Chevron #9-9014 (Minnesota)

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SHANNON & WILSON, INC.

GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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JUL 03 2000
Dept. of Environmental Conservation
Underground Storage Tanks — FAP

June 28, 2000

Williams Express, Inc.
1101 Kermit Drive, Suite 800
Nashville, Tennessee 37217-5111

Attn: Mr. Gregory Stephenson, P.G.

RE: GROUNDWATER PLUME CHARACTERIZATION AND LIMITED CORRECTIVE ACTION PLAN, WILLIAMS EXPRESS STORE NO. 5030, 3727 SPENARD ROAD, ANCHORAGE, ALASKA

ADEC File No. L30.30; FacID No. 2884

This letter report presents the results of our groundwater plume characterization activities conducted at Williams Express Store No. 5030 (WES No. 5030), 3727 Spenard Road, Anchorage, Alaska. Results of the monitoring well installation and sampling efforts were considered in conjunction with a limited document review and source area evaluation to identify site-specific remedial objectives and develop a corrective action plan. A vicinity map of the area is included as Figure 1, and a site map depicting pertinent site features is provided as Figure 2. Verbal authorization to proceed on this project was received from Mr. Gregory Stephenson of Williams Express, Inc. (Williams) on March 29, 2000.

BACKGROUND

The WES No. 5030 facility was constructed in 1992. The filling station stores gasoline product in four underground storage tanks (USTs) located near the site's northeast corner. Previous assessment work at this site includes a 1991 preaquisition site assessment, a 1991 UST closure assessment, and a June 1999 UST release investigation. Brief summaries of these efforts are included in the following paragraphs. Locations of the current WES No. 5030 UST array and dispenser islands, former Bunker C fuel UST, and other pertinent site features are shown on Figure 2.

Shannon & Wilson conducted a Preaquisition Site Assessment (PSA) for Williams in June 1991. Soil and groundwater samples were collected from six soil borings, shown on Figure 2 as TH1 through TH6. Laboratory analyses indicated elevated concentrations of diesel range organic compounds (DRO), gasoline range organic compounds (GRO), benzene, and 1,2-dichloroethane in the site's soil and groundwater. The PSA literature and records review identified several potential off-site sources of the petroleum hydrocarbons. The nearest potential sources were located approximately 100 feet north of the WES No. 5030 site at the properties occupied by Thrifty Rent-A-Car and a Chevron Service Station. Both sites were listed on the Alaska Department of Environmental Conservation (ADEC) Contaminated Sites database system

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in 1991, presumably due to impacted soils and groundwater associated with gasoline and diesel USTs in use at that time. A third filling station was identified to the northeast of WES No. 5030, on the property currently occupied by a Skipper's restaurant. The few details provided for this site were based largely on a review of aerial photographs, which indicated the filling station operated for an unknown duration between 1959 and 1980. Locations of the three potential source areas relative to WES No. 5030 are shown on Figures 1 and 2.

A 2,500-gallon UST was removed from the site's southwest corner in September 1991. The tank was apparently used to store Bunker C heating fuel, but was likely abandoned after the site was supplied with natural gas in 1963. Confirmation soil samples collected during the 1991 closure assessment contained maximum hydrocarbon concentrations of 141 ppm DRO and 113 ppm total petroleum hydrocarbons (TPH), and did not contain detectable GRO, benzene, toluene, ethylbenzene, and xylene (BTEX) constituents.

Site characterization work conducted since 1991 has confirmed the presence of impacted soil and groundwater at WES No. 5030. In June and July 1999, a release investigation was conducted to assess potentially impacted soil encountered during tank upgrade activities. As part of this effort, about 120 cubic yards of impacted soil were excavated from the north end of the UST array and transported off-site for treatment and disposal. Analytical soil samples collected from the excavation base at 7 to 9.5 feet below the ground surface (bgs) contained elevated GRO and BTEX constituent concentrations, with the highest concentrations measured in the soil samples collected between the USTs. The extent of impacted soil was not determined, although samples collected 5 to 10 feet north of the UST array exhibited a concentration reduction of two or three orders of magnitude. These results indicate that product migration through the coarse-grained soil was likely characterized primarily by vertical infiltration with a relatively limited lateral component. The impacted soil may therefore be confined to the immediate vicinity of the UST array, despite GRO concentrations up to 9,670 ppm remaining in the soil between the tanks. Moreover, the residual hydrocarbons in the soil may have limited mobility due to the overlying pavement that inhibits precipitation infiltration. As a precautionary measure, two horizontal vapor extraction lines were placed in the excavation, approximately 8 feet bgs. A detailed site map showing the excavation limits and vapor extraction lines is provided as Figure 3.

To evaluate the potential impact to groundwater, three monitoring wells were installed in July 1999. As shown on Figure 2, Monitoring Well B1MW was placed within the zone of impacted soil excavated in June 1999, and Wells B2MW and B3MW were positioned to assess downgradient areas. Soil and groundwater samples collected from two of the three monitoring well borings contained elevated GRO and BTEX constituents. Although Monitoring Well B1MW was placed within the area of impacted soil excavation, the highest hydrocarbon concentrations were measured in the groundwater sample collected from Monitoring Well B2MW, located about 50 feet west of the Williams UST array. Well B2MW is not directly downgradient from the on-site UST array, based on the southwesterly groundwater flow direction

measured in August 1999. In contrast, the August 1999 groundwater sample from Well B3MW, which *is* located downgradient of the Williams UST array, did not contain detectable GRO or BTEX constituents. Previous studies conducted for the WES No. 5030 site and adjacent properties have indicated different groundwater flow directions. In 1991, the on-site flow direction was reportedly measured to the southeast. Work conducted at the Chevron site to the north of WES No. 5030 reportedly indicated a flow direction to the south-southwest. Due to uncertainties regarding groundwater flow direction, it was not previously established whether the elevated hydrocarbon levels observed in B2MW are attributable to the on-site UST array and/or other potential sources.

PURPOSE AND OBJECTIVES

The purpose of the May 2000 project was to develop a remedial strategy to address impacted soil and groundwater at WES No. 5030. Specific data collection objectives consisted of the following:

1. characterize the impacted groundwater plume by determining flow direction, concentration gradient, and leading edge location;
2. evaluate potential source area(s); and
3. collect natural attenuation parameters and other data necessary to evaluate remedial action alternatives.

The site characterization results and document review effort were used to develop conclusions regarding plume properties and likely source areas. These conclusions in turn formed the basis of our site-specific remedial objectives and subsequent corrective action recommendations.

FIELD ACTIVITIES

Field activities performed or directed by Shannon & Wilson included drilling groundwater monitoring wells, field screening, monitoring well development and surveying, collecting analytical soil and groundwater samples, and coordination with the project laboratory for analytical testing. Summaries of these field activities are provided in the following sections. Under subcontract to Shannon & Wilson, Discovery Drilling (Discovery) provided personnel and equipment to advance the borings, install the monitoring wells, and transport soil cuttings to Alaska Soil Recycling (ASR) for thermal desorption. Under subcontract to Williams, CT&E Environmental Services, Inc. (CT&E) and Southern Petroleum Laboratories (SPL) provided laboratory analyses of the soil and groundwater samples. A work plan for this project was submitted to the ADEC, and approved on April 14, 2000 by Ms. Lynne Bush.

Soil Borings

Three soil borings, designated Borings B4, B5, and B6, were advanced on May 8, 2000. Approximate locations of the three borings are shown on Figure 2 as Monitoring Wells B4MW, B5MW, and B6MW. The monitoring well locations were selected to measure background groundwater conditions, evaluate contributions of potential off-site sources to the impacted groundwater plume, and to estimate plume dimensions. The three borings were advanced to depths ranging from approximately 17 to 18 feet bgs. Groundwater was encountered at about 14 feet bgs in each boring. Drill cuttings were containerized in three 55-gallon open-top drums, which were subsequently transported to ASR for thermal desorption.

Soil samples were obtained from Borings B4, B5, and B6 at approximately 5-foot intervals in the top 10 feet bgs, and at 2.5-foot intervals between ten feet bgs and the groundwater contact. Samples were collected using a 3-inch outside-diameter (OD) split-spoon sampler placed in the hollow drill stem and driven approximately 18 inches into undisturbed soil beneath the drill auger. Each of the twelve soil samples was visually classified and screened using an OVM 580B photoionization detector (PID) calibrated with 100 ppm of isobutylene standard gas.

Eight soil samples from the three borings were submitted for laboratory analyses. Samples were selected to evaluate the hydrocarbon distribution throughout the soil profile and to measure the soil's total organic carbon (TOC) content. The two soil samples from each borehole exhibiting the highest headspace reading were submitted for hydrocarbon analyses. It is significant to note that the highest headspace readings for each boring were measured in samples collected from the saturated soil directly above the silt interface at about 16.5 feet bgs, or from the adjacent sampling interval of 12.5 to 14 feet bgs. Two TOC samples were selected based on low headspace readings and representation of the site's range of soil types. Analytical soil samples were placed in the laboratory-supplied containers using a clean stainless-steel spoon. Soil samples for volatile hydrocarbon analyses were extracted in the field using 25-ml aliquots of methanol, in accordance with Alaska Method 101 (AK 101). The number, depth, field screening readings, and classification of the project's field screening and analytical soil samples are summarized in Table 1 and on Figures 5, 6, and 7.

Monitoring Well Installation, Development and Sampling

The three soil borings were completed as Monitoring Wells B4MW, B5MW, and B6MW. The wells were constructed of 2-inch nominal inside diameter (ID) schedule 40 PVC pipe with threaded connections. The bottom 10 feet of each well is constructed of a PVC well screen with 0.010-inch slots. The screened casing sections were placed at a depth interval of 8 to 18 feet bgs in B5MW and B6MW, and about 7 to 17 feet bgs in B4MW. The well screen intervals were selected both to encompass the interval of anticipated groundwater fluctuation, and to avoid

penetrating the silty soil stratum by more than 1.5 feet. Monitoring well construction details for B4MW, B5MW, and B6MW, including depths of placement and packing materials, are shown on Figures 8, 9, and 10, respectively.

Monitoring Wells B4MW, B5MW, and B6MW were developed and sampled on May 15, 2000, in accordance with ADEC guidelines. Using a Whale submersible pump, approximately 30 gallons of groundwater were removed from each of the three new monitoring wells. The water produced during development was transported and discharged to the water treatment system located at the former WES No. 5021, 6010 Old Seward Highway. Water quality parameters, including pH, temperature, dissolved oxygen (DO), turbidity, conductivity, and ferrous (dissolved) iron, were measured at 5-gallon intervals during the development process. The development details are listed in Table 2.

Immediately following development, groundwater samples were collected from Monitoring Wells B4MW, B5MW, and B6MW using a Whale submersible pump. In addition, groundwater samples from Monitoring Wells B1MW, B2MW, and B3MW were collected using a polyethylene disposable bailer. Prior to sample collection, Monitoring Wells B1MW, B2MW, and B3MW were purged of at least three well volumes. Water quality parameters, including pH, temperature, DO, turbidity, and conductivity, were measured prior to groundwater sample collection from Monitoring Wells B1MW through B6MW. Water quality results are shown in Table 2. Purgewater from B1MW, B2MW, and B3MW was transported to the former WES No. 5021 for discharge in that site's water treatment system.

LABORATORY ANALYSES

Using chain-of-custody procedures, soil and groundwater samples were transferred to the project laboratories in coolers with ice packs. The analytical results are listed in Table 3 and on Figure 2. Detailed laboratory reports from CT&E and SPL included in Attachments 1 and 2, respectively.

Soil samples were submitted to CT&E for hydrocarbon, lead, and TOC analyses. Samples B4S3, B4S4, B5S3, B5S4, B6S3 and B6S4 were analyzed for GRO by AK 101 and BTEX by Environmental Protection Agency (EPA) Method 8021B as modified by AK 101. Samples B4S4, B5S4, and B6S4 were also analyzed for total lead by EPA Method 6010B, and Samples B5S2 and B6S2 were analyzed for TOC using CT&E's TOC standard operating procedure (SOP).

Soil Samples B5S4 and B6S2 were submitted to Shannon & Wilson's geotechnical laboratory for sieve analysis by American Society of Testing and Materials (ASTM) Method D 422-63. The sieve analysis results are shown on Figure 11.

The groundwater samples from Monitoring Wells B1MW through B6MW were submitted to SPL for hydrocarbon analyses and to CT&E for natural attenuation parameters. Each sample was analyzed for GRO by AK 101, BTEX by EPA Method 602, nitrates and sulfates by EPA Method 300.0, and methane by ASTM Method D-1945M.

SUBSURFACE CONDITIONS

Soil conditions documented during drilling are recorded on the boring logs, included as Figures 5, 6, and 7. The soil encountered in Borings B4 through B6 generally consisted of non-frost susceptible (nfs), coarse-grained material to about 16.5 feet bgs, underlain by silt to the bottom of the borings. Samples B5S4 and B6S2, taken from approximately 15 to 16.5 and 10 to 11.5 feet bgs, respectively, were submitted to Shannon & Wilson's geotechnical laboratory for soil classification. Testing results, shown on Figure 11, indicate that Sample B5S4 is a gravelly sand (SP) and Sample B6S2 is a slightly silty, gravelly sand (SP-SM). Both classifications are consistent with field observations. The materials documented in the top 8 feet bgs of B4 did differ from those encountered in B5 and B6 at the same depth, possibly due to the boring locations. As shown on Figure 2, Boring B4 is located in a landscaped area whereas Borings B5 and B6 are located in the paved driveway.

The coarse-grained soils observed in Borings B4, B5, and B6 are not expected to retard vertical product infiltration or lateral transport of impacted groundwater. Results of TOC analyses support this conclusion. Samples B5S2 and B6S2, collected at a depth of approximately 10 to 11.5 feet bgs, contained TOC of 0.3271 and 0.1147 percent, respectively. These levels are consistent with typical TOC values of 0.1 to 0.2 percent reported for Alaskan soil of this type. The TOC results may be used in future fate and transport modeling to estimate hydrocarbon migration rates and/or to calculate alternative cleanup levels.

Groundwater was encountered in Borings B4, B5, and B6 at approximately 14 feet bgs during drilling on May 8, 2000. To obtain more precise determination of relative groundwater levels, a level loop vertical survey of the three new monitoring wells and three previously existing wells was conducted on May 12, 2000. The top of casing elevations (measuring points) for each well are recorded in Table 2. The survey results were used in conjunction with water level measurements to determine the groundwater flow direction. The May 2000 groundwater data indicated a flow direction to the southwest at an approximate gradient of 0.5 percent. This flow direction is consistent with the August, September, and December 1999 data for this site.

DISCUSSION OF RESULTS

Applicable soil cleanup levels for this site were determined using the ADEC's Method Two guidelines contained in the January 1999, 18 AAC 75.341 regulations. The most stringent

exposure pathway criteria listed in Tables B1 and B2 for the "under 40-inch (precipitation) zone" are assumed. Table C of 18 AAC 75.345 establishes groundwater cleanup levels. The applicable soil and groundwater cleanup levels are listed in Table 3. The following paragraphs discuss the results of the soil and groundwater sample analyses in context of these site cleanup levels and the site's data collection objectives.

Soil Samples

Two soil samples from each boring were tested for hydrocarbon constituents. In addition, one soil sample from each boring was tested for total lead. Detectable BTEX concentrations were reported for at least one of the two analytical soil samples from each soil boring, with the highest levels measured in Sample B5S4. The benzene concentrations of 0.0367, 1.48, and 1.32 ppm in Samples B4S4, B5S4, and B6S4, respectively, exceed the applicable soil cleanup levels. Detectable GRO concentrations were reported for two of the six samples, but do not exceed the applicable soil cleanup level. Total lead was not detected in the three soil samples analyzed for this parameter.

Each sample that contained elevated BTEX concentrations was collected from a depth interval within the saturated zone. This observation is consistent with the measurement of elevated concentrations in each groundwater sample, as discussed below. The only other sample to contain detectable benzene, Sample B5S3, was collected from a depth interval that is likely within the range of seasonal groundwater fluctuation. These data are consistent with the earlier assertion that impacted soil within the site boundaries is confined to the immediate vicinity of the UST array and "smear zone" soil overlying the impacted groundwater plume in the site's western area.

Groundwater Samples

The results of the hydrocarbon and natural attenuation parameter analyses are discussed separately in the following paragraphs.

Hydrocarbon Analyses

Detectable GRO and/or BTEX constituent concentrations were measured in each of the six groundwater samples collected in May 2000. The highest levels were measured in the B2MW groundwater sample, which contained 87 ppm GRO, 2 ppm benzene, 9.6 ppm toluene, 2.6 ppm ethylbenzene, and 20 ppm xylenes. Each of these constituent concentrations exceeds the corresponding groundwater cleanup level. With one exception, the GRO and benzene concentrations in the other groundwater samples also exceed the groundwater cleanup levels. The groundwater sample from Well B3MW, located downgradient of the WES No. 5030 UST

array with respect to groundwater flow, contained only trace concentrations of toluene and xylenes, and did not contain detectable GRO, benzene, or ethylbenzene.

In a conversation with Ms. Carla Morgan of SPL on May 30, 2000, she indicated that methyl tertiary butyl ether (MTBE) was detected in the groundwater samples from B1MW, B2MW, B5MW, and B6MW.

It is evident from an evaluation of groundwater results shown on Figure 2 that the impacted plume's on-site component is centered in the vicinity of B2MW, and extends to the southwest in the direction of groundwater flow. The general trend of decreasing concentrations over the distance spanned by B2MW, B5MW, and B6MW suggests that the source of the impacted groundwater is located further north or northeast of B2MW. The decreasing trend does not appear sufficient to contain the impacted plume within the WES No. 5030 site boundary, however, although the plume's leading edge location was not established by our field efforts. The literature references a 1995 direct-push groundwater sample collected in Greenland Drive, directly west of the WES No. 5030 site. This sample reportedly contained 5.8 ppm GRO and 1.8 ppm benzene, concentrations similar to the magnitudes measured in the May 2000 sample from Well B6MW. If the plume does extend off-site to the southwest, it may constitute a threat to human receptors. Based on information obtained in a previous Shannon & Wilson site assessment, at least one municipal or private well is located within ½ mile of the site.

Natural Attenuation

Results of the natural attenuation parameter analyses were evaluated to determine the presence of aerobic and/or anaerobic processes. The first parameter considered is dissolved oxygen (DO), as aerobic activity is the most energetically favorable degradation process, and available DO will likely be consumed first. The DO levels measured in May 2000 ranged from 2.24 ppm to 4.14 ppm, but are not believed to be representative of the groundwater formation due to potential agitation during the well development and purging process. In contrast, laboratory sample results indicate that anaerobic degradation may be occurring within the groundwater plume. Assuming that samples from Monitoring Wells B3MW and B4MW represent background conditions, sulfate reduction, nitrate reduction, and methane generation may be occurring within the impacted plume. Likewise, field measurements indicate that ferrous iron concentrations are higher within the impacted groundwater plume, providing evidence of iron (III) reduction. The distribution pattern for each of these four parameters is consistent with increased anaerobic activity within the impacted plume.

Quality Control

A laboratory-prepared methanol soil trip blank, designated TB, accompanied the soil sample bottles throughout the sample collection and transport processes. The trip blank did not contain detectable GRO or BTEX concentrations, indicating that the soil samples were not impacted during sample handling and storage.

A water trip blank, designated TB, accompanied the water sample bottles from the laboratory to the site during sampling activities and was analyzed by SPL. The trip blank did not contain detectable levels of GRO or BTEX, indicating that the groundwater samples were not impacted during the sample handling and storage process.

Summary of Analytical Data Interpretations

Groundwater samples collected from B1MW, B2MW, B5MW, and B6MW in May 2000 confirm the presence of impacted groundwater within the WES No. 5030 site boundaries. Results of the May 2000 soil sample analyses do not reveal areas of impacted soil above the groundwater smear zone, other than the previously-identified area at the UST array's north end. Considered in context of previous assessment results, the data also indicate that the impacted soil associated with the Williams UST array is not the primary source of the impacted groundwater plume that may extend off site to the southwest. This interpretation is supported data pertaining to the groundwater flow direction, the location of the groundwater plume relative to the Williams UST array, the estimated volume of impacted soil near the Williams UST array, the presence of only trace hydrocarbon concentrations in the groundwater downgradient from the UST array, the hydrocarbon concentration gradient within the plume, and previous meaurements of free product in monitoring wells north of WES No. 5030.

POTENTIAL OFF-SITE SOURCE AREAS

A brief search and records review was conducted to establish the potential contribution of off-site sources to the impacted groundwater observed at WES No. 5030. This search and records review was conducted to develop an overview of environmental conditions at nearby properties. The ADEC database was searched to identify registered USTs, leaking USTs (LUSTs), and contaminated sites at properties adjacent to WES No. 5030. Two active LUST sites were located directly upgradient of WES No. 5030: Thrifty Rent-A-Car (Thrifty), at 3730 Spenard Road; and Chevron Service Station #9-9014 (Chevron), at 3808 Minnesota Drive. The ADEC's Anchorage office records for Thrifty and Chevron were briefly reviewed on May 9, 2000. In addition, Shannon & Wilson's June 1991 Interim PSA Report for the former Foodland Market site was reviewed.

Based on aerial photographs, automobile filling and service stations have been operating north of the site since the 1950's. Moreover, petroleum releases have been documented at both sites. A summary of our records review for the Thrifty and Chevron sites is detailed below. Two other potential off-site sources identified during the review are also discussed.

Thrifty Rent-A-Car, 3730 Spenard Road

Aerial photographs from 1959 and 1966 show a filling station and automobile storage yard on the site now occupied by Thrifty. According to ADEC records, a 1,000-gallon used oil UST was installed in January 1980 and a 4,000-gallon gasoline UST was installed in January 1984. Locations of these USTs are shown on Figure 2. The results of a tank tightness test performed on the 4,000-gallon UST in September 1989 indicated a leaking swing joint on the suction line. Following repair activities in September 1989, four monitoring wells were installed. Analytical groundwater samples collected from Monitoring Wells T-1 through T-4 following installation contained maximum hydrocarbon concentrations of 28.8 ppm benzene, 81.4 ppm total BTEX, and 30.8 ppm TPH.

The ADEC database indicated that the 1,000-gallon used oil UST was last used in September 1988, but remains in place. The 4,000-gallon gasoline UST and associated piping was excavated and removed in August 1992. A soil sample collected at approximately 10 feet bgs below the northwest corner of the former gasoline UST contained 1.3 ppm benzene, 236.30 ppm total BTEX, and 940 ppm volatile petroleum hydrocarbons (VPH).

Free product ranging from 6 to 12 inches in thickness was encountered in Chevron Monitoring Wells MW-9 and MW-11 and on-site Thrifty Monitoring Well T-2 during groundwater sampling conducted for Thrifty in February 1995. Fingerprint analyses of the product and groundwater samples from the five monitoring wells sampled in February 1995 concluded that the hydrocarbon constituents were from an unleaded gasoline containing MTBE, probably from a single source, and with an estimated age of less than 4 years old. The report summarizing the groundwater and product sampling and analyses concluded that the groundwater flow direction was towards the southwest and that the impacted groundwater originated from the Chevron site.

Chevron Service Station #9-9014, 3808 Minnesota Drive

Aerial photographs show a filling station at the present Chevron site since at least 1959. According to ADEC records, five USTs used to store gasoline, diesel, and used oil were removed and replaced in July 1995. The UST closure assessment report was not available in the ADEC's Anchorage office files. The current ADEC project manager, Mr. Clint Adler, indicated that the records for the Chevron site are located in the ADEC's Fairbanks office. The Second Semi-

Annual 1999 Groundwater and Sampling report prepared by Gettler-Ryan, Inc. (G-R) and Fourth Quarter 1999 Remedial System Evaluation report prepared by SECOR International, Inc. (SECOR) for Chevron were obtained by internet access and reviewed. These reports are included in Attachment 3.

According to the G-R groundwater and sampling report, routine groundwater monitoring has been conducted at the Chevron site since July 1992. Thrifty Monitoring Wells T-1, T-2, and T-4 were sampled as part of the Chevron groundwater monitoring event in September 1994, and added to the Chevron monitoring program in August 1996. The SECOR remedial system evaluation report indicates that soil vapor extraction (SVE) and air sparging were initiated at the Chevron site on May 31, 1996.

Results of the October 18, 1999 groundwater sampling event conducted at the Chevron and Thrifty sites indicate that GRO and/or BTEX constituent concentrations continue to exceed the ADEC groundwater cleanup levels. The highest concentrations were measured in the groundwater samples from MW-9 and MW-11, although product was not reported at that time. To provide a comprehensive overview of groundwater concentrations at the Thrifty, Chevron, and Williams sites, the analytical results and groundwater flow directions measured in Fall 1999 are shown on Figure 4. A comparison of the groundwater analyses at both sites verifies that the highest BTEX constituent concentrations were measured in Chevron monitoring wells located upgradient of WES No. 5030. The groundwater flow directions measured during both sampling events were in the southwesterly direction. Based on this comparison, the impacted groundwater observed on the Williams site appears to be largely attributable to an upgradient source area(s).

Other Potential Sources

Two additional sources were noted in our brief research and records review. Due to the distance from the WES No. 5030 site or lack of ADEC records, these sites are not presently considered primary contributors to the impacted groundwater plume. The first potential source is the Alpina Auto Repair and Service Station at 3607 Spenard Road, approximately 1,000 feet northwest of WES No. 5030. According to ADEC records, nine USTs used to store gasoline, diesel, and used oil were removed from this site in September 1995.

The second potential source is a former Unocal filling station that operated on the property now occupied by Skipper's restaurant at 3611 Minnesota Drive. An aerial photograph from 1966 shows a filling and service station. A subsequent photograph from 1980 shows the building structure removed and the site unpaved. The ADEC database did not contain any records regarding a registered UST, LUST, or contaminated site located at this property.

CORRECTIVE ACTION

An objective of this investigation was to evaluate corrective action at the site, given that elevated hydrocarbon levels exist in the site's soil and groundwater. To develop a corrective action recommendation, alternative strategies are evaluated in the context of known site conditions, apparent hydrocarbon sources, and site-specific remedial objectives.

Source Area Summary

As presented in this document, multiple source area(s) are potential contributors to the impacted groundwater plume. Because source-area identification is an important consideration in establishing remedial objectives and associated corrective action, our conclusions and supporting data regarding potential source areas are reiterated in this section. Our efforts focused on potential source areas located on the WES No. 5030, Thrifty, and Chevron properties. Our field activities and limited document review were used to develop the conclusions listed below.

1. Impacted soil and groundwater are present at the WES No. 5030, Thrifty, and Chevron sites. The greatest apparent risk to human health and the environment is posed by impacted groundwater that extends southwest of WES No. 5030.

2. Based on soil samples collected from soil drilling and excavation activities, impacted soil within the WES No. 5030 site boundary appears to be limited to the vicinity of the UST array and the smear zone above the impacted groundwater plume. No on-site sources other than the WES No. 5030 UST array have been identified. Furthermore, the impacted soil near the UST array does not appear to be a primary contributor to the impacted groundwater plume.

3. Patterns of hydrocarbon distribution indicate that the center of the impacted groundwater plume's on-site component is located west of the Williams UST array, and appears to extend to the southwest in the direction of apparent groundwater flow.

4. Based on comparable groundwater flow directions measured at the WES No. 5030 and Chevron sites, the elevated hydrocarbon concentrations in the WES No. 5030 wells are indicative of a source area to the north or northeast of Well B2MW. This interpretation is consistent with previous observations of free product in Chevron Wells MW-9 and MW-11.

5. The source of detectable hydrocarbons in the B4MW groundwater sample has not been determined. It is possible that these levels reflect contributions from off-site sources at either the Chevron property and/or potential source areas further to the northeast.

6. The conclusions stated in items 1 through 5 above provide a strong line of evidence that the impacted plume observed at WES No. 5030 is attributable primarily to an off-site source located to the north to northeast.

Remedial Objectives

The fundamental remedial objective at most impacted sites is protecting human health and the environment. Site-specific remedial objectives are developed by applying this guiding principle to the particular site conditions, considering the chemical constituents of concern, soil properties, site use, evaluation of complete exposure pathways, and risk to potential receptors. The subsurface at the WES No. 5030 site is characterized by elevated concentrations of volatile petroleum hydrocarbon constituents in both the soil and groundwater, with assumed off-site migration of the impacted groundwater plume. For these conditions, corrective action typically consists of a combination of source-area treatment and downgradient plume control. Application of these dual objectives to WES No. 5030, however, is complicated both by the presence of multiple source areas and continued operation of the on-site filling station. Two primary regions of impacted media have been identified at WES No. 5030: the impacted soil and groundwater in the vicinity of the UST array, and the impacted groundwater plume that extends southwest from the site's northern boundary. Williams' specific remedial objectives associated with each of these areas are discussed separately in the following paragraphs.

UST Array

Eventually, source-area treatment will likely be required to address the impacted soil in the vicinity of the Williams UST array. Remedial action in this area is facilitated by the horizontal vapor extraction pipes placed during the 1999 soil removal action. In the immediate future, however, corrective action in this area may not be cost-effective for several reasons. First, the potential for a known or unknown subsurface release remains due to the site's continued operation as a fuel storage and distribution facility, and remedial action initiated at this time may therefore be duplicated at a later date. Second, the impacted soil constitutes a low risk to potential receptors, relative to the impacted groundwater plume to the west. Third, soil sample analyses indicate that the lateral extent of impacted soil is limited, despite the high GRO concentrations measured in 1999 directly below the assumed release location.

Similarly, active groundwater treatment is not recommended for this source area, based on sample results that indicate groundwater downgradient of the Williams UST array is not presently impacted with hydrocarbon concentrations greater than ADEC cleanup levels. Based on the concentration gradient across the Williams site and adjacent properties, the levels observed in Well B1MW may reflect the combined contributions of releases from the Williams UST array and off-site sources. Soil samples from the July 1999 and May 2000 soil boring efforts did not indicate other on-site areas of impacted vadose-zone soil that could serve as secondary sources for impacted groundwater.

In the context of these factors, the current remedial objective for the UST array is to conduct limited, cost-effective source-area treatment that utilizes in-place piping. Groundwater conditions will continue to be monitored using semi-annual sample collection from Monitoring Wells B1MW and B3MW.

Impacted Groundwater Plume

The impacted groundwater plume in the site's western area appears to migrate off site to the southwest, and corrective action is appropriate to protect downgradient receptors. To efficiently address the impacted plume, corrective action may include both source-area treatment and plume containment measures. Because the primary plume source appears to be located north of WES No. 5030 site boundary, source area treatment is not presently a remedial objective of Williams.

Evaluation of Remedial Action Alternatives

Williams' overall remedial objective is to protect human health and the environment from potential releases associated with Williams' on-site fuel handling and storage operations. Specific objectives for the WES No. 5030 presently consist of limited source-area treatment in the vicinity of the on-site UST array and continued groundwater monitoring. Groundwater treatment is not planned at this time.

Corrective action alternatives considered for source area soil treatment consisted of excavation with ex-situ treatment, passive vapor extraction, and active vapor extraction. Evaluation criteria included remedial effectiveness, access limitations, cost efficiency, cleanup time, impact to facility operations, and site-specific source area and subsurface soil conditions Based on these considerations, we recommend a passive vapor extraction system (VES) to treat the impacted soil in the vicinity of the Williams UST.

The proposed passive vapor extraction system (VES) consists of riser pipes installed on the existing extraction pipes. Wind-driven fans placed on the riser pipes will induce subsurface flow and physical removal of volatile hydrocarbon constituents. Implementation of this comparatively simple technology is intended to provide cost-effective treatment, given the apparently limited extent of impacted soil and extended timeframe for conducting cleanup. If site conditions or remedial objectives change, this system can be upgraded to active VES.

It is emphasized that these activities are not intended to achieve site closure. Due to continued site use as a commercial filling station, additional site assessment and corrective action may be required prior to site closure.

In the context of these factors, the current remedial objective for the UST array is to conduct limited, cost-effective source-area treatment that utilizes in-place piping. Groundwater conditions will continue to be monitored using semi-annual sample collection from Monitoring Wells B1MW and B3MW.

Impacted Groundwater Plume

The impacted groundwater plume in the site's western area appears to migrate off site to the southwest, and corrective action is appropriate to protect downgradient receptors. To efficiently address the impacted plume, corrective action may include both source-area treatment and plume containment measures. Because the primary plume source appears to be located north of WES No. 5030 site boundary, source area treatment is not presently a remedial objective of Williams. Measures to contain plume migration may be implemented to mitigate the potential impact to drinking water wells located downgradient of WES No. 5030.

Evaluation of Remedial Action Alternatives

Williams' overall remedial objective is to protect human health and the environment from potential releases associated with Williams' on-site fuel handling and storage operations. Specific objectives for the WES No. 5030 presently consist of limited source-area treatment in the vicinity of the on-site UST array and continued groundwater monitoring. Groundwater treatment is not planned at this time.

Corrective action alternatives considered for source area soil treatment consisted of excavation with ex-situ treatment, passive vapor extraction, and active vapor extraction. Evaluation criteria included remedial effectiveness, access limitations, cost efficiency, cleanup time, impact to facility operations, and site-specific source area and subsurface soil conditions Based on these considerations, we recommend a passive vapor extraction system (VES) to treat the impacted soil in the vicinity of the Williams UST.

The proposed passive vapor extraction system (VES) consists of riser pipes installed on the existing extraction pipes. Wind-driven fans placed on the riser pipes will induce subsurface flow and physical removal of volatile hydrocarbon constituents. Implementation of this comparatively simple technology is intended to provide cost-effective treatment, given the apparently limited extent of impacted soil and extended timeframe for conducting cleanup. If site conditions or remedial objectives change, this system can be upgraded to active VES.

It is emphasized that these activities are not intended to achieve site closure. Due to continued site use as a commercial filling station, additional site assessment and corrective action may be required prior to site closure.

CONCLUSIONS AND RECOMMENDATIONS

As a result of our 1999 and 2000 field activities, impacted soil and groundwater were identified in the vicinity of Monitoring Wells B1MW through B6MW. Hydrocarbon concentrations measured in the groundwater samples from each well except B3MW exceed the applicable ADEC cleanup levels for one or more constituents. The analytical soil results do not provide evidence of on-site source areas other than the Williams UST array. Soil samples collected during a 1999 UST assessment indicate that impacted soil is confined to the immediate vicinity of the USTs, although the precise extent has not been determined.

Corrective action is recommended to treat impacted soils within the vicinity of the UST array. An evaluation of remedial alternatives was conducted in context of site assessment data, a source area evaluation, and site-specific remedial objectives. It is our opinion that passive vapor extraction using previously-installed piping is presently the best method to achieve source area soil treatment in an effective and cost-efficient manner.

Groundwater located directly downgradient of the Williams UST array does not appear to be impacted at this time. Groundwater samples from Monitoring Well B3MW, located directly downgradient from the UST with respect to groundwater flow, have contained only trace hydrocarbon constituents. The highest on-site dissolved hydrocarbon concentrations were observed in groundwater samples from Well B2MW. Based on our field observations, analytical results, and document review, the impacted groundwater plume associated with Well B2MW appears to be migrating from an upgradient source(s), with the leading edge likely extending off site to the southwest. In accordance with Williams' remedial objectives, we recommend continued groundwater monitoring at this site.

CLOSURE/LIMITATIONS

This report was prepared for the exclusive use of our client and their representatives in the study of this site. The findings we have presented within this report are based on the limited research, sampling, and analyses that we conducted at this site. They should not be construed as definite conclusions regarding the soil and groundwater conditions at this site. It is possible that our subsurface tests missed higher levels of petroleum hydrocarbon constituents, although our intention was to sample areas likely to be impacted. As a result, the sampling and analyses performed can only provide you with our professional judgment as to the environmental characteristics of this site, and in no way guarantees that an agency or its staff will reach the same conclusions as Shannon & Wilson, Inc. The data presented in this report should be considered representative of the time of our site assessment. Changes in site conditions can occur with time, due to natural forces and/or human activity. In addition, changes in Government codes, regulations, or laws may occur. Because of such changes beyond our control, our observations and interpretations may need to be revised.

Shannon & Wilson has prepared the information in Attachment 4, "Important Information About Your Geotechnical/Environmental Report," to assist you and others in understanding the use and limitations of our reports.

You are advised that various state and federal agencies (ADEC, EPA, etc.) may require the reporting of this information. Shannon & Wilson does not assume the responsibility for reporting these findings and therefore, has not, and will not, disclose the results of this study without your prior approval.

We appreciate this opportunity to be of service. Please call the undersigned with any questions or comments concerning the contents of this report.

Sincerely,

SHANNON & WILSON, INC.

Prepared By

Julie A. Makela
Environmental Engineer II

Approved By

Matthew S. Hemry, P.E.
Principal Engineer

srb: RNB

encl: Tables 1, 2, and 3; Figures 1 through 11; Attachments 1 through 4

cc: Mr. Paul Farnsworth, Alaska Projects
Ms. Lynne Bush, ADEC

TABLE 1 - SAMPLE LOCATIONS AND DESCRIPTIONS

Sample No.	Date	Sample Location	Depth (ft.)	Headspace (ppm) ^	Sample Classification
Soil Samples					
B4S1	5/8/2000	Boring 4, Sample 1	5-6.5	0.1	Gray-brown, slightly silty, sandy GRAVEL; damp
B4S2	5/8/2000	Boring 4, Sample 2	10-11.5	0	Gray-brown, slightly silty, fine SAND; moist
B4S3	5/8/2000	Boring 4, Sample 3	12.5-14	9	Brown, slightly silty, gravely, coarse SAND; moist
B4S4	5/8/2000	Boring 4, Sample 4	15-16.5	1.6	Brown, slightly silty, gravely, coarse SAND; wet
B5S1	5/8/2000	Boring 5, Sample 1	5-6.5	0	Brown, slightly silty, gravelly SAND; damp
B5S2	5/8/2000	Boring 5, Sample 2	10-11.5	0.5	Gray-brown, slightly silty, gravelly SAND; damp
B5S3	5/8/2000	Boring 5, Sample 3	12.5-14	460	Gray-brown, gravelly, coarse SAND; moist
B5S4	5/8/2000	Boring 5, Sample 4	15-16.5	217	Gray-brown, gravelly, coarse SAND; wet (SP)
B6S1	5/8/2000	Boring 6, Sample 1	5-6.5	0.2	Brown, slightly silty, gravelly SAND; damp
B6S2	5/8/2000	Boring 6, Sample 2	10-11.5	0.2	Brown, slightly silty, gravelly SAND; damp (SP-SM)
B6S3	5/8/2000	Boring 6, Sample 3	12.5-14	0.8	Gray-brown, slightly silty, gravelly, medium SAND; moist
B6S4	5/8/2000	Boring 6, Sample 4	15-16.5	152	Gray-brown, slightly silty, gravelly, coarse SAND; wet
TB	5/8/2000	Trip Blank	-	-	Ottawa sand with methanol, prepared by the laboratory
Groundwater Samples					
B1MW	5/15/2000	Boring/Monitoring Well B1MW	11.86*	-	Groundwater
B2MW	5/15/2000	Boring/Monitoring Well B2MW	12.77*		Groundwater
B3MW	5/15/2000	Boring/Monitoring Well B3MW	13.24*		Groundwater
B4MW	5/15/2000	Boring/Monitoring Well B4MW	12.08*	-	Groundwater
B5MW	5/15/2000	Boring/Monitoring Well B5MW	12.90*	-	Groundwater
B6MW	5/15/2000	Boring/Monitoring Well B6MW	12.9*	-	Groundwater
TB	5/5/2000	Trip Blank	-	-	Organic-free water, prepared by the laboratory

KEY	DESCRIPTION
1.23	Sample analyzed by the laboratory
-	Not applicable
^	Field screening instrument was an OVM 580B photoionization detector (PID)
*	Depth below measuring point (top of well casing)
ppm	Parts per million

TABLE 2 - WATER SAMPLING LOG

WATER LEVEL MEASUREMENT DATA

WELL NUMBER	B1MW	B2MW	B3MW	B4MW	B5MW	B6MW
DATE WATER LEVEL MEASURED	5/15/2000	5/15/2000	5/15/2000	5/15/2000	5/15/2000	5/15/2000
TIME WATER LEVEL MEASURED	15:50	15:25	16:35	10:15	14:20	12:15
MP ELEVATION, FT	97.90	98.48	98.82	98.23	98.43	98.13
DEPTH TO WATER BELOW MP, FT	11.86	12.77	13.24	12.08	12.90	12.90
WATER LEVEL ELEVATION, FT	86.04	85.71	85.58	86.15	85.53	85.23

DEVELOPMENT, PURGING, AND SAMPLING DATA

WELL NUMBER	B1MW	B2MW	B3MW	B4MW	B5MW	B6MW
DATE SAMPLED	5/15/2000	5/15/2000	5/15/2000	5/15/2000	5/15/2000	5/15/2000
TIME SAMPLED	16:10	15:40	16:50	11:40	15:10	13:00
DEPTH TO WATER BELOW MP, FT	11.86	12.77	13.24	12.08	12.90	12.90
TOTAL DEPTH OF WELL BELOW MP, FT	17.77	17.69	17.46	16.76	17.80	17.81
WATER COLUMN IN WELL, FT	5.91	4.92	4.22	4.68	4.90	4.91
GALLONS PER FOOT	0.16	0.16	0.16	0.16	0.16	0.16
GALLONS IN WELL	0.95	0.79	0.68	0.75	0.78	0.79
TOTAL GALLONS PUMPED/BAILED	3.0	2.5	2.5	28.0	32.0	35.0
TEMPERATURE, °C	4.9	4.8	5.0	5.4	5.2	5.2
SPECIFIC CONDUCTANCE, µMHO/CM	921	577	561	606	616	653
pH - STANDARD UNITS	6.20	6.31	6.23	6.30	6.40	6.46
DISSOLVED OXYGEN, PPM	3.29	4.14	4.12	3.46	2.24	2.61
TURBIDITY, NTU	10	10	10	432	220	50
FERROUS IRON, PPM	5.0	8.0	1.6	2.0	6.0	5.0
DEVELOPMENT METHOD	-	-	-	Whale Pump	Whale Pump	Whale Pump
PURGING METHOD	Bailer	Bailer	Bailer	-	-	-
SAMPLING METHOD	Bailer	Bailer	Bailer	Whale Pump	Whale Pump	Whale Pump
DIAMETER OF WELL CASING	2-inch	2-inch	2-inch	2-inch	2-inch	2-inch
REMARKS		Slight Hydro-carbon Odor			Slight Hydro-carbon Odor	

Sampling Personnel: Julie Makela & Mike Soltis

Note: MP Elevations Surveyed by Shannon & Wilson on May 12, 2000

KEY	DESCRIPTION
°C	Degrees Celsius
FT	Feet
µMHO/CM	Micromhos per Centimeter
MP	Measuring Point
NM	Not Measured
NTU	Nephelometric Turbidity Units
PPM	Part per Million

Soil Samples

TABLE 3 - SUMMARY OF ANALYTICAL RESULTS

Parameter Tested	Method*	Cleanup Level (ppm)**	Sample Number and Depth in Feet (See Table 1, Figures 2, 5, 6, and 7, and Attachment 1)*				
			B4S3 12.5-14	B4S4 15-16.5	B5S2 10-11.5	B5S3 12.5-14	B5S4 15-16.5
PID Headspace Reading - ppm	OVM 580B	NA	9	1.6	0.5	460	217
Gasoline Range Organics (GRO) - ppm	AK 101	300	ND [1.42]	ND [1.51]	-	ND [1.77]	12.2
Aromatic Volatile Organics (BTEX)	EPA 8021B/AK 101						
Benzene - ppm	EPA 8021B/AK 101	0.02	ND [0.00708]	**0.0367**	-	0.0141	**1.48**
Toluene - ppm	EPA 8021B/AK 101	5.4	ND [0.0283]	ND [0.0303]	-	0.0490	0.0450
Ethylbenzene - ppm	EPA 8021B/AK 101	5.5	ND [0.0283]	ND [0.0303]	-	ND [0.0353]	0.0813
Xylenes - ppm	EPA 8021B/AK 101	78	ND [0.0283]	ND [0.0303]	-	0.0927	3.41
Total Lead - ppm	EPA 6010B	1,000	-	ND [5.06]	-	-	ND [5.27]
Total Organic Carbon (TOC) - percent	TOC CTE SOP	NA	-	-	0.3271	-	-

KEY	DESCRIPTION
*	See Attachment 12 for compounds tested, method, and laboratory reporting limits
**	Soil cleanup level is the most stringent standard listed in Table B1 or B2, 18 AAC 75, for the "under 40 inches (precipitation) zone"
-	Sample not analyzed for this parameter
NA	Not applicable
ND [1.29]	Analyte not detected above the laboratory reporting limit of 1.29 ppm
ppm	Parts per million
	Reported concentration exceeds regulated cleanup level

0020

TABLE 3 - SUMMARY OF ANALYTICAL RESULTS

Soil Samples

Parameter Tested	Method*	Cleanup Level (ppm)**	Sample Number and Depth in Feet (See Table 1, Figures 2, 5, 6, and 7, and Attachment 1)* B6S2 10-11.5	B6S3 12.5-14	B6S4 15-16.5	TB -
PID Headspace Reading - ppm	OVM 580B	NA	0.2	0.8	152	-
Gasoline Range Organics (GRO) - ppm	AK 101	300	-	ND [1.78]	3.46	ND [2.50]
Aromatic Volatile Organics (BTEX)	EPA 8021B/AK 101					
Benzene - ppm	EPA 8021B/AK 101	0.02	-	ND [0.00888]	1.32	ND [0.0125]
Toluene - ppm	EPA 8021B/AK 101	5.4	-	ND [0.0355]	ND [0.0256]	ND [0.0500]
Ethylbenzene - ppm	EPA 8021B/AK 101	5.5	-	ND [0.0355]	ND [0.0256]	ND [0.0500]
Xylenes - ppm	EPA 8021B/AK 101	78	-	ND [0.0355]	0.238	ND [0.0500]
Total Lead - ppm	EPA 6010B	1,000	-	-	ND [5.23]	-
Total Organic Carbon (TOC) - percent	TOC CTE SOP	NA	0.1147	-	-	-

KEY	DESCRIPTION
*	See Attachment 1 for compounds tested, method, and laboratory reporting limits
**	Soil cleanup level is the most stringent standard listed in Table B1 or B2, 18 AAC 75, for the "under 40 inches (precipitation) zone"
-	Sample not analyzed for this parameter
NA	Not applicable
ND [1.29]	Analyte not detected above the laboratory reporting limit of 1.29 ppm
ppm	Parts per million
	Reported concentration exceeds regulated cleanup level

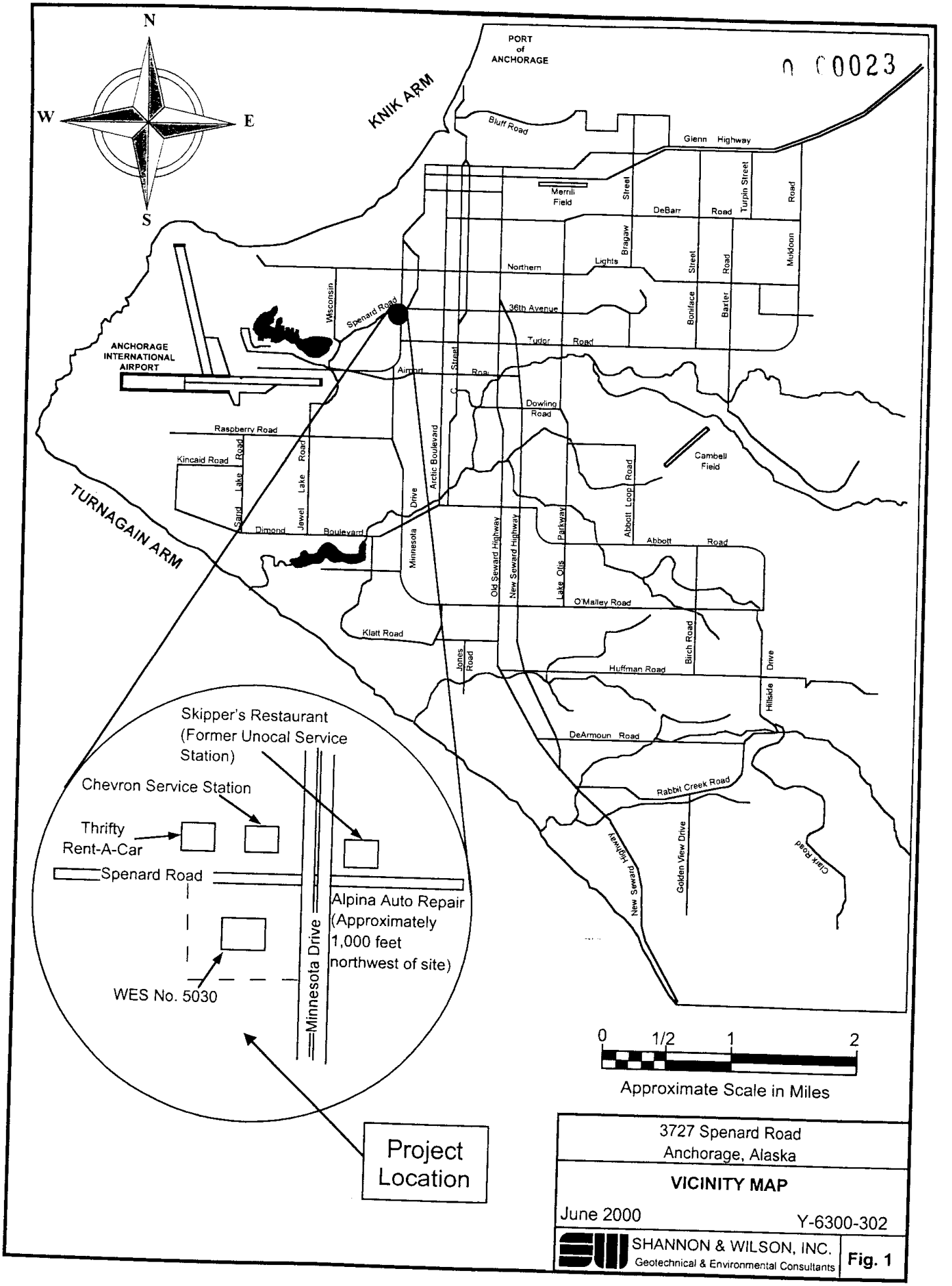
1200021

TABLE 3 - SUMMARY OF ANALYTICAL RESULTS

Groundwater Samples

Parameter Tested	Method*	Cleanup Level (ppm) ***	Sample Number and Depth in Feet (See Table 1, Figure 2, and Attachments 1 and 2)*						
			B1MW 11.86 †	B2MW 12.77 †	B3MW 13.24 †	B4MW 12.08 †	B5MW 12.90 †	B6MW 12.90 †	TB -
Gasoline Range Organics (GRO) - ppm	AK 101	1.3	**15**	**87**	ND [0.2]	**1.6**	**56**	**6.3**	ND [0.2]
Aromatic Volatile Organics	EPA 602								
Benzene - ppm	EPA 602	0.005	**0.54**	**2**	ND [0.001]	**0.4**	**9.3**	**4.5**	ND [0.001]
Toluene - ppm	EPA 602	1.0	0.15	**9.6**	0.0026	ND [0.001]	**2.9**	ND [0.001]	ND [0.001]
Ethylbenzene - ppm	EPA 602	0.7	0.34	**2.6**	ND [0.001]	ND [0.001]	0.45	ND [0.001]	ND [0.001]
Xylenes - ppm	EPA 602	10.0	4	**20**	0.018	0.017	8.5	0.14	ND [0.001]
Nitrate - ppm	EPA 300.0	NA	ND [0.500]	0.581	1.54	1.68	0.580	0.581	-
Sulfate - ppm	EPA 300.0	NA	6.11	2.32	25.6	12.4	ND [0.500]	0.580	-
Methane - ppm	ASTM D-1945M	NA	1.69	5.83	ND [0.0500]	0.796	1.51	1.94	-

KEY	DESCRIPTION
*	See Attachments 1 and 2 for compounds tested, method, and laboratory reporting limits
***	Groundwater cleanup level is regulated standard listed in Table C, 18 AAC 75
†	Depth from measuring point (top of well casing) to static water level
-	Sample not analyzed for this parameter
NA	Not applicable
ND [1.29]	Analyte not detected above the laboratory reporting limit of 1.29 ppm
ppm	Parts per million
Bold	Reported concentration exceeds regulated cleanup level



3727 Spenard Road
Anchorage, Alaska

VICINITY MAP

June 2000 Y-6300-302

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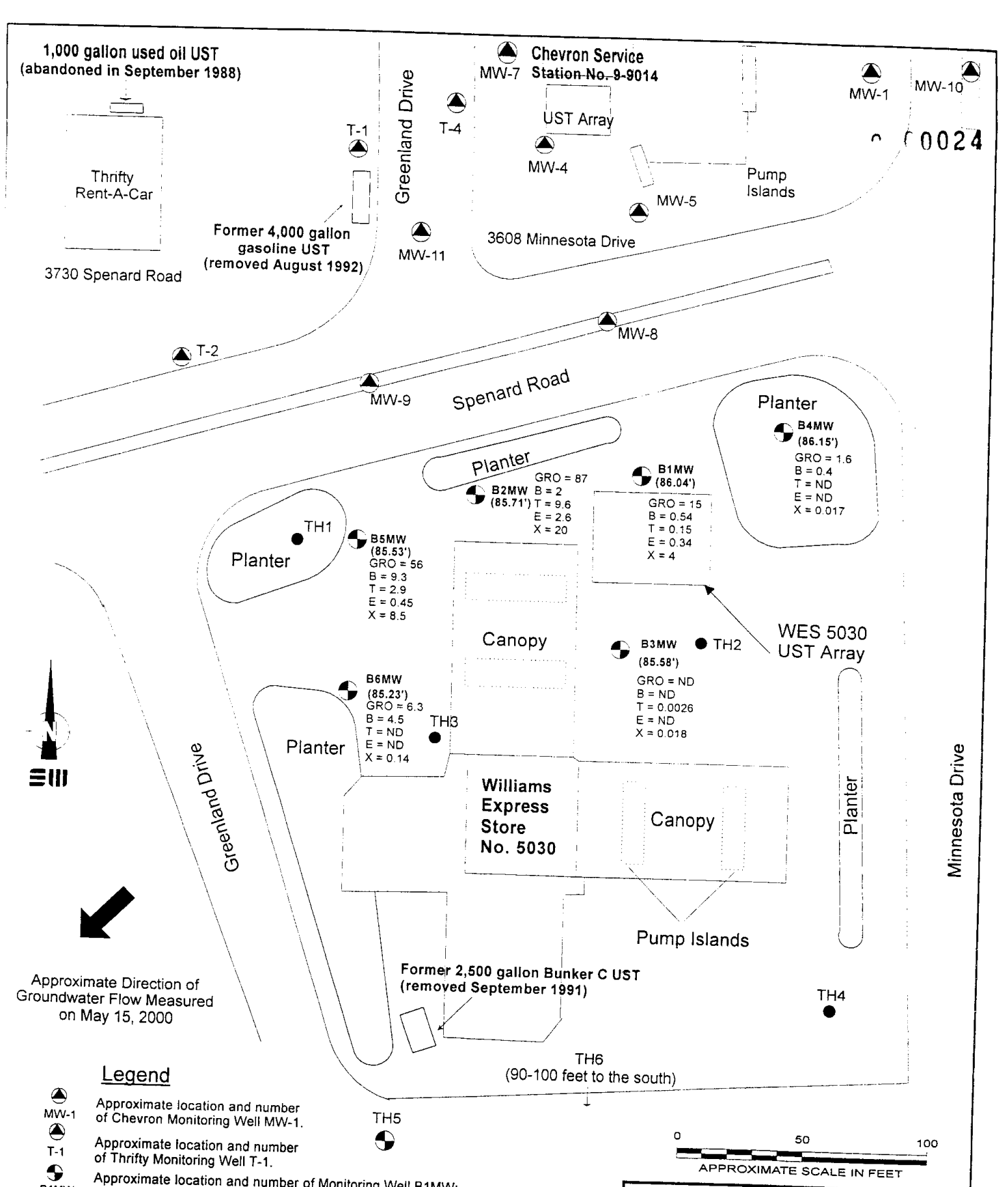
Fig. 1



Legend

MW-1 — Approximate location and number of Chevron Monitoring Well MW-1.

T-1 — Approximate location and number of Thrifty Monitoring Well T-1.

B1MW (86.04') GRO = 15 B = 0.54 T = 0.15 E = 0.34 X = 4 — Approximate location and number of Monitoring Well B1MW; installed by Shannon & Wilson. Groundwater level elevation in feet; measured on May 15, 2000. GRO and BTEX concentrations in ppm; May 2000 groundwater sampling event.

B1 — Approximate location and number of soil boring drilled in June 1991.

ND — Analyte not detected above the laboratory reporting limit.

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SITE PLAN

June 2000

Y-6300-302

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Fig. 2

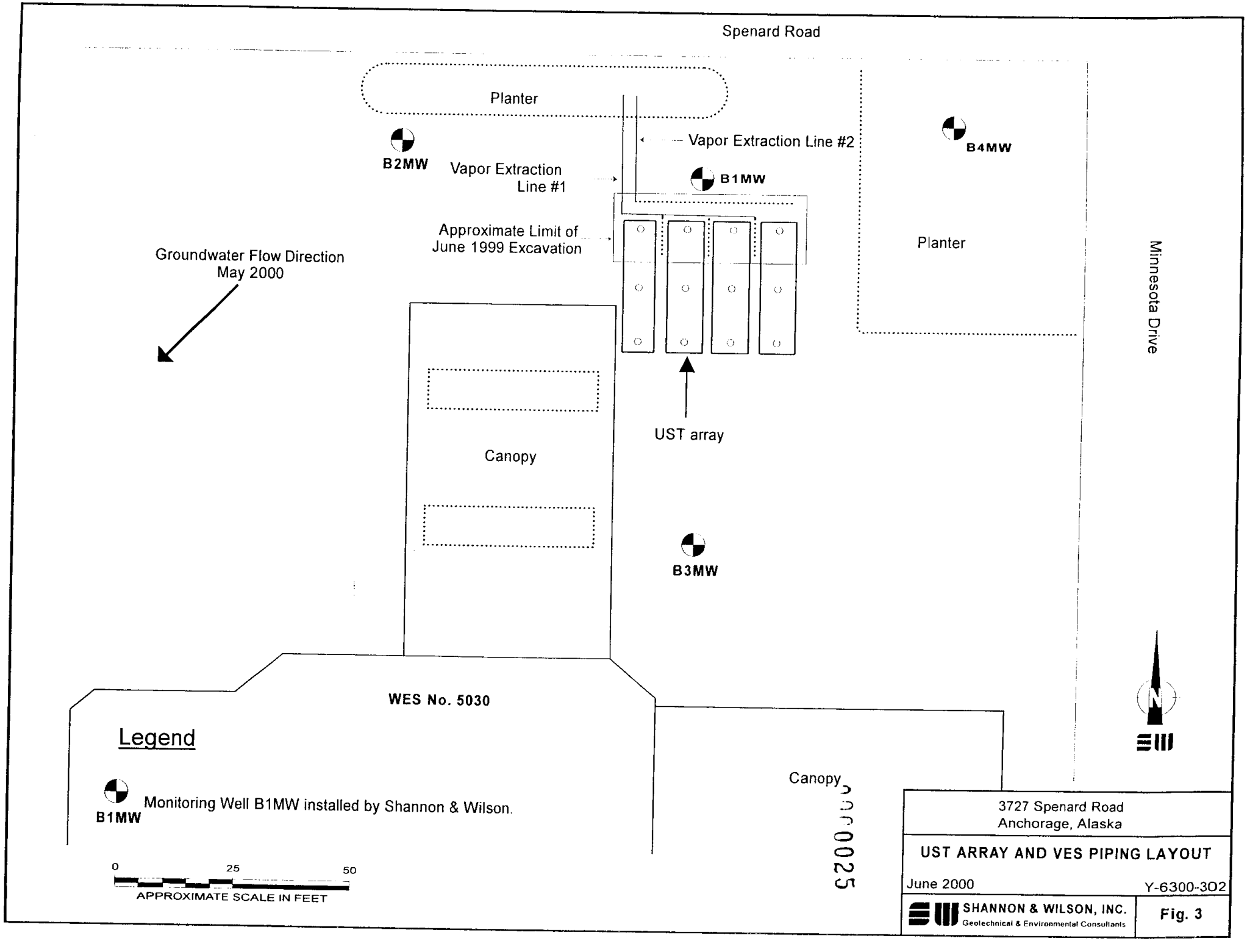
Spenard Road
Planter
B2MW
Vapor Extraction Line #2
B4MW
Vapor Extraction Line #1
B1MW
Approximate Limit of June 1999 Excavation
Planter
Minnesota Drive
Groundwater Flow Direction May 2000
UST array
Canopy
B3MW
WES No. 5030
Legend
Monitoring Well B1MW installed by Shannon & Wilson.
B1MW
Canopy
0
25
50
APPROXIMATE SCALE IN FEET
3727 Spenard Road
Anchorage, Alaska
UST ARRAY AND VES PIPING LAYOUT
June 2000
Y-6300-302
SHANNON & WILSON, INC.
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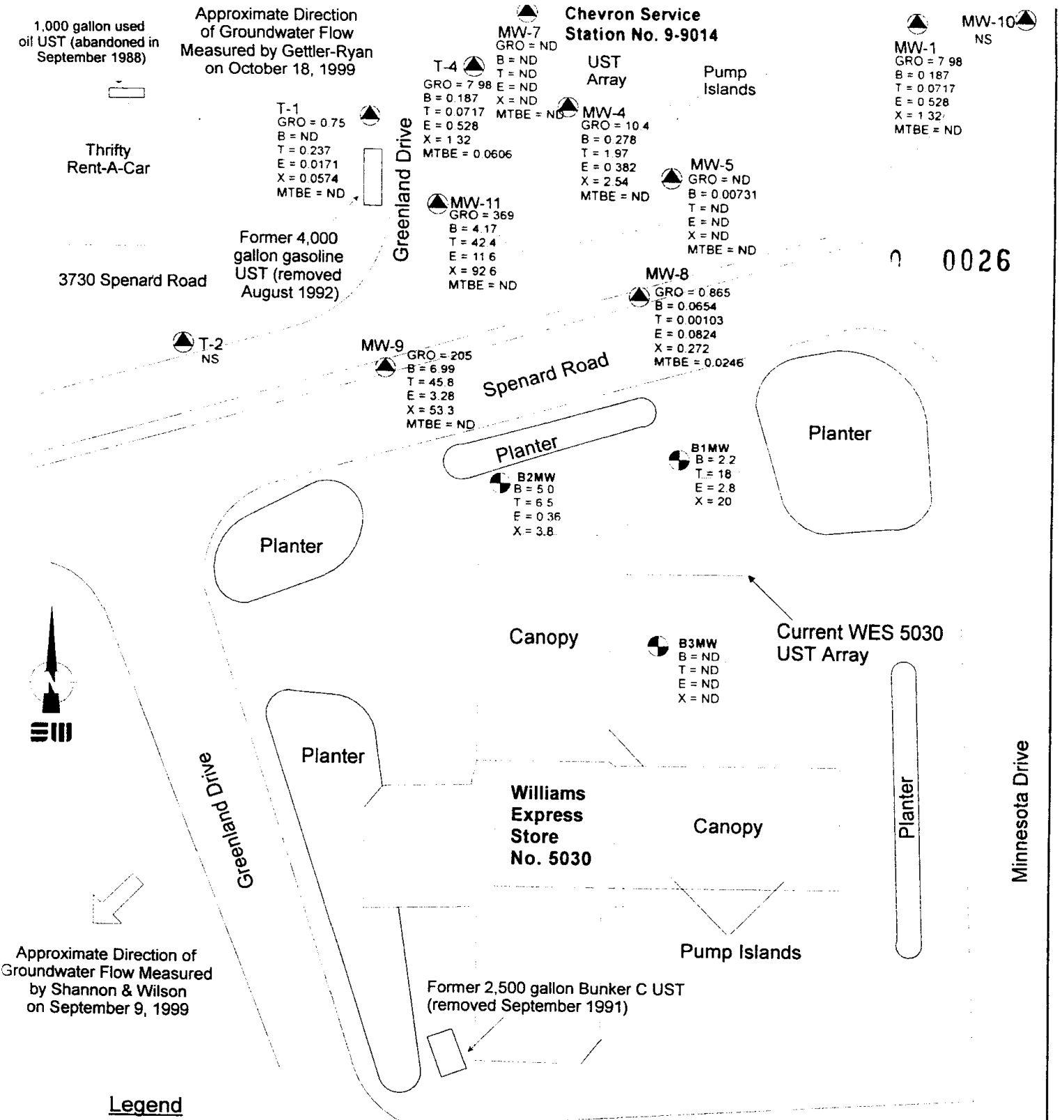
Fig. 3



Legend

B1MW
B = 2.2
T = 18
E = 2.8
X = 20

Approximate location and number of Williams Monitoring Well B1MW; installed by Shannon & Wilson.

BTEX concentrations in ppm; September 9, 1999 groundwater sampling event performed by Shannon & Wilson for Williams Express.

MW-1
GRO = 7.98
B = 0.187
T = 0.0717
E = 0.528
X = 1.32
MTBE = ND

Approximate location and number of Thrifty or Chevron Monitoring Well MW-1.

GRO, BTEX, and MTBE concentrations in ppm; October 18, 1999 groundwater sampling event performed by Gettler-Ryan for Chevron.

NS = Not Sampled

ND = Not Detected

0 50 100

APPROXIMATE SCALE IN FEET

3727 Spenard Road
Anchorage, Alaska

FALL 1999 SITE PLAN

June 2000

Y-6300-302

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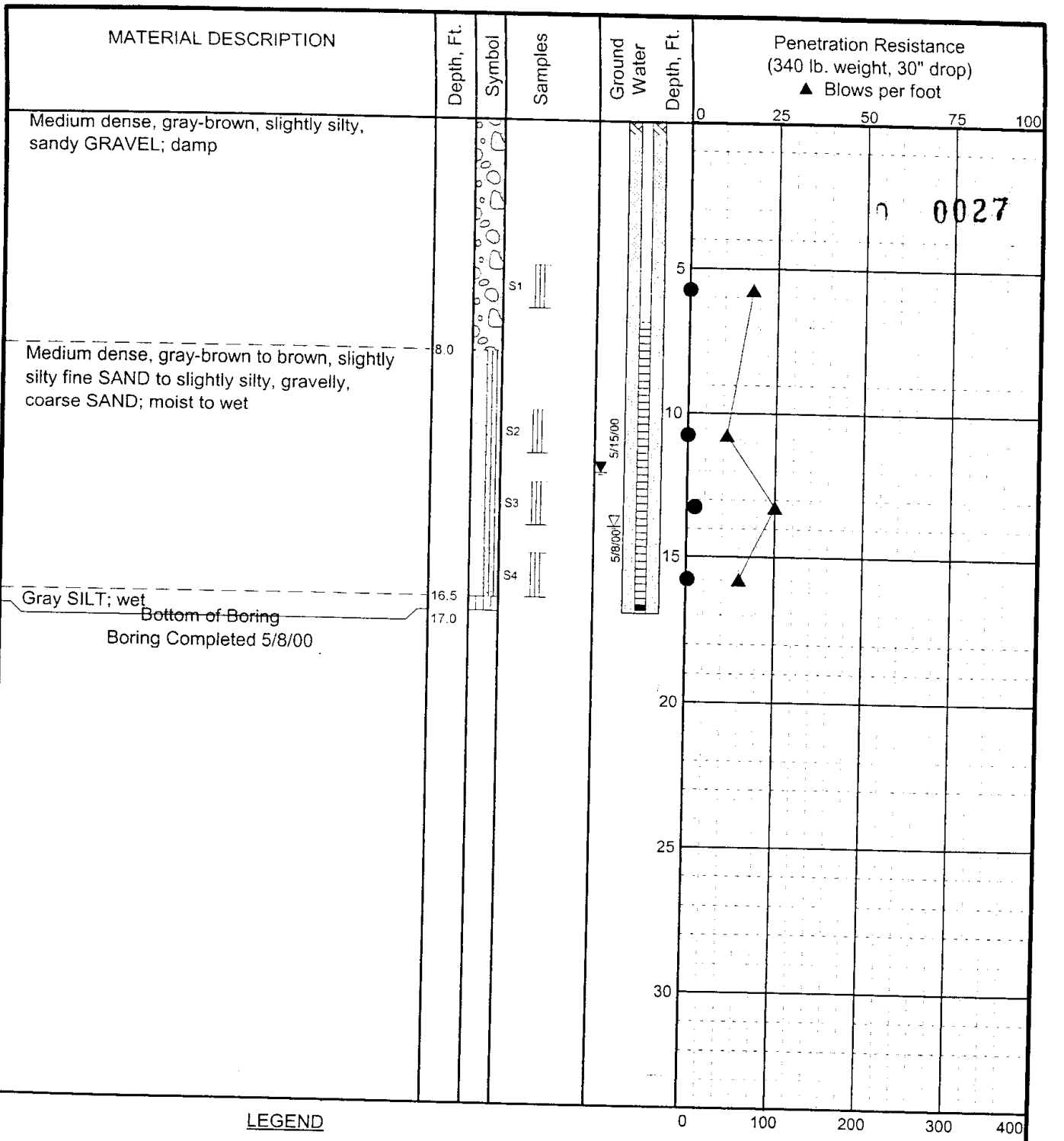
Fig. 4



LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- 3" O.D. Split Spoon Sample
- Surface Seal
- Solid Casing and Annular Sealant
- Well Screen and Filter Sand
- Cuttings Backfill
- Ground Water Level At Time of Drilling
- Static Ground Water Level

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. USC letter symbol based on visual classification.

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LOG OF BORING NO. B4

June 2000 Y-6300-302

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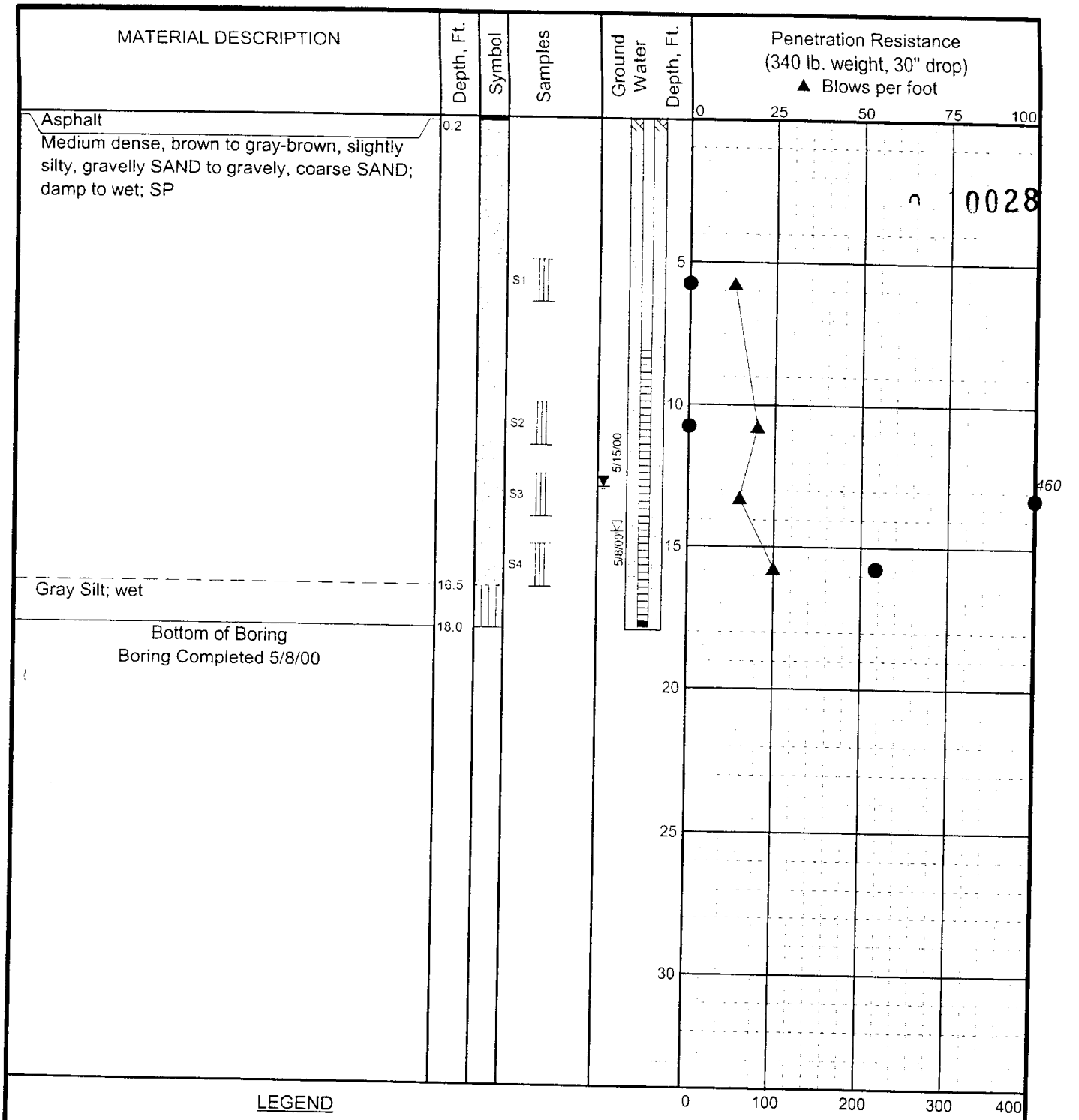
Fig. 5

MASTER LOG 5030MW.GPJ SHAN_WIL.GDT 6/12/00



0028

LEGEND

* Sample Not Recovered
2" O.D. Split Spoon Sample
3" O.D. Split Spoon Sample
Surface Seal
Solid Casing and Annular Sealant
Well Screen and Filter Sand
Cuttings Backfill
Ground Water Level At Time of Drilling
Static Ground Water Level

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. USC letter symbol based on visual classification.

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Anchorage, Alaska

LOG OF BORING NO. B5

June 2000 Y-6300-302

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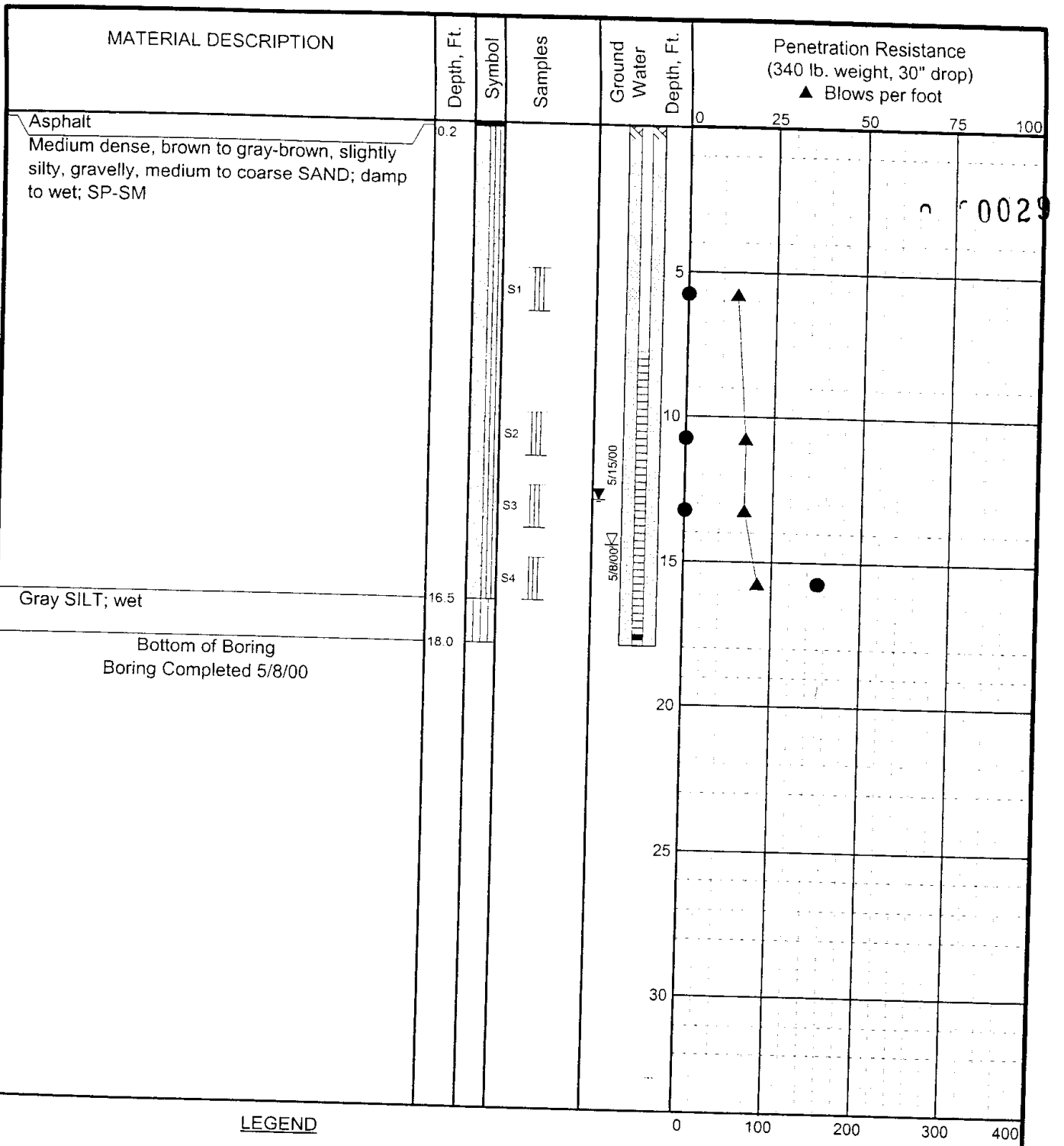
Fig. 6

MASTER LOG 5030MW.GPJ SHAN WIL.GDT 6/12/00



LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- 3" O.D. Split Spoon Sample
- Surface Seal
- Solid Casing and Annular Sealant
- Well Screen and Filter Sand
- Cuttings Backfill
- Ground Water Level At Time of Drilling
- Static Ground Water Level

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. USC letter symbol based on visual classification.

3727 Spenard Road
Anchorage, Alaska

LOG OF BORING NO. B6

June 2000 Y-6300-302

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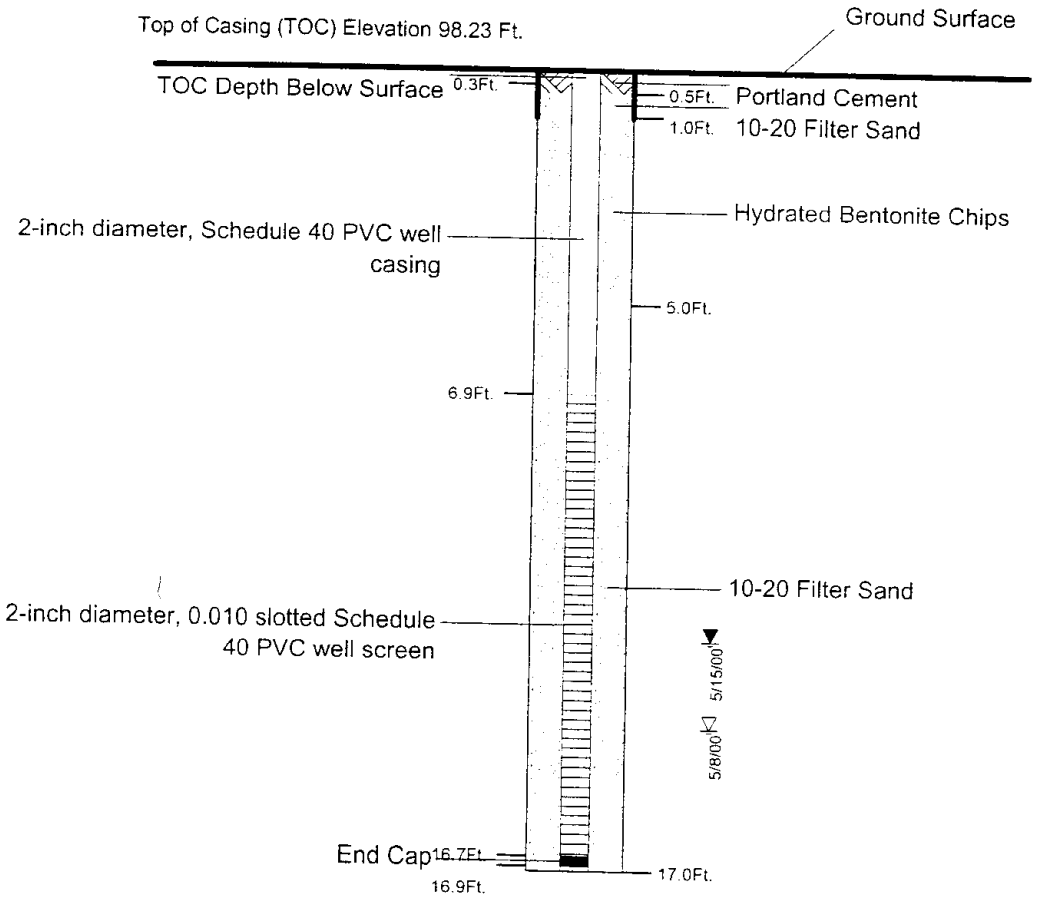
Fig. 7

MASTER LOG 5030MW.GPJ SHAN WIL.GDT 6/12/00

Casing Description **Backfill Description**



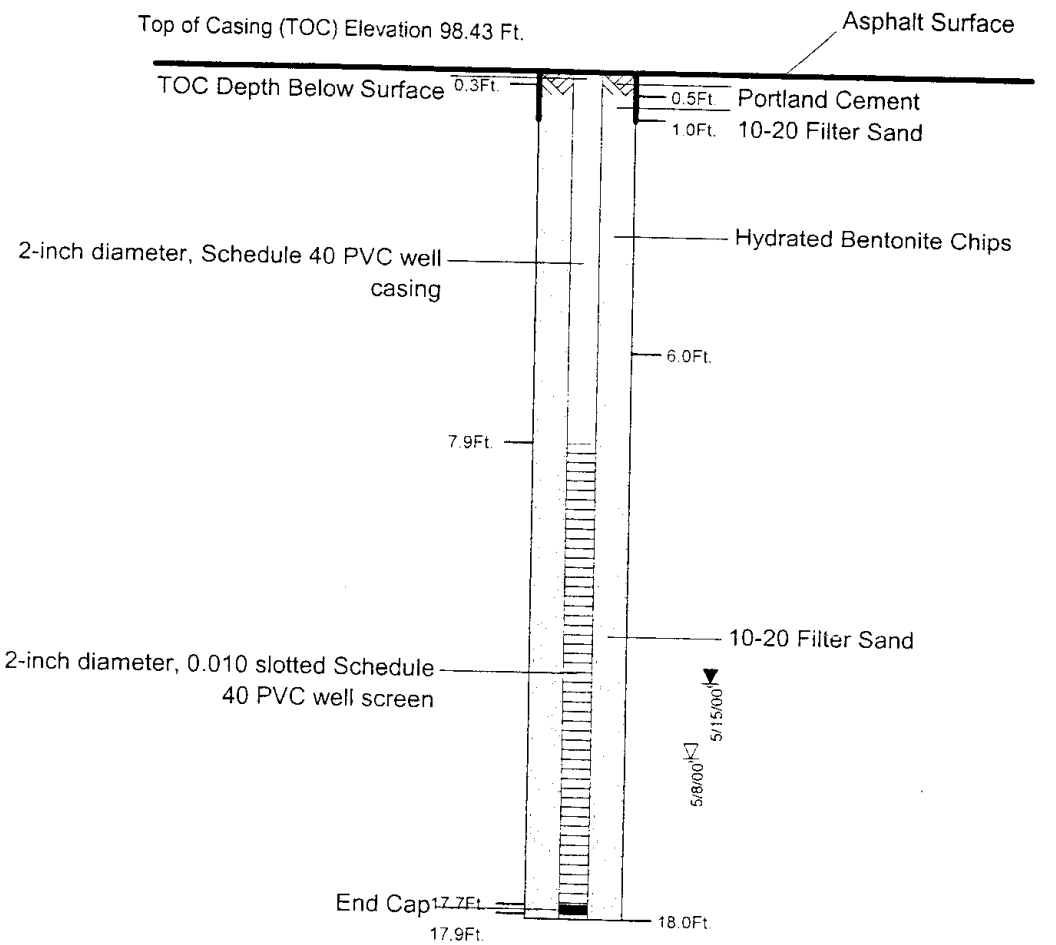
LEGEND

- ▽ Ground Water Level At Time of Drilling
- ▼ Static Ground Water Level

NOTE: All joints use threaded connections.

3727 Spenard Road Anchorage, Alaska	
MONITORING WELL B4MW CONSTRUCTION DETAIL	
June 2000	Y-6300-302
SHANNON & WILSON, INC. Geotechnical and Environmental Consultants	Fig. 8

Casing Description | **Backfill Description**



LEGEND

▽ Ground Water Level At Time of Drilling

▼ Static Ground Water Level

NOTE: All joints use threaded connections.

3727 Spenard Road
Anchorage, Alaska

MONITORING WELL B5MW CONSTRUCTION DETAIL

June 2000 Y-6300-302

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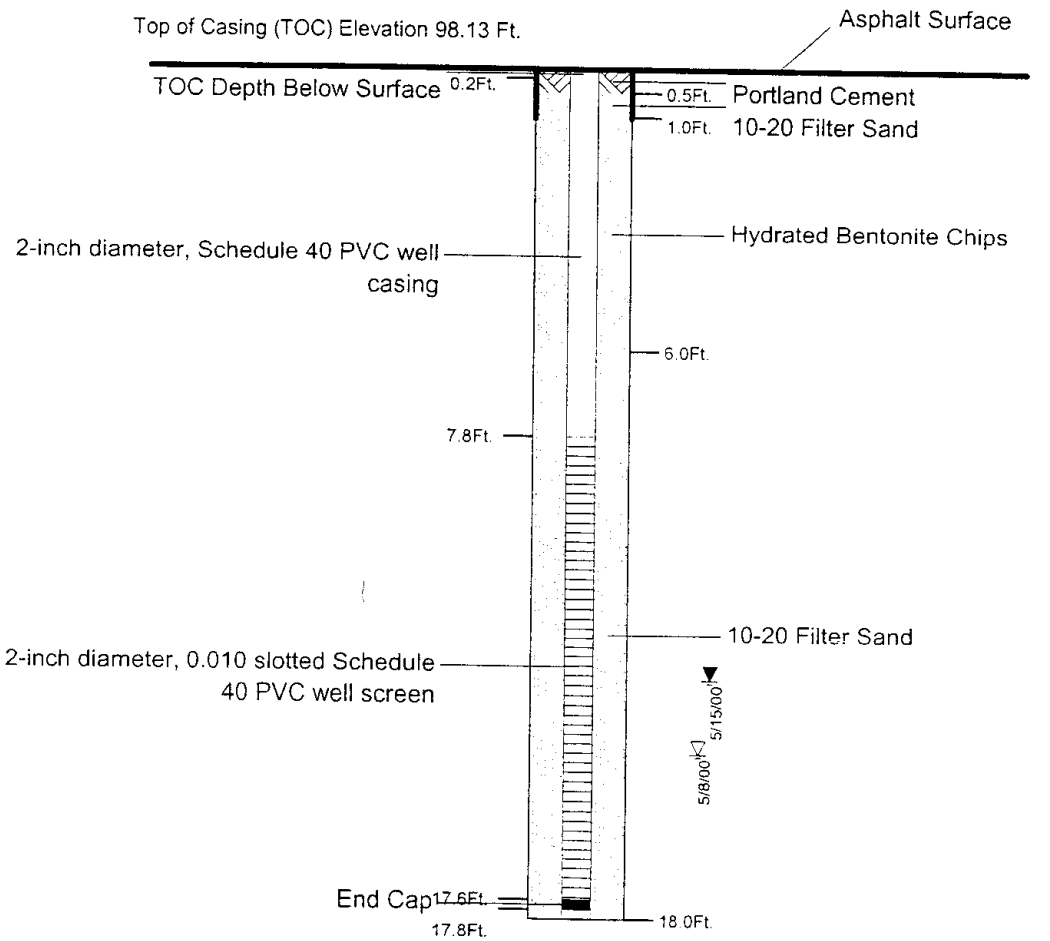
Fig. 9

Casing Description **Backfill Description**

0032



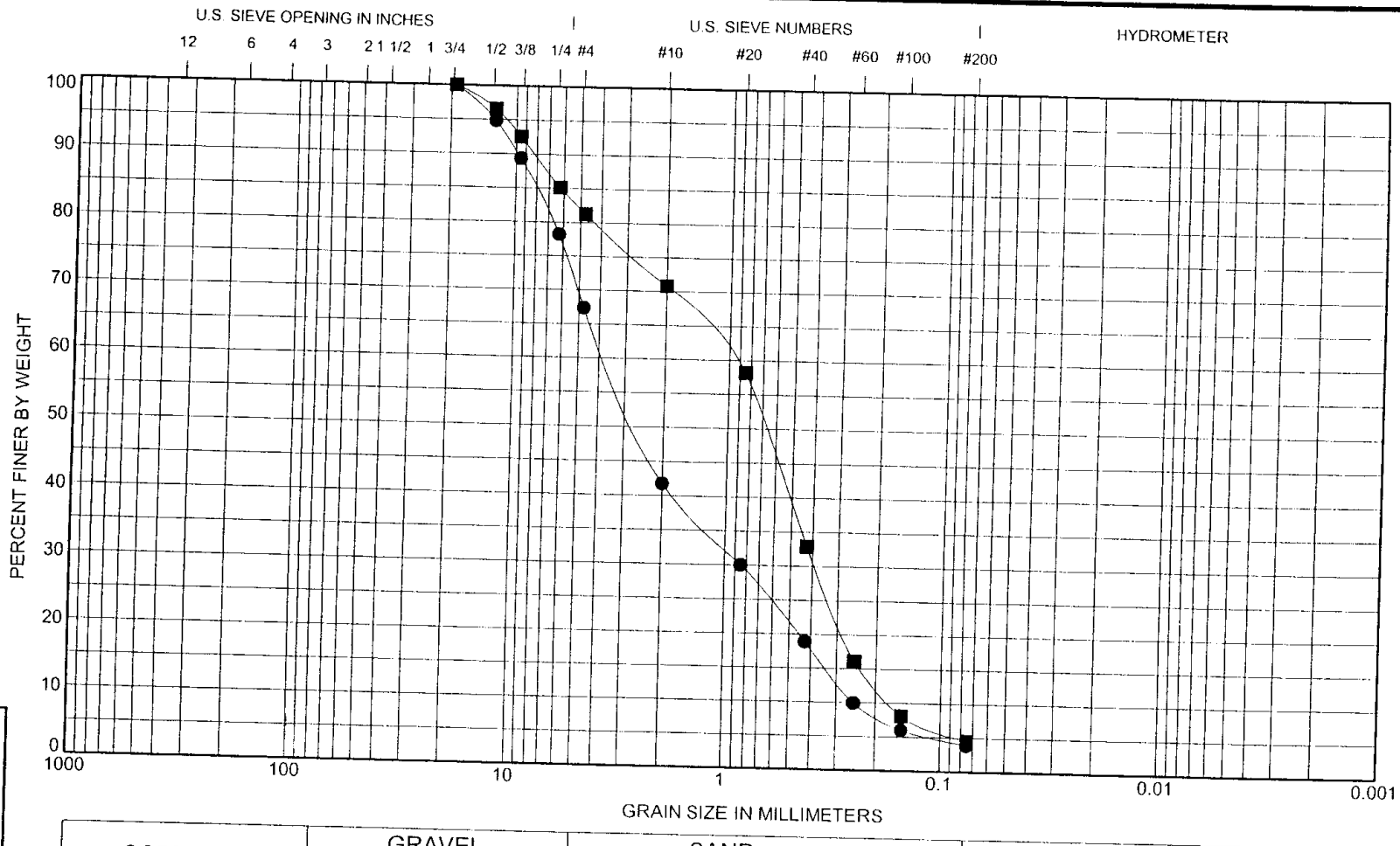
LEGEND

▽ Ground Water Level At Time of Drilling

▼ Static Ground Water Level

NOTE: All joints use threaded connections.

3727 Spenard Road Anchorage, Alaska	
MONITORING WELL B6MW CONSTRUCTION DETAIL June 2000	Y-6300-302
SHANNON & WILSON, INC. Geotechnical and Environmental Consultants	**Fig. 10**



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	B-5, S-4	15.0 - 16.5	Gravelly SAND (SP)				0.8	14.8
■	B-6, S-2	10.0 - 11.5	Slightly silty, gravelly SAND (SP-SM)				0.9	5.7

	Sample	Depth, Ft	D100	D60	D30	D10	%Cobble	%Gravel	%Sand	%Silt	%Clay
●	B-5, S-4	15.0 - 16.5	19	3.71	0.85	0.25	0	33	63	4	
■	B-6, S-2	10.0 - 11.5	19	0.96	0.39	0.17	0	18	77	5	

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GRAIN SIZE CLASSIFICATION

June 2000

Y6300-302

Fig. 11

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