethyl Benzene	310	PPB (UG/L)
Total Xylene	470	PPB (UG/L)

BFB (Surrogate) Recovery = 102 %

Dilution Factor = 20

Results for sample : W-7

Date collected: 5/25/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-3
Project Manager: Jim Griswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	<0.5	PPB (UG/L)
Toluene	<0.5	PPB (UG/L)
Ethyl Benzene	<0.5	PPB (UG/L)
Total Xylene	<0.5	PPB (UG/L)

BFB (Surrogate) Recovery = 108 %

Dilution Factor = 1

Results for sample : W-8

Date collected: 5/25/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-4
Project Manager: Jim Griswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<250	PPB (UG/L)
Benzene	12,000	PPB (UG/L)
Toluene	8,300	PPB (UG/L)
Ethyl Benzene	1,500	PPB (UG/L)
Total Xylene	3,300	PPB (UG/L)

BFB (Surrogate) Recovery = 108 %

Dilution Factor = 100

Results for sample : W-9

Date collected: 5/25/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-5
Project Manager: Jim Griswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<5.0	PPB (UG/L)
Benzene	100	PPB (UG/L)
Toluene	6.3	PPB (UG/L)
Ethyl Benzene	2.5	PPB (UG/L)
Total Xylene	170	PPB (UG/L)

BFB (Surrogate) Recovery = 90 %

Dilution Factor = 2

Results for sample : W-14

Date collected: 5/26/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-6
Project Manager: Jim Griswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<125	PPB (UG/L)
Benzene	6,600	PPB (UG/L)
Toluene	4,300	PPB (UG/L)
Ethyl Benzene	1,200	PPB (UG/L)
Total Xylene	4,000	PPB (UG/L)

BFB (Surrogate) Recovery = 105 %

Dilution Factor = 50

Results for sample : W-15

Date collected: 5/26/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-7
Project Manager: Jim Giswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	<0.5	PPB (UG/L)
Toluene	<0.5	PPB (UG/L)
Ethyl Benzene	<0.5	PPB (UG/L)
Total Xylene	<0.5	PPB (UG/L)

BFB (Surrogate) Recovery = 90 %

Dilution Factor = 1

Results for sample : W-16

Date collected: 5/26/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-8
Project Manager: Jim Griswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	52	PPB (UG/L)
Toluene	<0.5	PPB (UG/L)
Ethyl Benzene	7.9	PPB (UG/L)
Total Xylene	15	PPB (UG/L)

BFB (Surrogate) Recovery = 103 %

Dilution Factor = 1

Results for sample : W-17

Date collected: 5/26/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-9
Project Manager: Jim Griswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	<0.5	PPB (UG/L)
Toluene	<0.5	PPB (UG/L)
Ethyl Benzene	<0.5	PPB (UG/L)
Total Xylene	<0.5	PPB (UG/L)

BFB (Surrogate) Recovery = 109 %

Dilution Factor = 1

Results for sample : W-18

Date collected: 5/26/93 Date received: 5/28/93
Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: 930530-10
Project Manager: Jim Griswold Sampled by: JEG
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	1.6	PPB (UG/L)
Toluene	1.8	PPB (UG/L)
Ethyl Benzene	<0.5	PPB (UG/L)
Total Xylene	2.0	PPB (UG/L)

BFB (Surrogate) Recovery = 106 %

Dilution Factor = 1

Results for QC: Reagent Blank

Date extracted: NA Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad HEAL #: RB 5/31
Project Manager: Jim Griswold
Matrix: Aqueous

Method: EPA 602

Compound	Amount	Units
MTBE	<2.5	PPB (UG/L)
Benzene	<0.5	PPB (UG/L)
Toluene	<0.5	PPB (UG/L)
Ethyl Benzene	<0.5	PPB (UG/L)
Total Xylene	<0.5	PPB (UG/L)

BFB (Surrogate) Recovery = 91 %

Dilution Factor = 1

Results for QC: Matrix Spike/Matrix Spike Dup

Date extracted: NA — Date injected: 5/31/93
Client: Billings and Associates, Inc.
Project Name: Walstad — HEAL #: 930525-3 MS/MSD
Project Manager: Jim Griswold — Sampled by: NA
Matrix: Aqueous

Method: EPA 602

Compound	Sample Result	Amount Added	Matrix Spike	MS %	MS Dup	MSD %	RPD
MTBE	<2.5	40.0	43.8	110	46.2	116	5
Benzene	<0.5	20.0	23.0	115	23.2	116	1
Toluene	<0.5	20.0	22.5	113	23.0	115	2
Ethyl Benzene	<0.5	20.0	21.5	108	21.8	109	1
Total-Xylenes	<0.5	60.0	65.4	109	66.6	111	2

HALL ENVIRONMENTAL ANALYSIS LABORATORY
2403 SAN MATEO NE, SUITE P-13 • ALBUQUERQUE, NM 87110 • (550) 880-1803

CHAIN-OF-CUSTODY RECORD

ANALYSIS REQUEST

CLIENT: Billings + Assoc., Inc.	**PROJECT MANAGER:** Jim Griswold
ADDRESS: 3816 Academy Pky NNE Albq. NM 87109	**PHONE #:** 345-1116
	FAX #:
PROJECT NAME: Walstad	**SAMPLER:** JEG
	PROJECT #:

DATE	TIME	MATRIX	SAMPLE I.D. NO.	NUMBER/ VOLUME	PRESERVATIVE $HgCl_2$	PRESERVATIVE HgCl	PRESERVATIVE OTHER
5/25/93	10:21	Water	W-1	2@40ml	✓		
5/25/93	14:00		W-4		✓		
5/25/93	16:30		W-7		✓		
5/25/93	18:00		W-8		✓		
5/25/93	18:10		W-9		✓		
5/26/93	11:14		W-14		✓		
5/26/93	12:37		W-15		✓		
5/26/93	11:50		W-16		✓		
5/26/93	13:10		W-17		✓		
5/26/93	10:30		W-18		✓		

BTEX (METHOD 602)	BTEX + MTBE (602)	TEH (METHOD 8015 MOD)	BTEX + TEH COMBINATION	TPH (METHOD 418.1)	601/602 VOLATILES	EDB (METHOD 504.1)	EDC	610 (PNA OR PAH)		AIR BUBBLES OR HEADSPACE (Y OR N)	SAMPLES COLD: (Y or N)	HEAL#
	✓									N	Y	930530-1
	✓									N		-2
	✓									N		-3
	✓									N		-4
	✓									N		-5
	✓									N		-6
	✓									N		-7
	✓									N		-8
	✓									N		-9
	✓									N		-10

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY:
	5/28/93	1400	
RELINQUISHED BY: (Signature)	**DATE:**	**TIME:**	**RECEIVED BY:**

REMARKS: