TGA *Thor Gold Alaska Inc.*

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Palmer Alaska 99645
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Corrective Plan of Action

In 1997 Thor Gold Alaska Inc. removed several underground fuel storage tanks. The tanks were cut up and hauled from the site by B.C. Excavating Inc. The soil around the tanks, was sampled and then hauled to a containment area and covered.

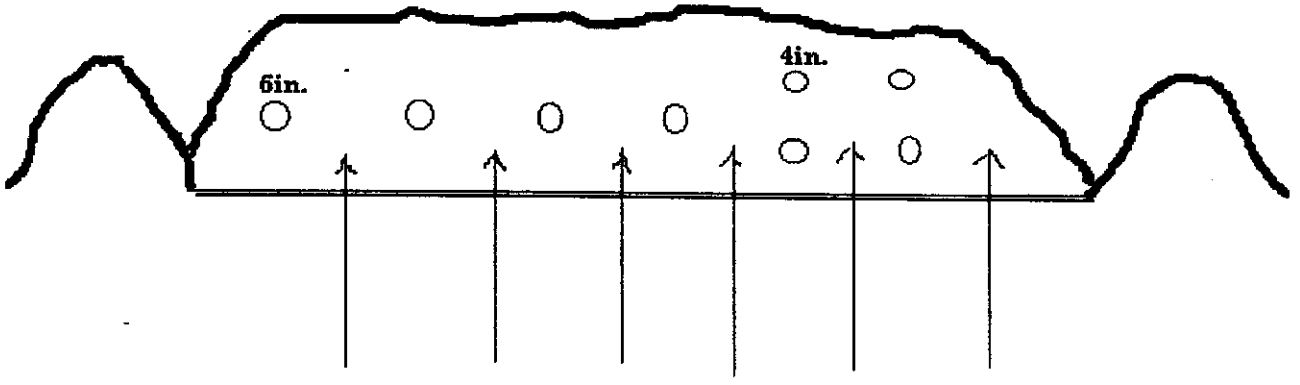
In 1998 Thor Gold placed perforated pipe threw out the soil to start Ventilating as shown in the sketch marked #1. The soil was then covered.

In 1999 Thor Gold would like to add more perforated pipe to allow for more soil to be exposed to air movement. every four years after the placement of the vent pipe, samples will be taken and tested. Sampling of the soil will be repeated every four years until soil reaches DEC standards.

The holes left by the fuel tanks have been left open to ventilate since the removal of the tanks. The hole located at the mill building poses no threat to the stability of the buildings foundation. We would like to leave this hole open to continue to ventilate until levels reach DEC standards. Samples will be taken every two years.

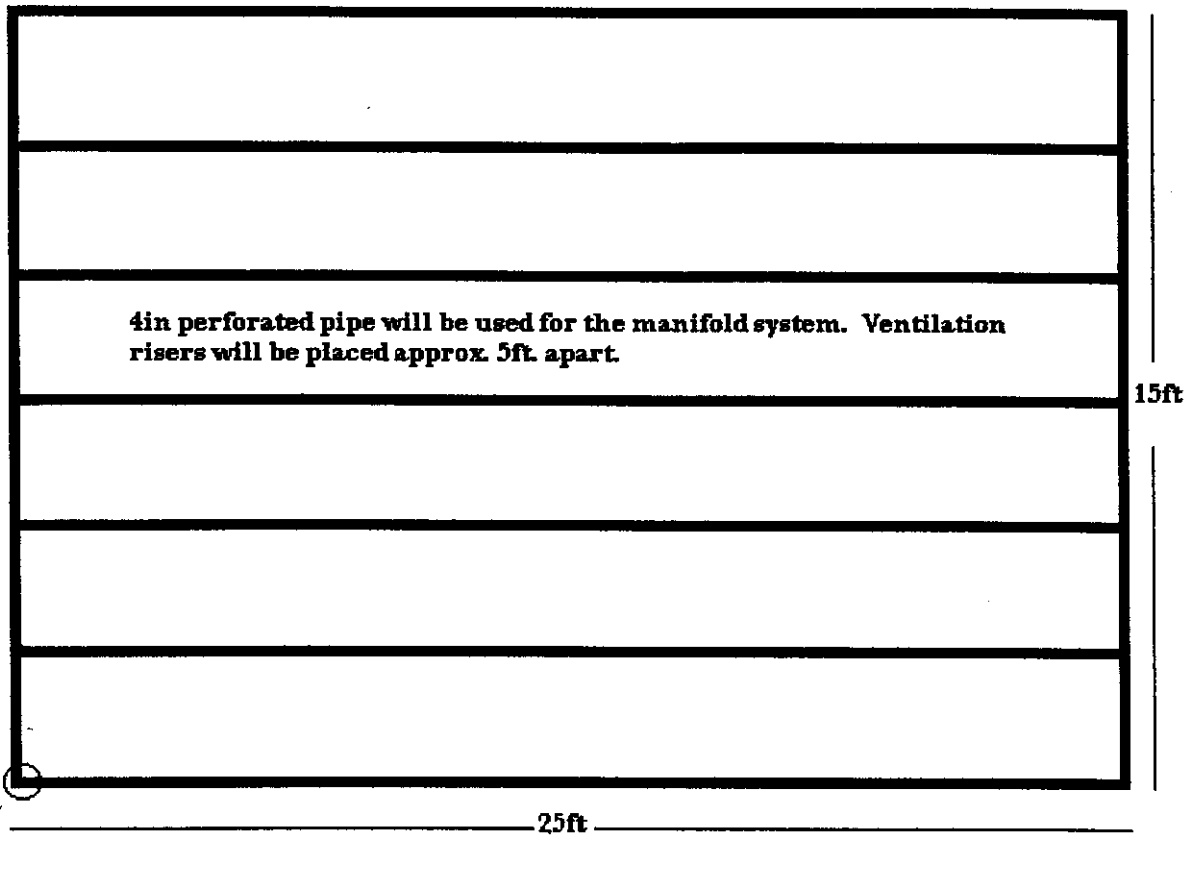
The two holes located at the shop building do pose a threat to the foundation's stability and should be backfield in 1999. Thor would like to sample the bottom and side walls of the holes. After the test results are completed and if the soil still exceds the level set by the DEC a manifold system as shown in sketch #2 will be placed in the bottom, there will be ventilating risers placed approx. every five feet and sticking two to three feet above the ground level. A core sample of the bottom of the hole will be taken every five years and the soil tested.

Containment area 50ft. x 60ft.
Soil Highth 5ft.
6in. and 4in. perforated pipe was used to ventalate soil
Two layers of reinforceed plastic was used to cover soil after ventilating
soil sets on a 20-mil petroleum resistant liner



4in. perferited pipe will be added to allow for better ventilation.

#2


4in perforated pipe will be used for the manifold system. Ventilation risers will be placed approx. 5ft. apart.
15ft
25ft
Risers

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DEC 29 1998
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
MSBO

Underground Storage Tank Closure Assessment Willow Creek Mine Hatcher Pass Road Palmer, Alaska

October 1997

Thor Gold Alaska
Mr. Paul Glavinovich
P.O. Box 111323
Anchorage, AK 99511

SHANNON & WILSON, INC.
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1.0 INTRODUCTION

This report documents the results of the closure assessment conducted during the removal of five underground storage tanks (USTs) at the Willow Creek Mine. The site, referred to as the Mine, hereafter, is located at Mile 22.5 of the Hatcher Pass Road, north of Palmer, Alaska. The subject vessels covered in this report included two regulated 10,000 gallon diesel USTs, two regulated 5,000 gallon diesel USTs, and a regulated 2,000 gallon gasoline UST. A sixth UST used for the storage of waste oil was not removed during these assessment activities.

Tank closure activities were conducted in accordance with the Alaska Department of Environmental Conservation (ADEC) UST Regulations and Shannon & Wilson's ADEC approved Quality Assurance Project Plan (QAPP) as amended by our adoption of the November 3, 1995 UST Regulations and the September 22, 1995 UST Guidance Manual . Authorization to proceed with this work was received from Paul Glavinovich, in the form of a signed proposal, dated June 7, 1997.

Presented in this report are our on-site observations with respect to field monitoring during the tank removals, screening and sampling the soils in the UST excavations and stockpiled soils, laboratory analyses, and characterization of the subsurface conditions and extent of petroleum hydrocarbon impact to the soil. In summary, confirmation analytical results indicate that levels of petroleum hydrocarbons, ADEC's clean up guidelines, remain in the soils surrounding all five of the former USTs at the Mine.

2.0 SITE AND PROJECT DESCRIPTION

The Willow Creek Mine is located north of Palmer, Alaska, at Milepost 22.5 of the Hatcher Pass Road, as shown on Figure 1. The site is situated in the northern 1/2 of Section 2, Township 19 North, Range 1 West, Seward Meridian, and can be found on the Anchorage (D-7 NW) USGS Quadrangle. The approximate coordinates of the site are 61° 46' north latitude, 149° 24' west longitude. A site plan showing the location of the tanks in relation to site features is included as Figure 2. Details of the UST excavations, including excavation dimensions and sampling locations, are included on Figures 3 through 5. Photographs of the UST closure activities are included in Appendix A.

This project consisted of monitoring the removal of five regulated USTs. Tanks 1 and 2 were regulated 10,000 gallon USTs formerly used to supply diesel fuel to the generators that provided electrical power to the Mill site. Tank 3 was a regulated 5,000 gallon UST formerly used

to supply diesel fuel to the generators that provided electrical power for the Shop. Tanks 4 and 5 were used to supply fuel to vehicles, equipment, and tools at the Mine, and were a regulated 2,000 gallon gasoline UST and a regulated 5,000 gallon diesel fuel UST, respectively.

Tank 6 is reportedly a regulated 1,000 gallon UST used to store used oil and was not removed as a part of this project. Site plans showing the location of this tank are included in Figures 2 and 6.

Thor Gold employees, under the guidance of Shannon & Wilson, provided the labor and equipment for the removal of the USTs and associated piping. Shannon & Wilson was retained to screen the soils in the excavations, coordinate with the analytical laboratory for testing of confirmation samples, and report the results of these efforts to Mr. Scott Ubanks and Mr. Paul Glavinovich of Thor Gold Alaska. B.C. Excavating (BCX) of Anchorage, Alaska, provided services for the cutting, cleaning, and disposal of the USTs at Alaska Metal Recycling (AMR). CT&E Environmental Services, Inc. of Anchorage, Alaska, provided laboratory analysis of the samples. Alaska Pollution Control (APC) of Anchorage, Alaska, removed and recycled the water and fuel mixture recovered from Tank 5.

3.0 FIELD ACTIVITIES

On August 6 and 7, 1997, the subject USTs and associated piping were removed from the ground. The UST excavations were barricaded and left open until the receipt of confirmation sample results. On September 17, 1997, a Shannon & Wilson representative returned to the site to collect additional confirmation samples after additional material was removed from the Tanks 1 & 2 and Tank 5 excavations. Additional material could not be removed from the Tanks 3 & 4 excavation due to the presence of competent bedrock in the excavation bottom. Field activities for the project included health and safety monitoring, UST and piping removal, soil screening and sampling. The following sections provide an overview of the project and address each of the field activities. Photographs of the field activities are included in Appendix A.

3.1 UST and Piping Removal Procedures

Prior to removing the USTs, the level of residual product in each tank was measured. The residual product was then pumped from the tanks and placed in an on site AST or disposed of offsite. A John Deer 690 ELC tracked backhoe was used to remove the soil from around the tanks and to extract the USTs from the ground. During the excavation work, soil was field screened and segregated, using an OVM 580B photoionization detector or a Sensidyne flame ionization detector (PID/FID) to detect volatile organic vapors which indicate the presence of petroleum hydrocarbons. During the soil segregation process potentially impacted soil from the excavations was stockpile on a 10-mil reinforced liner while clean soils were stockpiled on the ground.

Before the USTs were removed from the excavation, each tank was inerted and the interior was monitored for explosive atmosphere using a combustible gas indicator. When the atmosphere

inside the tank was less than 10 percent of the lower explosive limit (LEL) at three measurement points within the tank, the tank was removed from the ground. The atmosphere in the work area was monitored by Shannon & Wilson's field representative using a PID/FID to check for the presence of volatile hydrocarbon vapors during initial excavation and periodically during removal activities.

After removal from the ground, the USTs were moved to the storage cell along the southern side of the Mill for final inerting, cleaning, and cutting by BCX. The location of this cell is shown in Figure 2. The USTs and the associated piping were disposed of at AMR. Disposal receipts from AMR are included in Appendix B.

3.1.1 Tanks 1 & 2

Tanks 1 and 2, as referred to in the UST Closure Notice, were two 10,000 gallon diesel USTs installed in about 1982. These tanks were used to supply fuel to the generators that provided power to operate the Mill. The USTs were located along the north side of the Mill as shown in Figures 2 and Appendix A. Photographs 1 through 4. These two tanks were set end to end and oriented with their long axis in an east-west direction, as shown in Figure 3. A portion of the Mill's security office was constructed over the USTs, where the ends met. The security office was removed from above the USTs for the closure activities. Approximately 750 gallons of diesel fuel was removed from each UST and placed in the 10,000 gallon AST, located at the site.

Both USTs were cylindrical, steel vessels measuring 8 feet in diameter by 29 feet in length. The subject USTs were located in an unpaved area beneath approximately 3 feet of soil. The USTs had 2-inch steel pipes located at the east end of each UST and a single 2-inch vent pipe, that surfaced near the east end of the western UST. The tank piping was plumbed in a manner such that as one tank emptied, fuel from the other UST would be transfer into the near empty UST through a turbine pump. All of the tank piping was situated over the tanks or within the limits of the excavation for the two USTs. The USTs showed light to moderate signs of corrosion, but no holes were observed.

Approximately 120 cubic yards of potentially contaminated material were removed from the excavation and stockpiled on a liner. The surface area of the excavation measured approximately 1,050 square feet. Groundwater was not encountered during the excavation of the USTs which was extended to a total depth of 14 feet bgs. The water puddles, shown in photographs 3 and 4 in Appendix A, in the bottom of the excavation were not a reflection of groundwater, but rather that of heavy rainfall that had fallen during the removal period. Water is also visible on the ground surface in these photos.

3.1.2 Tanks 3 & 4

Tank 3, as referred to in the UST Closure Notice, was a regulated 5,000 gallon diesel tank and Tank 4 was a regulated 2,000 gallon gasoline UST. The location of these tanks are shown in

Figure 2. These tanks were installed in about 1982 to supply fuel to vehicles, equipment, and tools. The USTs were located east of the southeast corner of the Shop Building, as shown in Figure 4 and Photographs 5 through 8 in Appendix A. Approximately 100 gallons of diesel fuel was removed from Tank 3 and placed in a 10,000 gallon AST, located at the site. Tank 4, originally thought to be a 3,000 gallon tank, contained about 50 gallons of gasoline. This fuel was pumped into a 55 gallon drum prior to beginning the excavation activities.

Tank 3 was a cylindrical, steel vessel measuring 8 feet in diameter by 14 feet in length. A detailed diagram showing the orientation of the UST and associated piping is included in Figure 4. As shown in Phot 5 in Appendizx A, Tank 3 was located in an unpaved area and buried approximately 4 feet below the ground surface. The UST had two 1-inch steel feed and return lines that ran from the ends of the UST towards the pump dispensing island, shown in Figure 4. A 4-inch fill pipe was located at the north end of the UST and a 2-inch vent pipe, also connected to the top of the tank, was located at the southern end of the UST. The UST showed no signs of corrosion and no holes were observed.

Tank 4 was a 2,000 gallon, cylindrical, steel vessel measuring 5.3 feet in diameter by 12 feet in length. A detailed diagram showing the orientation of the UST, associated piping and stockpiled soils is included as Figure 4. Tank 4 was located in an unpaved area beneath approximately 2.25 feet of soil. The UST had two 1/2-inch steel feed and return lines that ran from the west end of the UST, west to the former pump island. A 4-inch fill pipe was located at the east end of the UST, and surfaced near the southern end of the pump island. The 2-inch vent pipe, connected to west end of the tank, surfaced at about the center of the pump island as shown in Photograph 5. The UST showed light to moderate signs of corrosion, but no holes were observed.

Approximately 110 cubic yards of potentially contaminated material were removed from the single excavation for Tanks 3 and 4 and stockpiled on 10-mil reinforced plastic liner. As shown in Figure 4, the excavation encompassed an area of approximately 800 square feet. Competent bedrock was encountered in the sidewalls and base of the excavation. Groundwater was not encountered during the excavation of the USTs which was extended to a total depth of 13 feet bgs. Water puddled in the excavation bottom in Photo 8 was from rains during the removal period.

3.1.3 Tank 5

Tank 5 was a regulated 5,000 gallon diesel tank, installed in about 1982 to supply fuel to generators that provided electrical power to the Shop. The UST was located north of the northeast corner of the Shop, as shown in Figure 2, and Photographs 9 through 12. The tank was oriented with its long axis in an east-west direction as shown in Figure 5. Approximately 5,000 gallons of product and water were removed and disposed of through APC. At the time of the UST removal activities the UST was full of water and product. It appears that the water entered the UST via a fill or vent line that had broken off below grade. It appears that as the UST filled with water, fuel flowed out the broken line and into the subsurface soils.

Tank 5 was a cylindrical, single wall steel vessel measuring 8 feet in diameter by 14 feet in length. As shown in Photo 9 in Appendix A, it was located in an unpaved area and buried approximately 4 feet below the ground surface. The UST had two 1/2-inch steel feed and return lines that ran from the west end of the UST into the Generator Shed, as shown in Figure 5. A 4-inch fill pipe was located at the eastern end of the UST, while the 2-inch vent line originated from the western end of the UST. The UST showed light to moderate signs of corrosion, but no holes were observed.

Approximately 50 cubic yards of potentially contaminated material were removed from the excavation and stockpiled on 10-mil reinforced plastic liner in the three temporary piles shown in Figure 5. The excavation encompassed an area of approximately 425 square feet. Groundwater was not encountered during the excavation of the UST which was extended to a total depth of 13 feet bgs. The water visible in Photos 11 and 12 is from recent rainfall.

3.1.4 Used Oil UST

UST No. 6, as we understand, is a regulated 1,000 gallon diesel tank that was installed in about 1982. This tank is used for the storage of used oil removed from machinery and equipment at the Mine. The UST was located along the west side of the Shop Building, as shown in Figure 6. The UST is located inside the building, beneath the concrete floor slab. The UST appears to lie inside the footing wall for the structure.

On August 7, 1997 the tank contained about 2 feet of product or about 50 percent of the tank capacity. The top of the tank is about 4 feet below the top of the concrete floor and the bottom of the UST is about 8 feet below the top of the concrete floor. A feed pipe, with a filter drain is attached to the western interior wall of the structure. A 2-inch vent line lies about 4 feet north of the fill line. A 4-inch clean out pipe lies about 3 feet north of the fill pipe, flush with the concrete floor slab. The vent and clean out pipes vent into the building.

3.2 Sample Collection and Screening

The soil at the UST sites were evaluated or "screened" for volatile organic compounds using a OVM 580B photoionization detector (PID) calibrated with 100 parts per million (ppm) of isobutylene standard gas and headspace screening methods. Samples collected during the follow up sampling activities were also screened with a Sensidyne flame ionization detector (FID). The PID/FID measured the total hydrocarbon vapors released by the soil collected from around the tank and piping excavation as well as the stockpiled soil. In the screening process, headspace samples were collected in zip lock plastic bags by filling them with freshly exposed soil to about one-half their volumes using a stainless-steel spoon and then sealing the top. New stainless-steel spoons were used to take each headspace and analytical sample. Headspace samples were allowed to warm up to a common temperature prior to field screening. Field PID/FID readings were performed within 1/2 hour of the sample collection. Screening was accomplished by inserting the

PID/FID sampling probe into the air space above the soil in the bag. The PID/FID display was observed and the maximum reading was recorded for each sample.

Analytical samples, with the exception of gasoline range organics (GRO) and aromatic volatile organic (BTEX) samples, were collected by quickly and completely filling the appropriate laboratory provided jars. The analytical samples analyzed for GRO and BTEX were collected using the ADEC sampling procedure for Alaska Method 101 (AK 101). In accordance with the ADEC method, approximately 25 grams of soil were quickly placed into a laboratory supplied 4 oz. jar that had been pre-weighed. Afterward, 25 milliliters (ml) of reagent grade methanol were added to completely submerge the soil. The methanol extracted the volatile petroleum hydrocarbons from the soil at the time of sampling, thereby reducing the possible loss of volatile constituents before analysis. All samples were transferred to the jars using new stainless-steel spoons., and transported to the laboratory in coolers with ice packs using chain-of-custody procedures. The number, depth, location, soil classification, and headspace screening results of the samples collected for the project are summarized in Table 1. The sampler's name, the date, and time of sample collection are listed on the chain-of-custody forms included in Appendix C.

Under the sample number scheme used for this project, a typical analytical sample number is Y-5789-S1 for excavation or Y-5789-SP1S1 for stockpile samples. The 'Y-5789' indicates the Shannon & Wilson project number. The 'SP1' designation represents the stockpile number. The 'S1' designation represents the sample number. For brevity in the text, tables, and figures of this report, the 'Y-5789' prefix is omitted and samples are identified by their sample number.

3.3 UST and Piping Excavation

Headspace samples were collected from the excavations and screened with a PID/FID to evaluate potential migration of contamination in the soil or rock surrounding the UST. Based on the highest headspace readings, two soil/rock samples were collected for the first 250 square feet of excavation surface area, and one for each additional 250 square feet. Additionally, one sample was collected for each 20 feet of piping. The headspace and analytical sample locations are shown in Figures 3 through 6 and a description of each sample is included in Table 1.

3.3.1 Tanks 1 & 2

Eleven headspace samples, designated Samples HS1 through HS11, were collected from the sidewalls of the excavation for Tanks 1 and 2. Samples were collected from depths ranging from 5 to about 7 feet below the ground surface. Five analytical confirmation samples, designated S9 through S13 were collected from the bottom of the excavation for Tanks 1 and 2 during our August 8, 1997 site visit. The results from these samples indicated that additional contamination was present in the bottom of the excavation. Following the removal of additional material from the bottom of the excavation, six additional samples, designated S17 through S22 were collected from the bottom of the excavation. Headspace and analytical sample locations are shown in Figure 3. Headspace screening results are presented in Table 1.

3.3.2 Tanks 3 & 4

Three headspace samples, designated Samples HS1 through HS3, were collected from the sidewalls of the excavation for Tank 3. Samples were collected from depths ranging from 6 to 7 feet bgs. Two analytical samples, designated S1 and S2 were collected from beneath the southern and northern ends of the UST, respectively. These samples were collected from depths of about 11.5 and 13 feet bgs. Headspace and analytical sample locations are shown in Figure 4. Screening results are presented in Table 1.

Three headspace samples, designated Samples HS1 through HS3, were collected from the sidewalls of the excavation for Tank 4. Samples were collected from depths ranging from 5 to 7 feet below the ground surface. Two analytical samples, designated Samples S3 and S4 were collected from beneath the western and eastern ends of the UST, respectively. These samples were collected from depths of about 13 feet. Headspace and analytical sample locations are shown in Figure 4.

One sample, designated S5 was collected from beneath the dispenser island. The dispenser island lies within the partially shared excavation for Tanks 3 and 4. Sample S5 was collected from the weathered bedrock beneath the former pump island at a depth of about 8 feet. The result is presented in Table 1.

3.3.3 Tank 5

Seven headspace samples, designated Samples HS1 through HS7, were collected from the sidewalls of the excavation for Tank 5. Samples were collected from depths ranging from about 5 to 10 feet bgs. Two analytical samples, designated Samples S6 and S7 and field duplicate Sample S107, were collected from the bottom of the excavation for Tank 5 during our August 8, 1997, site visit. One sample, designated Sample S8, was collected from beneath the piping to the former generators.

Nine additional headspace samples, designated Samples HS8 through HS14 were collected from the sidewalls and bottom of the excavation, following the removal of additional soils from the bottom of the excavation. Based on the headspace results, Samples S15 and S16 were collected from the base of the final excavation at about 13 feet bgs. Sample locations, descriptions, and screening results are described in Table 1, while the locations of head space and analytical samples are shown on Figure 5.

3.4 Stockpiled Soils

After the tanks were removed, headspace samples were also collected from the stockpiles at a rate of at least one sample per 10 cubic yards using ADEC approved headspace sampling methods. The locations of these samples are shown on Figures 3 through 5.

As soil or rock was removed from the excavations, it was segregated using headspace sampling and placed on 10-mil plastic liners. Following the receipt of analytical sampling results, all of the stockpiled material, except for approximately 10 cubic yards of material generated during the removal of Tank 5, was placed in a long term storage cell. The long term storage cell was constructed south of the Mill Building, at the locationshown in Figure 2. The stockpile is also shown in Photos 13 and 14 in Appendix A. The cell, measuring about 100 by 100 feet with bermed walls about 4 feet in height, was constructed of waste rock and soil from tunneling activities at the mine. Approximately 1 foot of fine sand, a waste material from crushing and milling operations, was placed on the bottom of the storage cell. The bottom of the cell was then lined with a 20-mil petroleum resistant liner. The cell was also used to hold the USTs prior to being hauled off site, and finally the soils removed from the tank excavations.

3.4.1 Tanks 1 & 2

Three temporary stockpiles, designated Stockpiles 4, 5 and 6 were generated during the removal of Tanks 1 and 2. As shown in Figure 3, these soils were temporarily stored to the north of the excavation on a 10-mil reinforced plastic liner. Stockpiles 4 and 6 contained about 50 cubic yards of material, while Stockpile 5 contained about 20 cubic yards. A total of thirteen headspace samples, designated Samples SP4S1 through SP4S5, SP6S1 through SP6S5, and SP5S1 through SP5S3, were collected and screened from the 50 cubic yards in each of Stockpiles No. 4 and 6 and the 20 cubic yards in Stockpile No. 5, respectively. Soil samples SP4S4, SP5S1, and SP6S5 were selected to characterize the soils in Stockpile No 4, 5 and 6, respectively. The headspace screening values are listed in Table 1 and the location of the headspace samples are shown on Figure 3.

3.4.2 Tanks 3 & 4

A total of ten headspace samples, designated Samples SP1S1 through SP1S5 and SP2S1 through SP2S5, were collected and screened from two piles of soil stockpiled during the removal of Tanks 3 and 4. Samples SP1S4 and SP1S5 were selected based on headspace results to characterize the 80 cubic yards of soil in Stockpile No. 1. Sample SP2S3 was selected to characterize the 30 cubic yards of soil in Stockpile No. 2. The headspace screening values are listed in Table 1 and the location of the headspace samples are shown on Figure 4.

3.4.3 Tank 5

A total of five headspace samples, designated Samples SP3S1 through SP3S5, were collected and screened from the 50 cubic yards of stockpiled soils generated during the excavation of Tank 5. Sample SP3S5 was selected to characterize the stockpiled soils. The headspace screening values are listed in Table 1 and shown on Figure 5.

4.0 LABORATORY ANALYSES

Soil samples collected from the excavations and stockpiles were selected for analytical testing based on visual and olfactory evidence and the PID/FID headspace readings presented in Table 1. The samples collected from the UST excavations and stockpiles, were selectively analyzed for diesel range organics (DRO) by Alaska Method 102 (AK 102), GRO by AK 101, and BTEX by EPA Method 8020 as modified by AK 101. Additionally, Samples S3, S5, SP1S5, and SP2S3, collected from the gasoline UST (Tank 4), were analyzed for total lead by EPA Method 7421. One methanol/trip blank, designated Sample TB-2, was analyzed for GRO by AK 101 and BTEX by EPA Method 8020 as modified by AK 101. All samples were delivered to the laboratory using chain-of-custody procedures and analyzed by CT&E of Anchorage, Alaska. The laboratory results are summarized in Table 2, while individual laboratory reports are presented in Appendix C.

5.0 SUBSURFACE CONDITIONS

5.1 Soils

Soils encountered during the excavation of the USTs were generally a silty gravel fill or native weathered rock. Competent bedrock was encountered at about 13 feet bgs in the Tanks 3 and 4 excavation near the southeast corner of the Shop.

5.2 Groundwater

Groundwater at the Willow Creek Mine lies at depths of about 18 to 28 feet. Depth to the shallow groundwater was measured in three of the eleven monitoring wells located around the perimeter of the Mill and tailing ponds. The depth to groundwater in Monitoring Wells 1, 3 and 8 are about 18, 25 and 28 feet below the ground surface, respectively. The locations of Monitoring Wells 1 and 3 are shown on Figure 2, and Monitoring Well 8 is located northwest of the Bunk House. Reportedly, the two drinking water wells (Nos. 3 and 4 in Figure 2) at the Mine are completed at a depth of about 360 feet into the bedrock.

6.0 DISCUSSION OF RESULTS

The following sections and Table 2 present the results of the analytical testing of the soil/rock from the UST and piping excavations and stockpiles. The ADEC Soil Matrix Score Sheet, included as Table 3, indicate that the site must be cleaned up to Category A Clean up levels. As shown in Table 3, the appropriate Category A soil cleanup levels are: 100 ppm DRO, 50 ppm GRO, 0.1 ppm benzene, and 10 ppm BTEX. The following sections describe the results of our analytical sampling and testing program.

6.1 Tanks 1 & 2

Five samples designated S9 through S13 were collected from the bottom of the excavation during our initial site visit on August 7, 1997. Samples S9, S10, S12 and S13 contained DRO concentrations ranging from 6.54 to 733 ppm. Sample S12 the sample with the highest DRO concentration of 733 ppm and contained 1.3 ppm GRO and non-detectable BTEX. Sample S11 collected from the soils between the two USTs contained 29.3 ppm DRO, 14.7 ppm GRO and 0.9773 ppm total BTEX, attributable to 0.0393 ppm toluene, 0.331 ppm ethylbenzene, and 0.607 ppm xylenes.

On September 17, following the removal of additional soils from the bottom of the excavation, six additional samples, designated Samples S17 through S22 were collected from the bottom of the excavation. Samples S17, S21 and S22 contained DRO concentrations ranging from non-detectable to 12.1 ppm, and non-detectable concentrations of GRO and total BTEX. Samples S18, S19 and S20 contained DRO concentrations ranging from 89.9 to 735 ppm, GRO concentrations ranging from 2.48 to 52.4 and total BTEX concentrations ranging from 0.0318 to 0.734 with non-detectable concentrations of benzene.

Although most areas of the excavation are below the Category A cleanup criteria, DRO and GRO concentrations greater than the applicable Category A cleanup criteria remain in the soils where the two USTs bordered each other and at the eastern end of Tank 2.

Sample SP4S4, collected from the east side of Stockpile No. 4 at a depth of about 1.5 feet, had 150 ppm DRO, 5.05 ppm GRO and non-detectable concentrations of benzene, toluene, and ethylbenzene and 0.0725 ppm total xylenes for a total BTEX concentration of 0.0725 ppm. Sample SP5S1, collected from the south side of Stockpile No. 5 at a depth of about 1.5 feet, contained 404 ppm DRO, 16.2 ppm GRO and non-detectable concentrations of benzene and ethylbenzene, 0.0555 ppm toluene, and 0.248 ppm total xylenes for a total BTEX concentration of 0.304 ppm. Sample SP6S5 collected from the center of Stockpile No. 6 at a depth of about 1.5 feet, contained 1730 ppm DRO, 10.8 ppm GRO and non-detectable concentrations of benzene and ethylbenzene, 0.0243 ppm toluene, and 0.244 ppm total xylenes for a total BTEX concentration of 0.268 ppm.

The DRO concentrations remaining in Stockpiles No. 4, 5 and 6 soils were greater than the applicable Category A cleanup criteria, therefore, these soils were placed in the long term storage cell.

6.2 Tanks 3 & 4

Five samples, designated Sample S1 through S5 were collected from the undisturbed soils at the bottom of the excavation for Tanks 3 and 4 and from beneath the pump island. Sample S1 taken from beneath the southern end of the Tank 3 excavation at a depth of about 13 feet, contained 3070 ppm DRO, 123 ppm GRO and 3.015 ppm total BTEX, attributable to 0.0568 ppm benzene,

0.155 ppm toluene, 0.283 ppm ethylbenzene and 2.52 ppm xylenes. Sample S2, collected from the soils beneath the fill pipe end of the UST excavation at a depth of about 11.5 feet, had 539 ppm DRO. Sample S3 collected from beneath the western end of Tank 4, at a depth of about 13 feet contained 205 ppm GRO and 0.0171 ppm benzene, 0.346 ppm toluene, 0.963 ppm ethylbenzene and 6.19 ppm xylenes for a total BTEX concentration of 7.50 ppm. Sample S3 also contained 5.9 ppm lead. Sample S4 collected from beneath the eastern end of Tank 4, at a depth of about 13 feet contained 4.01 ppm GRO and non-detectable concentrations of benzene and toluene, 0.022 ppm ethylbenzene and 0.094 ppm xylenes for a total BTEX concentration of 0.116 ppm. Sample S5 collected from beneath the pump dispenser island for USTs Nos. 3 and 4 contained 1670 ppm DRO, 1170 ppm GRO, 6.48 ppm benzene, 58.9 ppm toluene, 19.2 ppm ethylbenzene, 111.6 ppm xylenes for a total BTEX concentration of 196.2 ppm. Sample S5 also contained 3.77 ppm lead.

The DRO and BTEX concentrations remaining in the soils beneath UST Nos. 3 and 4 and beneath the pump dispenser island are greater than the applicable Category A cleanup criteria.

Sample SP1S4, collected from the north side of Stockpile No. 1 at a depth of about 1.5 feet, had 878 ppm DRO, 87.40 ppm GRO and 0.0527 ppm benzene, 0.178 ppm toluene, 0.347 ppm ethylbenzene and 4.91 ppm total xylenes for a total BTEX concentration of 5.49 ppm. Sample SP1S5, collected from the top of Stockpile No. 1 at a depth of about 1.5 feet, contained 238 ppm DRO, 7.38 ppm GRO and non-detectable concentrations of benzene, 0.0271 ppm toluene, 0.0368 ethylbenzene and 0.333 ppm total xylenes for a total BTEX concentration of 0.397 ppm and 5.9 ppm lead. Sample SP2S3 collected from the north end of Stockpile No. 2 at a depth of about 1.5 feet, contained 2070 ppm DRO, 53.10 ppm GRO and 0.0672 ppm benzene, 0.514 ppm toluene, 0.554 ppm ethylbenzene, and 5.06 ppm total xylenes for a total BTEX concentration of 6.19 ppm and 6.07 ppm lead.

The DRO concentrations remaining in Stockpiles Nos. 1 and 2 soils are greater than the applicable Category A cleanup criteria, therefore, these soils were placed in the long term storage cell.

6.3 Tank 5

Sample S6 was collected from the undisturbed soils beneath the eastern end of the UST at a depth of about 12 feet and contained 213 ppm DRO. Sample S7, collected from the undisturbed soils at the northwestern corner of the excavation at a depth of about 10 feet, contained 5960 ppm DRO, 851 ppm GRO and non-detectable benzene, 0.233 ppm toluene, 1.81 ppm ethylbenzene and 3.37 ppm total xylenes for a total BTEX concentration of 5.41 ppm. A duplicate sample of S7, designated S107, contained 5440 ppm DRO.

The DRO, GRO and BTEX concentrations remaining in the Tank 5 soils are greater than the applicable Category A cleanup criteria.

Sample SP3S5, collected from the eastern end side of Stockpile No. 3 at a depth of about 1.5 feet, had 1240 ppm DRO, 36 ppm GRO and non-detectable concentrations of benzene, 0.0828 ppm toluene, 0.602 ppm ethylbenzene and 1.038 ppm total xylenes for a total BTEX concentration of 1.723 ppm.

The DRO concentrations remaining in the Tank 5 Stockpiles No. 3 soils were greater than the applicable Category A cleanup criteria, therefore, these soils were placed in the long term storage cells.

6.4 Quality Control

The analytical results for the soil samples were presented by the laboratory in a Level I Data Deliverables Report. The data quality objectives (DQO) for this project are contained in Shannon & Wilson's April 20, 1991 Quality Assurance Project Plan (QAPP) for UST Site Assessments which has been approved by the ADEC and amended by our adoption of the UST Sampling Procedures Manual of September 22, 1995.

As determined from laboratory reports provided by CT&E, the data quality objectives for this project have been met. In addition, all samples arrived at the laboratory in chilled coolers and were extracted and analyzed within the holding time for each parameter.

Sample S107, a duplicate of Sample S7, was submitted for quality control purposes. Sample S7 and S107 had 5960 ppm and 5440 ppm DRO, respectively. The calculated percent precision for the S7/S107 sample set is 9.1%. In addition to the duplicate samples, one methanol/trip blank, designated TB+2 were also submitted. Non-detectable concentrations of GRO and BTEX compounds were found in the trip sample. The precision goals of internal laboratory duplicates were met.

7.0 CONCLUSIONS/RECOMMENDATIONS

Based on the data presented herein and our interpretations of the conditions at the five UST sites our conclusions and recommendations are summarized below.

The undisturbed soils remaining in the sidewalls and bottom of the excavation for all five USTs are above the ADEC Category A cleanup guidelines established for this site. Additionally, the soils in all of the stockpiles, except 10 cubic yards of the stockpile created at Tank No. 5 site, were determined to be above ADEC Category A cleanup guidelines, therefore, this impacted soil was placed in the long term storage cell shown on Figure 2.

We have performed the above described sampling and testing procedures in accordance with the November 3, 1995 ADEC UST Regulations 18 AAC 78 and September 22, 1995 UST Standard Sampling Procedures. A Notice of Tank Closure and a completed Post Closure Information For Alaska Underground Storage Tanks forms are provided in Appendix D. We

recommend that the owner follow the UST Regulations and submit a copy of this report to the ADEC for their review.

8.0 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 limited research and on the sampling analysis that we conducted at this site. They should not be construed as a definite conclusion regarding the soil and groundwater quality at this site. It is possible that our subsurface tests may have missed some higher levels of petroleum hydrocarbon constituents, although our intention was to sample areas likely to be impacted. As a result, the analysis and sampling performed can only provide you with our best 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, because of natural forces 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 attachments in Appendix E "Important Information About Your Geotechnical/Environmental Report" to assist you and others in understanding the use and limitations of our report.

You are advised that various state and federal agencies (ADEC, EPA, etc.) may require the reporting of this information. Shannon & Wilson, Inc. does not assume the responsibility for reporting these findings and therefore, has not, and will not, disclose the results of this study.

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

Prepared By:

Steff W. Browne, C.P.G.
Geological Engineer II

Approved By:

Fred R. Brown, P.E.
Senior Vice President

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS

		Confirmation Analytical Sample Number and Depth in Feet (See Table 1, Figures 3 through 5, and Appendix C)												
		Tanks 1 & 2											Tank 3	
Parameter Tested	Method*	S9 @ 12	S10 @ 12	S11 @ 12	S12 @ 12	S13 @ 12	**S17** @ 14	S18 @ 14	S19 @ 14	S20 @ 14	S21 @ 14	S22 @ 14	S1 @ 13	S2 @ 11.5
PID Headspace Reading - ppm	OVM 580B	2	4	20	34	15	ND	ND	50	20	ND	ND	268	14
Total Solids - %	SM18 2540G	92.3	90.6	89.9	81	86.9	86.2	87.0	87.0	87.8	87.3	85.5	85.6	91.6
Diesel Range Organics (DRO) - ppm	AK 102	348	112	29.3	733	652	12.1	735	89.9	480	ND	ND	3070	539
Gasoline Range Organics (GRO) - ppm	AK 101	-	-	14.7	1.30	-	ND	31.5	52.4	2.48	ND	ND	123	-
Aromatic Volatile Organics (BTEX)														
Benzene - ppm	EPA 8020/AK 101	-	-	ND	ND	-	ND	ND	ND	ND	ND	ND	0.0568	-
Toluene - ppm	EPA 8020/AK 101	-	-	0.0393	ND	-	ND	ND	ND	ND	ND	ND	0.155	-
Ethylbenzene - ppm	EPA 8020/AK 101	-	-	0.331	ND	-	ND	0.163	0.260	ND	ND	ND	0.283	-
Xylenes - ppm	EPA 8020/AK 101	-	-	0.607	ND	-	ND	0.405	0.474	0.0172	ND	ND	2.52	-
Total BTEX - ppm	EPA 8020/AK 101	-	-	0.9773	ND	-		0.568	0.734	0.0172			3.0148	-
Lead - ppm	EPA 7421	-	-	-	-	-	-	-	-	-	-	-	-	-

KEY	DESCRIPTION
S17	BOLDED SAMPLE NUMBER INDICATES FINAL EXCAVATION CONFIRMATION SAMPLE
-	ANALYTE NOT ANALYZED
*	SEE APPENDIX C FOR LIMITS OF DETECTION
J	ESTIMATED QUANTITY
	DETECTED ANALYTE IS ABOVE ADEC CATEGORY A CLEANUP CRITERIA

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS

		Confirmation Analytical Sample Number and Depth in Feet (See Table 1, Figures 3 through 5, and Appendix C)												
		Tank 4			Tank 5			Stockpiles						
Parameter Tested	Method*	S3 @ 13	S4 @ 13	S5 @ 8	S6 @ 12	S7 @ 10	S8 @ 1.5	SP1S4 @ 1.5	SP1S5 @ 1.5	SP2S3 @ 1.5	SP3S5 @ 1.5	SP4S4 @ 1.5	SP5S1 @ 1.5	SP6S5 @ 1.5
PID Headspace Reading - ppm	OVM 580B	340	100	516	60	350	-	282	122	365	255	7	100	55
Total Solids - %	SM18 2540G	92	93.2	94.2	-	93	89.5	90.2	90.2	88.9	90.5	89.3	87.6	87.9
Diesel Range Organics (DRO) - ppm	AK 102	-	-	1670	213	5960	6.54	878	238	2070	1240	150	404	1730
Gasoline Range Organics (GRO) - ppm	AK 101	205	4.01	1170	-	851	-	87.4	7.38	53.1	36.0	5.05	16.2	10.8
Aromatic Volatile Organics (BTEX)														
Benzene - ppm	EPA 8020/AK 101	0.0171J	ND	6.48	-	ND	-	0.0527	ND	0.0672	ND	ND	ND	ND
Toluene - ppm	EPA 8020/AK 101	0.346	ND	58.9	-	0.233	-	0.178	0.0271	0.514	0.0828	ND	ND	ND
Ethylbenzene - ppm	EPA 8020/AK 101	0.963	0.022	19.2	-	1.81	-	0.347	0.0368	0.554	0.602	ND	0.0555	0.0243
Xylenes - ppm	EPA 8020/AK 101	6.19	0.094	111.6	-	3.37	-	4.91	0.333	5.06	1.038	0.0725	0.248	0.244
Total BTEX - ppm	EPA 8020/AK 101	7.499	0.116	196.18	-	5.413	-	5.49	0.397	6.20	1.723	0.0725	0.304	0.268
Lead - ppm	EPA 7421	5.90	-	3.77	-	-	-	-	5.90	6.07	-	-	-	-

KEY	DESCRIPTION
S17	BOLDED SAMPLE NUMBER INDICATES FINAL EXCAVATION CONFIRMATION SAMPLE
-	ANALYTE NOT ANALYZED
*	SEE APPENDIX C FOR LIMITS OF DETECTION
J	ESTIMATED QUANTITY
	DETECTED ANALYTE IS ABOVE ADEC CATEGORY A CLEANUP CRITERIA

000020

TABLE 2 - SUMMARY OF ANALYTICAL RESULTS

		Confirmation Analytical Sample Number and Depth in Feet (See Table 1, Figures 3 through 5, and Appendix C)												
		QA/QC												
		TB+2	S107											
Parameter Tested	**Method***		@ 10											
PID Headspace Reading - ppm	OVM 580B	-	350											
Total Solids - %	SM18 2540G	-	92.4											
Diesel Range Organics (DRO) - ppm	AK 102	-	5440											
Gasoline Range Organics (GRO) - ppm	AK 101	ND	-											
Aromatic Volatile Organics (BTEX)														
Benzene - ppm	EPA 8020/AK 101	ND	-											
Toluene - ppm	EPA 8020/AK 101	ND	-											
Ethylbenzene - ppm	EPA 8020/AK 101	ND	-											
Xylenes - ppm	EPA 8020/AK 101	ND	-											
Total BTEX - ppm	EPA 8020/AK 101	ND	-											
Lead - ppm	EPA 7421	-	-											

KEY	DESCRIPTION
S17	BOLDED SAMPLE NUMBER INDICATES FINAL EXCAVATION CONFIRMATION SAMPLE
-	ANALYTE NOT ANALYZED
*	SEE APPENDIX C FOR LIMITS OF DETECTION
J	ESTIMATED QUANTITY
	DETECTED ANALYTE IS ABOVE ADEC CATEGORY A CLEANUP CRITERIA

TABLE 3 - ADEC SOIL MATRIX SCORE SHEET

SHANNON & WILSON, INC.

Part A: Determine score for each item*

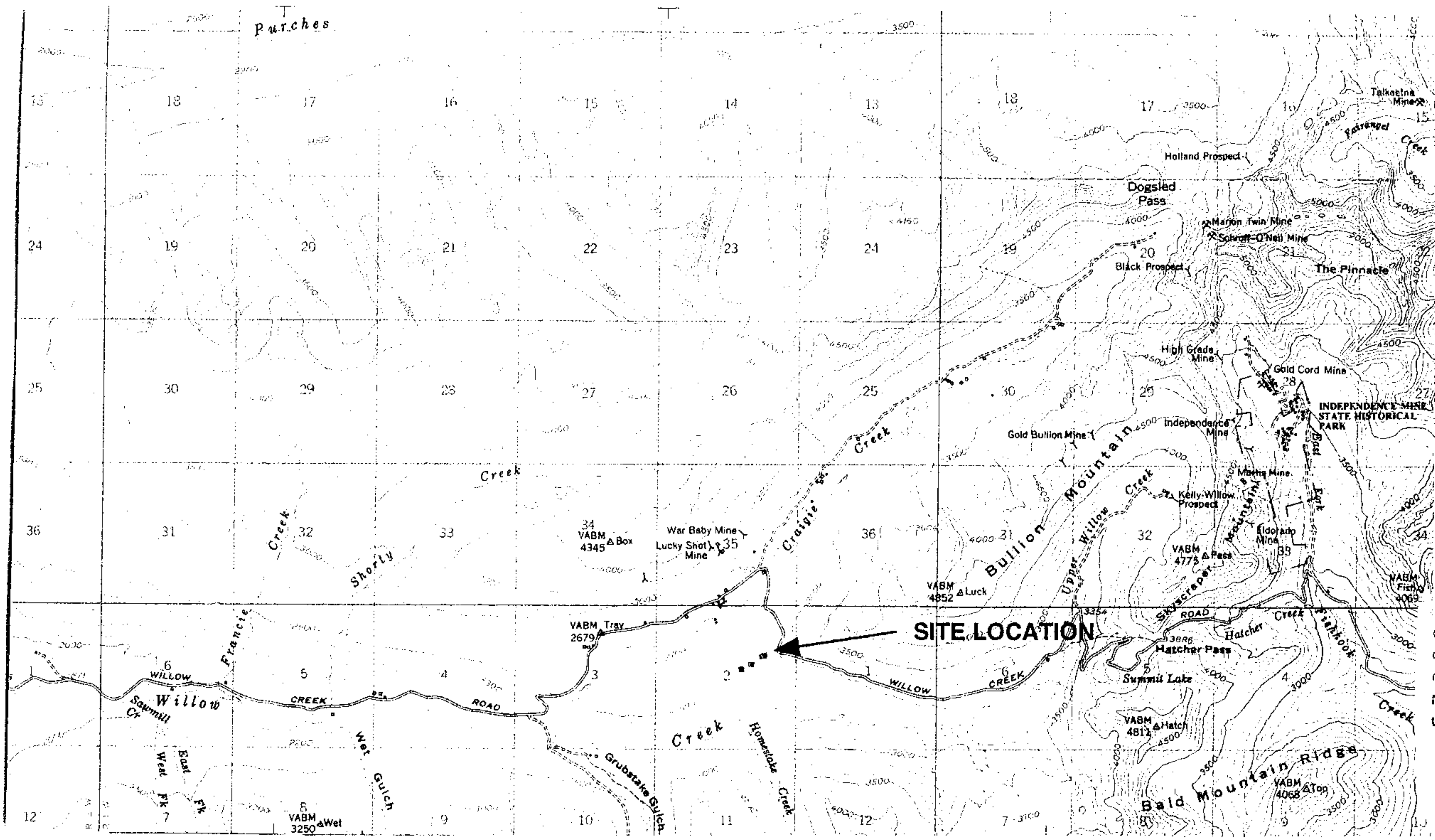
1. Depth to Subsurface Water	(Based on existing monitoring wells)		
	< 5 feet	[10]	
	5-15 feet	[8]	
	15-25 feet	[6]	**6**
	25-50 feet	[4]	
	> 50 feet	[1]	
2. Mean Annual Precipitation	(Anchorage Area Atlas)		
	>40 inches	[10]	
	25-40 inches	[5]	**5**
	15-25 inches	[3]	
	<15 inches	[1]	
3. Soil Type (Unified Soil Classification)	(Based on Assessment)		
	Clean, coarse-grained soils	[10]	
	Coarse-grained soils with fines	[8]	**8**
	Fine-grained soils (low OC)	[3]	
	Fine-grained soils (high OC)	[1]	
4. Potential Receptors	(Based on Assessment)		
	Public well within 1000 feet, or		
	Private well(s) within 500 feet	[15]	**15**
	Municipal/priv well w/i 1/2 mi	[12]	
	Municipal/priv well w/i 1 mile	[8]	
	No known well within 1/2 mile	[6]	
	No known well within 1 mile	[4]	
	Non-potable groundwater	[1]	
5. Volume of Contaminated Soil	(Based on Assessment)		
	>500 cubic yards	[10]	
	100-500 cubic yards	[8]	**8**
	25-100 cubic yards	[5]	
	>De Minimis-25 cubic yards	[2]	
	De Minimis	[0]	

*The items to be scored are defined at 18 AAC 78.315(b)

Total Score : 42

Part B: Add scores from Part A to determine matrix score and cleanup level

Matrix Score for Each Category	Cleanup Level in mg/kg				
	Gasoline Range Organics	Diesel Range Organics	Residual Range Organics	Benzene	Total BTEX
Category A: More than 40	50	100	2000	0.1	10
Category B: 27-40	100	200	2000	0.5	15
Category C: 21-26	500	1000	2000	0.5	50
Category D: Less than 21	1000	2000	2000	0.5	100



0 1.0 2.0

Approximate Scale in Miles

Elevation in Meters
Contour Interval 100 meters
Taken From
Anchorage (D-7) NW U.S. Geological Survey

N

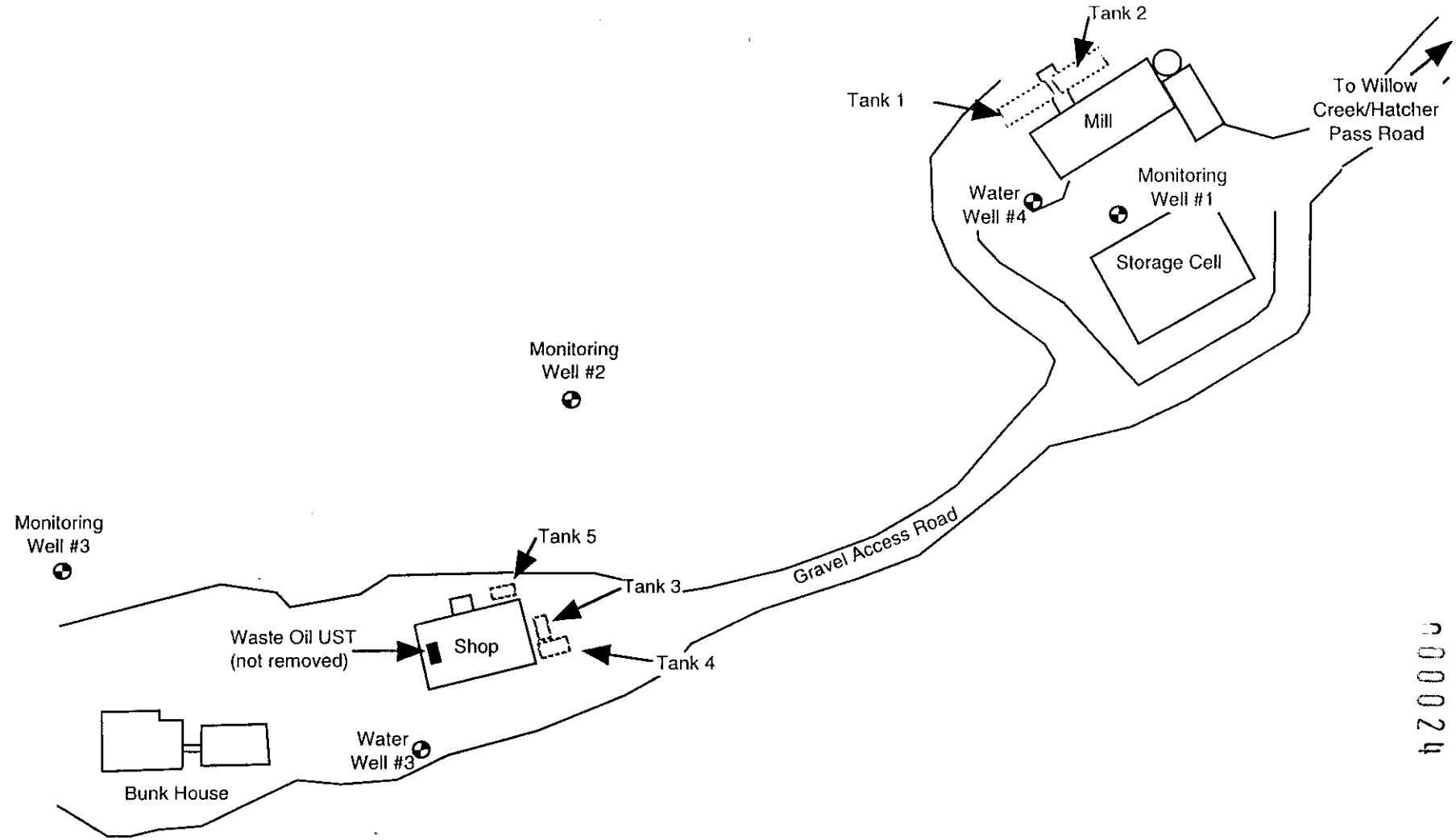
Willow Creek Mine
Hatcher Pass, Alaska

VICINITY MAP

October 1997 Y-5789

SHANNON & WILSON, INC.

Fig. 1



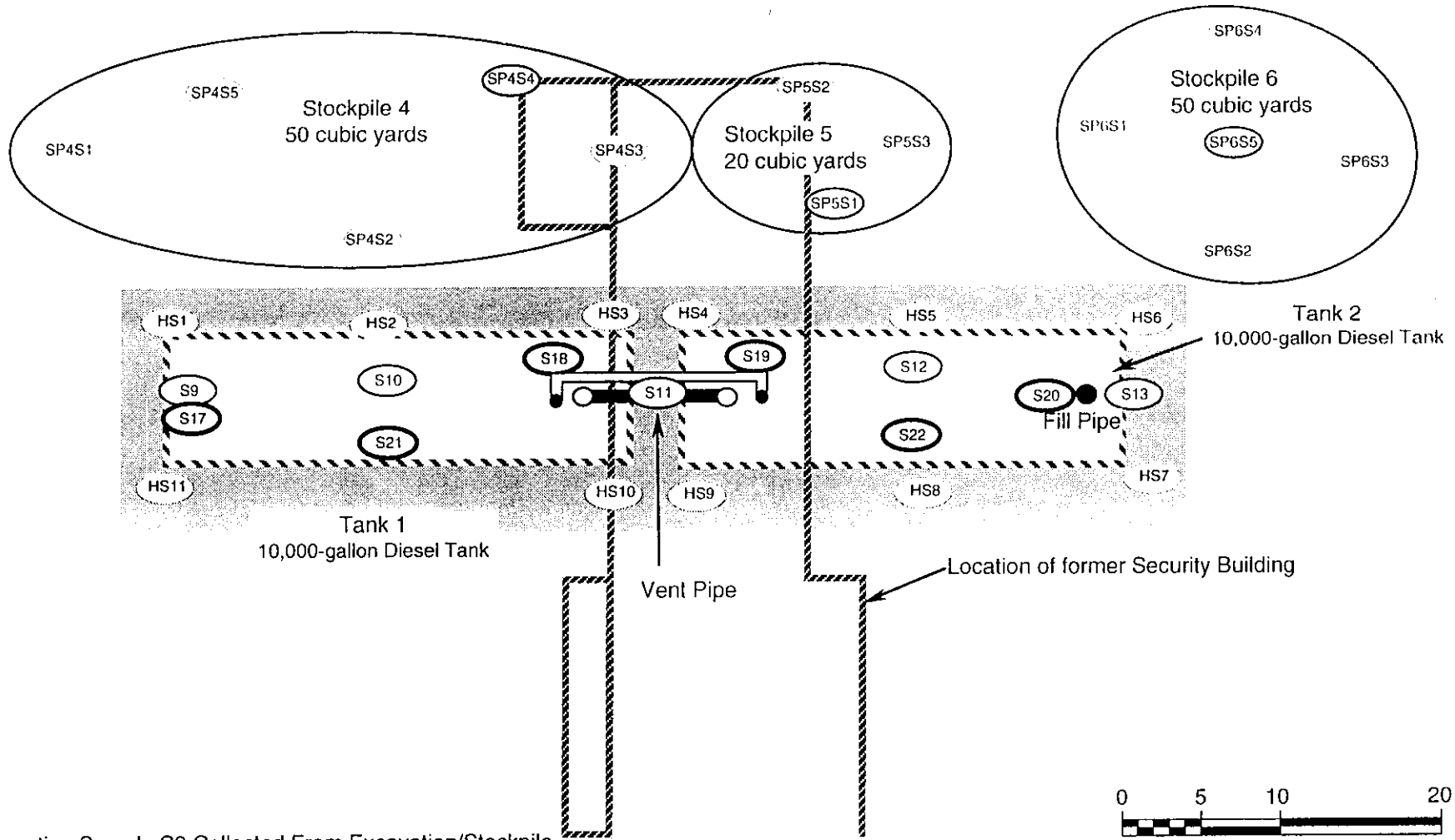
Willow Creek Mine
Hatcher Pass, Alaska

SITE PLAN

October 1997 Y-5789

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. 2



LEGEND

- (S9) Confirmation Sample S9 Collected From Excavation/Stockpile By Shannon & Wilson, Inc., August 1997
- HS11 Headspace Sample HS11 Collected From Excavation By Shannon & Wilson, Inc., August and September 1997
- SP4S1 Headspace Sample SP4S1 Collected From Stockpile By Shannon & Wilson, Inc., August 1997
- (S14) Final Confirmation Sample 14 Collected From Excavation By Shannon & Wilson, Inc., September 1997
- Approximate Excavation Area

0 5 10 20

Approximate Scale in Feet

N

Willow Creek Mine and Mill Site
Hatcher Pass, Alaska

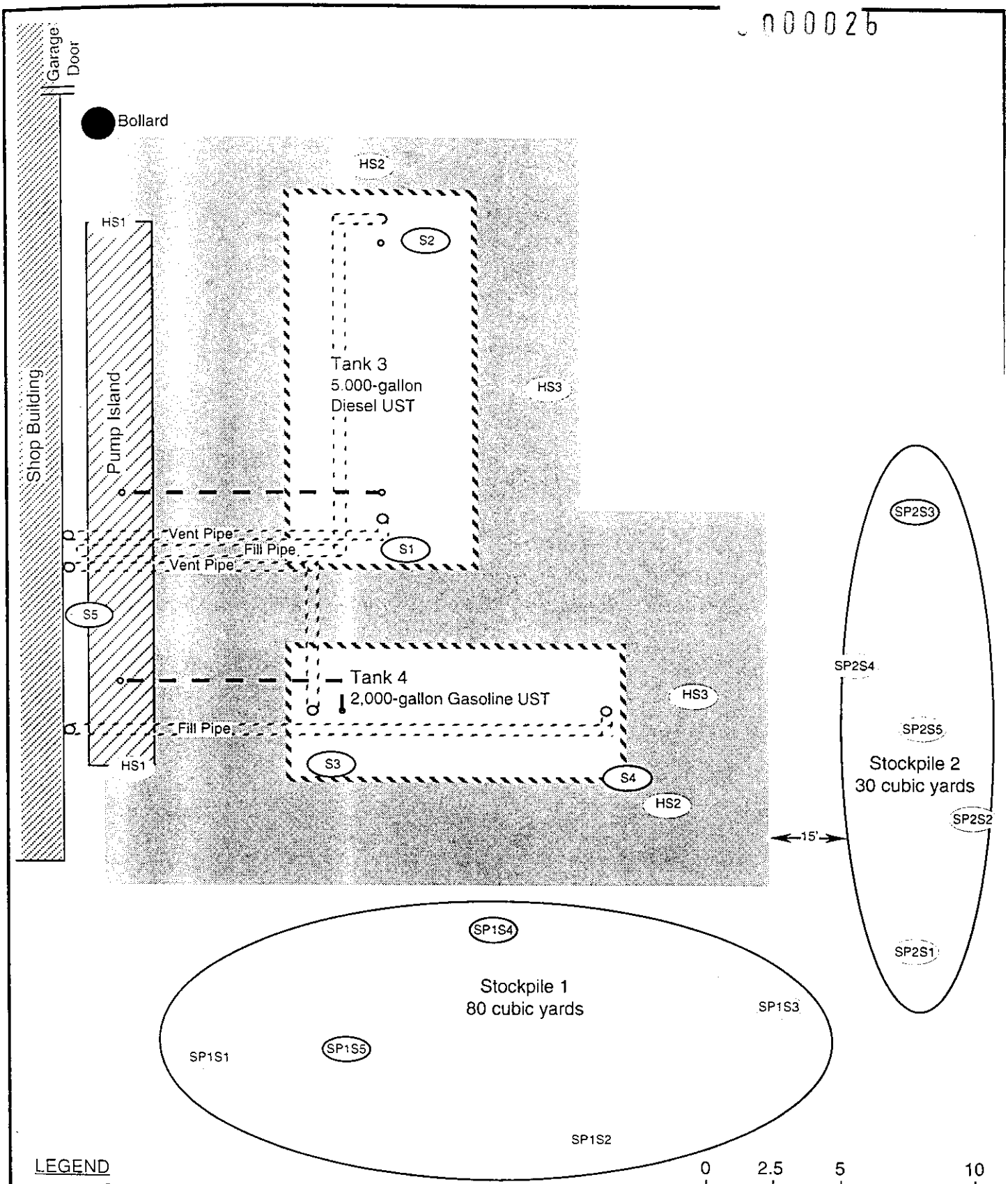
TANKS 1 & 2 SAMPLING PLAN

October 1997 Y-5789

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. 3

S20000 000025



LEGEND

- S1 — Confirmation Sample S9 Collected From Excavation/Stockpile By Shannon & Wilson, Inc., August 1997
- SP4S1 — Headspace Sample SP4S1 Collected From Stockpile By Shannon & Wilson, Inc., August 1997
- HS8 — Headspace Sample HS8 Collected From Excavation By Shannon & Wilson, Inc., August and September 1997
- Approximate Excavation Area

0 2.5 5 10

Approximate Scale in Feet

N

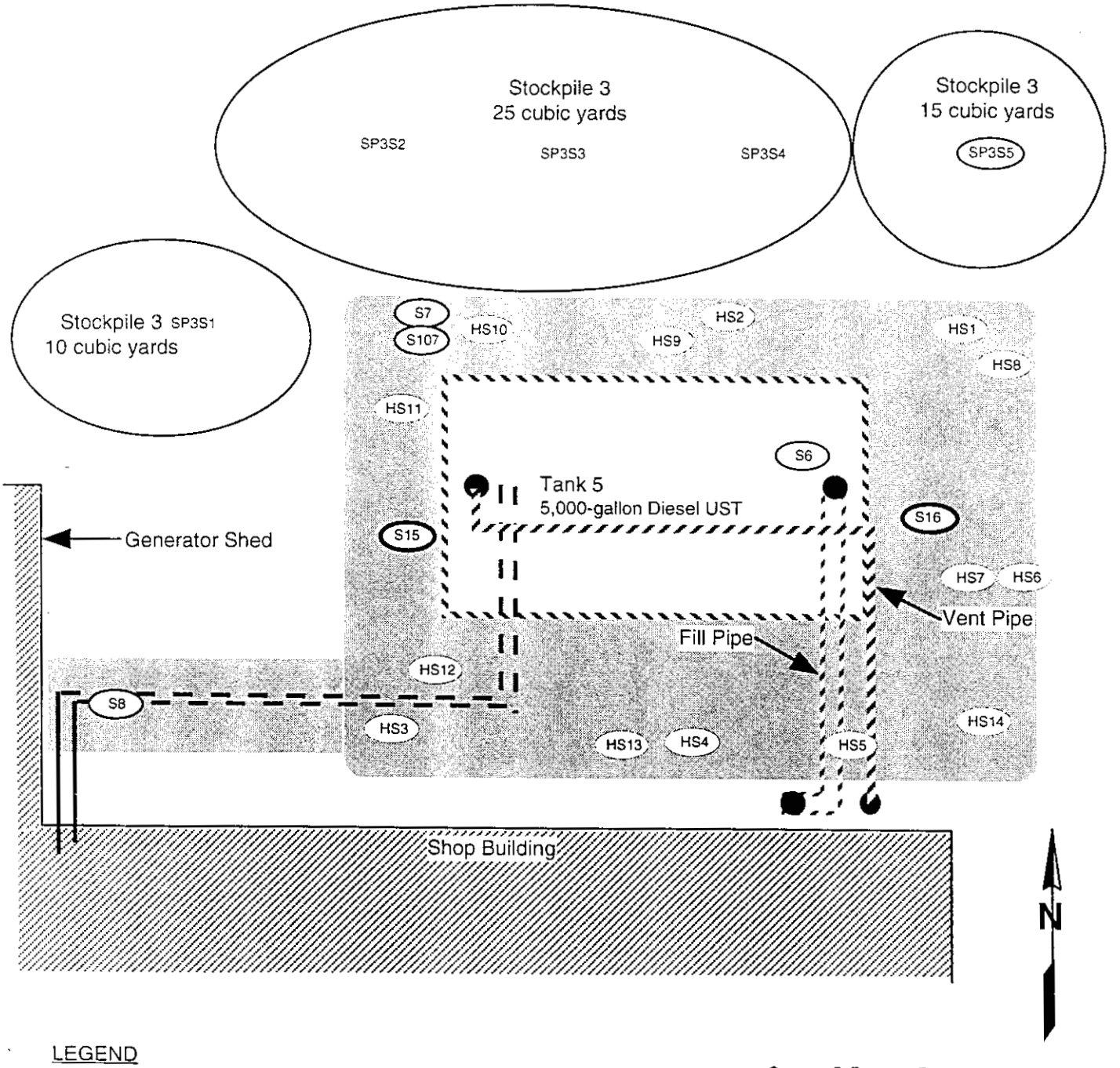
Willow Creek Mine
Hatcher Pass, Alaska

TANKS 3 & 4 SAMPLING PLAN

October 1997 Y-5789

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. 4



LEGEND

- S6 — Confirmation Sample S6 Collected From Excavation/Stockpile By Shannon & Wilson, Inc., August 1997
- SP3S1 — Headspace Sample SP3S1 Collected From Stockpile By Shannon & Wilson, Inc., August 1997
- HS1 — Headspace Sample HS1 Collected From Excavation By Shannon & Wilson, Inc., August 1997
- S15 — Final Confirmation Sample 15 Collected From Excavation By Shannon & Wilson, Inc., September 1997
- Approximate Excavation Area

0 2.5 5 10

Approximate Scale in Feet

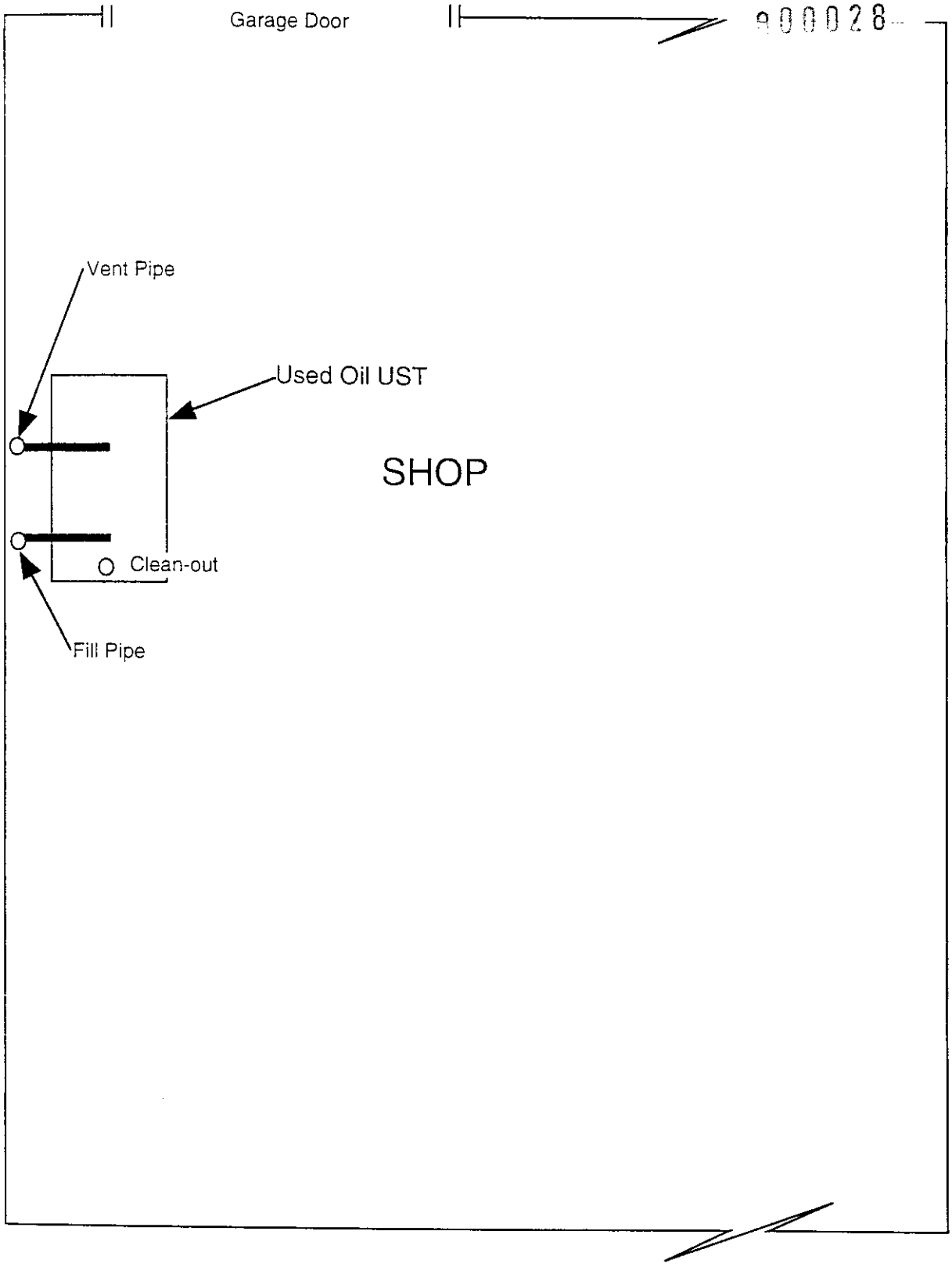
Willow Creek Mine
Hatcher Pass, Alaska

TANK 5 SAMPLING PLAN

October 1997 Y-5789

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. 5



Not to Scale

N

Willow Creek Mine
Hatcher Pass, Alaska

USED OIL UST SITE PLAN

October 1997

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

F