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SITE CHARACTERIZATION REPORT

Norgetown Laundry Site
Anchorage, Alaska

Prepared For:
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JULY 2000

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1.0
INTRODUCTION

1.1 PURPOSE

This report is presented in fulfillment of Task 6 – Site Characterization Report from the Site Characterization Work Plan (ALTA, June 1999b). It incorporates previous information and discussion from the July 1998 Site Investigation Report (ALTA, July 1998), and reflects ADEC's comments on the Site Investigation Report (ADEC, September 28, 1998). It also includes information developed during the implementation of Task 1 (new monitoring well installation), Task 2 (well survey), and Task 3 (sewer line replacement), as set forth in the June 1999 Work Plan.

1.2 BACKGROUND

The Norgetown Laundry Site, is located at 5477 East Northern Lights Blvd. (see Figure 1 and Figure 2). Elevated concentrations of tetrachloroethylene (PCE) were discovered in soil and groundwater near the intersection of Boniface Parkway and Northern Lights Boulevard in the late 1980's. Several possible sources or combinations of sources may exist. Numerous studies have been performed in the area around the intersection of Boniface Parkway and Northern Lights Boulevard since the late 1980's. Some of these studies were associated with the Norgetown Laundry itself, others associated with proposed widening of Boniface Parkway, and still others associated with site assessment and remediation of the adjacent Mapco service station. A history of these investigations, their findings, discussion of potential sources for the contamination, and additional data needs was presented in the Data Summary Report (ALTA, July 1997).

ALTA Geosciences was initially retained (1996) by one of the potentially responsible parties (the Jaeger's) to assist them in responding to DEC's concerns regarding possible environmental contamination at the site. Other parties (EEB and the Bergs) agreed to share in funding his work during the summer of 1997. Working for the above parties, ALTA has prepared a series of reports, reviewed and summarized work done in the past, surveyed the site, performed a soil gas survey, installed soil borings and monitoring wells, collected groundwater samples, and overseen the replacement of a section of sewer line at the Site. Other parties that may share in the responsibility for the low levels of contamination identified at the site have not contributed to the cost of developing this information about the site.

Tetrachloroethylene (also tetrachloroethene, perchloroethylene, perc, or PCE) is a colorless, aromatic, volatile liquid used in the dry cleaning and metal degreasing industries. For ease and consistency, it will be referred to as PCE throughout this report.

1.3 SCOPE OF WORK

1.3.1 Implementation Of July 1997 Work Plan

The work necessary to satisfy data needs identified in the Data Summary Report was described in the Work Plan, Site Investigation (ALTA, July 1997). That Work Plan was modified following completion of the Soil Gas Study (ALTA & ESL, October 1997) and after negotiations with ADEC, as described in a letter dated March 5, 1998. Besides the Soil Gas Survey, the Site investigation Work Plan called for installation of hollow-stem auger soil borings and groundwater monitoring wells, plus associated soil and groundwater sampling and analysis. This work was performed in late March and early April 1998, The work included nine borings and installing monitoring wells in three of the borings. Laboratory chemical analyses were made on 47 soil samples. The Site Investigation Report (ALTA, June 1998) presented a summary of the completed work set forth in the Work Plan (and amending letter).

The first round of groundwater samples were obtained in May 1998 from the three newly installed monitoring wells and eleven preexisting wells (total of 14 groundwater wells sampled). All laboratory analyses were performed by Multichem Analytical Services, Inc., of Anchorage, Alaska.

All soil and groundwater analyses utilized EPA Method 8260, a Gas Chromatography/Mass Spectrometer method targeting halogenated volatile organic compounds (HVOCs). Except for the soil gas survey, all work was performed under the direct supervision of an civil/environmental engineer from ALTA Geosciences, Inc. The soil gas probe installation and associated field work was performed under the direction of geologist Jim Cross of ESL, LLC.

Additionally, a detailed Site Map was prepared showing pertinent site features; monitoring well, soil boring, and gas probe locations; monitoring well top of casing elevations; property lines and structures; and site topography. The Site Map was prepared by licensed land surveyors from USKH, Inc., of Anchorage, Alaska. The Site Map was used as the basis for site figures in this report.

1.3.2 Implementation Of June 1999 Work Plan

Building on the work completed under the July 1997 Work Plan, a new Site Characterization Work Plan (ALTA, June 1999) was developed. This plan called for installation of an additional down-gradient monitoring well, a survey of potential water wells in the down-gradient direction, partial replacement of the sewer line outside (draining) the laundry building, implementation of a quarterly groundwater monitoring program, and development of the present Site Characterization Report. In addition, disposition of investigation derived soil and groundwater temporarily stored at the Site is being pursued. All of the above work except actual disposal of the investigation derived wastes has been completed, and is summarized in the present report.

1.4 GEOLOGIC CONDITIONS

Subsurface conditions are quite consistent in all explorations and consist of a two-layer system as described below:

1. From the ground surface to about 20 feet below ground surface (bgs), soils consist of relatively clean, dense sandy gravel.
2. Underlying the gravel is very dense glacial till consisting primarily of sandy silt with cobbles.

A layer of stiff sandy silt is described in the boring log for MW-44 from 4.5 to 7.5 feet bgs, but is absent from other boring logs and is therefore apparently a feature of only limited extent.

The glacial till layer represents a substantial barrier to downward migration of groundwater and contaminants. The glacial till is present at 20 to 30 feet bgs across the site, at an elevation of 170 to 175 feet above mean sea level (msl). The top of the till surface appears to be somewhat irregular, but the surface generally appears to slope gently downward to the south.

1.5 HYDROGEOLOGIC CONDITIONS

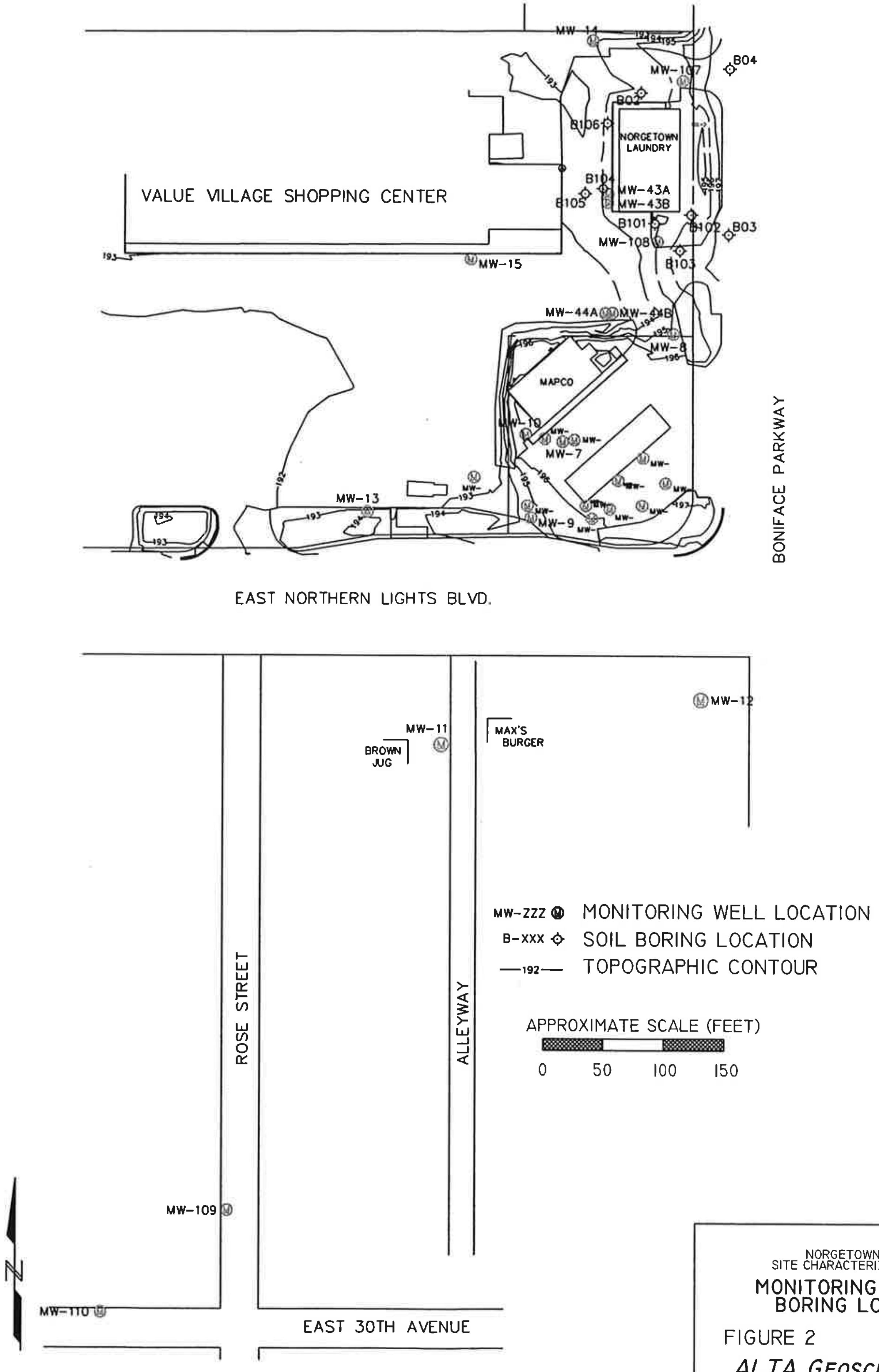
Groundwater beneath the site is encountered at 10 to 15 feet bgs. There is typically a 2 foot change between dry season low groundwater levels (midwinter) and wet season high groundwater levels (early summer). High groundwater elevations are about elevation 183 feet, while wintertime groundwater elevations are typically near 181 feet.

Historical groundwater gradients across the site have been very flat, typically 0.001 feet per foot downwards to the southwest (Shannon & Wilson, December 1993, p.16).

Pump tests in the shallow groundwater zone were performed by Hart Crowser in conjunction with their investigations of the adjacent MAPCO facility (Hart Crowser, 1988). These indicated a permeability of 0.39 cm/sec.

1.6 HISTORICAL BUILDING LAYOUTS

In response to ADEC request, we received information on historical building interior layouts from the current operator (Richard Jaeger). These layout sketches cover the period 1983 to present and are contained in Appendix A. We received no information from the prior facility operator concerning site layouts before 1983.



NORGETOWN LAUNDRY
SITE CHARACTERIZATION REPORT

MONITORING WELL AND BORING LOCATIONS

FIGURE 2 JUNE 2000

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2.0
SOIL GAS INVESTIGATION

2.1 INTRODUCTION

In October, 1997, a soil gas survey was undertaken at the Norgetown Laundry facility The goal of the soil gas investigation was to survey the subject property and adjacent area for evidence of PCE impacts to soils in the vadose zone and more effectively focus potential groundwater and soils investigations. Forty two soil gas probes were installed surrounding the laundry building. The zone adjacent to the sanitary sewer line between the laundry and the adjacent mall building was of special interest during siting of the probes

2.2 PROBE DESIGN AND INSTALLATION

The soil gas probes were installed as shown on Figure 3. The probes were designed such that the atmosphere inside of the probe casing was directly exposed to all of the soils in the vadose zone immediately adjacent to the groundwater. Volatile organic compounds would therefore equilibrate partial pressures in the casing atmosphere to that of local soil pore space vapor concentrations.

2.3 SAMPLING METHOD

The original work plan called for the vapor from the soil gas probe to be withdrawn and placed in a Tedlar bag for analysis by direct injection to the gas chromatograph (NIOSH Standard Method 3704). This approach presented several problems. Firstly, the volume of vapor to be extracted and sampled would be quite small (typically 0.5L), thus raising concerns that it would be representative of soil pore space concentrations. Secondly, the analytical laboratory (CT&E Environmental Services) expressed concern that the PCE levels would be so low (based on field screening and prior soil sample analyses) that a great many of the results would be below the analytical detection limit for PCE in air. Therefore, after extensive consultations with the analytical laboratory, the sampling was modified to the use of NIOSH Standard Method 1007, where a known volume of atmosphere is drawn through a sample tube containing analytical-grade charcoal sorbent (SKC Anasorb CSC). By increasing the total air volumn pumped through the sampler, the total amount of contaminant per sample tube would be increased. This concern was later verified as many of the sample results would have been below the detection limit if method 3704 had been utilized. The sample tube is then capped and the sorbent analyzed for target compounds by standard methods (in this case, for PCE by EPA SW834 Standard Method 8010). The advantage to this technique is that it is in extremely wide use throughout the country for ambient atmosphere workplace exposure monitoring, it is relatively inexpensive, and it has a very low practical quantitation level (below one tenth of a microgram per tube). The disadvantages to this approach are that it appears to be somewhat affected by sampling artifacts such as the variability in probe annular atmospheric circulation, sampling pump temperature, etc.. The change in sampling procedure from that described in the original work plan is believed to have produced more definitive results.

At least 24 hours prior to sampling (to allow time for atmospheric equilibration), a vinyl drop tube was inserted into the soil gas probe casing and suspended with the bottom of the tube within 1-2 ft of the static groundwater level in the screened interval. The purpose of this was to insure that the atmosphere at the bottom of the casing was sampled first--without annular mixing of unequilibrated ambient atmosphere--as PCE is slightly heavier than air and would settle near the bottom of the probe bore.

At the time of sampling, the plug was removed from the casing throat and the vinyl drop tube attached to the sampling train as detailed in Figure 4 and 5.

An SKC Airchek 52 sample pump, calibrated by rotometer to one third of its design flow rate at 400 cubic centimeters per minute, was connected to a sampling train which includes the SKC Sample tube. Each tube has two chambers, one with 50 mg and the other with 100 mg of NIOSH-grade sorbent, where the organic vapor target compound is collected from the sampled gases. The sampled gases from the probe atmosphere are drawn through the sorbent tube for 15 minutes, resulting in a total atmospheric sample volume of 6 liters (6000 cc), an order of magnitude greater sample volume than would have occurred with Standard Method 3704. The pump is then shut off, the sample tube removed from the sample train, and the ends of the tube closed with the fitted caps supplied with the tube. The tubes were sealed in labeled plastic bags and stored in a cooler until transported to the laboratory.

At the laboratory, the entire contents of each tube are extracted by dimethyl sulfoxide, and the halogenated organic compounds quantitated by gas chromatography according to EPA's Solid Waste 834 Standard Method 8010. The result is then recorded as total micrograms of analyte per tube; as that total of analyte was extracted from 6 liters of air, the result can be recorded as total micrograms of analyte / 6000 cubic centimeters of atmosphere. Multiplying both values by 1000 would transform this to milligrams of analyte per 6,000,000 cc; as 1,000,000 cc is a cubic meter (m^3 or cM), the final reported value, mg per cubic meter, is derived by the following:

$$\frac{\mu g/\text{tube}}{6} = \text{mg/cM}$$

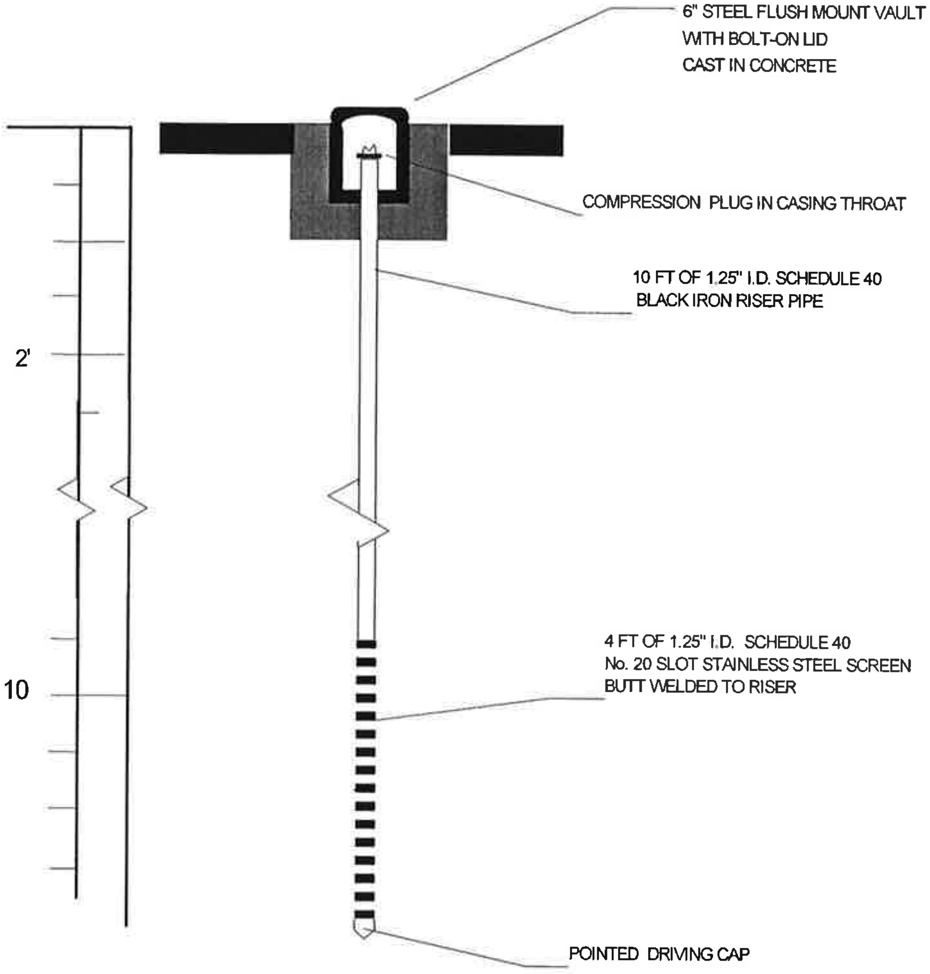
2.4 DISCUSSION OF SAMPLING RESULTS

Sampling results from the gas probes are presented in Table 1 and on Figures 6 and 7. The contaminant measurement results of the soil gas sampling show significant variability. However, a sufficient sample point population, along with correlation of groundwater co-sampling data, provides clear trends for interpreting the gas survey results. These results were used to assist in placement of soil borings and monitoring wells described in Section 3.1.

Table 1
SOIL GAS PROBE SAMPLING RESULTS

Sample No.	Date	Depth	Source	PCE in ug/tube	Source	PCE in mg/cM
GMW43A-29	971017	10 FT BGS	Sorbent media	5.97	Soil Gas	0.9952
GMW44B-40	971022	11FT BGS	Sorbent media	2.69	Soil Gas	0.4485
GP1-09	971014	11 FT BGS	Sorbent media	14.2	Soil Gas	2.3721
GP10-26	971016	11 FT BGS	Sorbent media	71.4	Soil Gas	11.9069
GP11-34	971017	12 FT BGS	Sorbent media	3.67	Soil Gas	0.6124
GP11-39	971022	12 FT BGS	Sorbent media	ND	Soil Gas	ND
GP11A-28	971016	12 FT BGS	Sorbent media	25.4	Soil Gas	4.2319
GP12-33	971017	12 FT BGS	Sorbent media	0.142	Soil Gas	0.024
GP13-34	971017	12 FT BGS	Sorbent media	0.108	Soil Gas	0.018
GP14-31	971017	12 FT BGS	Sorbent media	0.232	Soil Gas	0.039
GP15-05	971014	10 FT BGS	Sorbent media	3.49	Soil Gas	0.5814
GP16-06	971014	10 FT BGS	Sorbent media	0.548	Soil Gas	0.091
GP17-08	971014	10 FT BGS	Sorbent media	9.24	Soil Gas	1.5407
GP18-30	971017	10 FT BGS	Sorbent media	2.63	Soil Gas	0.4376
GP19-31	971015	10 FT BGS	Sorbent media	5.37	Soil Gas	0.8948
GP2-02	971014	11 FT BGS	Sorbent media	3.45	Soil Gas	.05744
GP20-12	971015	10 FT BGS	Sorbent media	1.97	Soil Gas	0.3278
GP21-25	971016	10 FT BGS	Sorbent media	0.304	Soil Gas	0.051
GP22-24	971016	11 FT BGS	Sorbent media	1.77	Soil Gas	0.295
GP23-23	971016	12 FT BGS	Sorbent media	24.1	Soil Gas	4.02
GP24-15	971015	10 FT BGS	Sorbent media	1.96	Soil Gas	0.327
GP25-14	971015	10 FT BGS	Sorbent media	1.07	Soil Gas	0.179
GP26-13	971015	10 FT BGS	Sorbent media	5.43	Soil Gas	0.906
GP27-20	971016	11 FT BGS	Sorbent media	2.21	Soil Gas	0.368
GP28-21	971016	12 FT BGS	Sorbent media	1.79	Soil Gas	0.297
GP29-17	971015	10 FT BGS	Sorbent media	1.45	Soil Gas	0.241
GP3-03	971014	10 FT BGS	Sorbent media	5.10	Soil Gas	0.850
GP30-18	971015	10 FT BGS	Sorbent media	1.07	Soil Gas	0.179
GP31-19	971015	11 FT BGS	Sorbent media	2.39	Soil Gas	0.398
GP32-22	971016	12 FT BGS	Sorbent media	ND	Soil Gas	ND
GP33-35	971017	10 FT BGS	Sorbent media	ND	Soil Gas	ND
GP34-36	971017	11 FT BGS	Sorbent media	2.80	Soil Gas	0.467
GP35-37	971017	12 FT BGS	Sorbent media	3.80	Soil Gas	0.633
GP36-38	971017	4.5 FT BGS	Sorbent media	0.102	Soil Gas	0.0107
GP37-41	971017	4.5 FT BGS	Sorbent media	ND	Soil Gas	ND
GP38-42	971022	4.5 FT BGS	Sorbent media	ND	Soil Gas	ND
GP39-43	971022	4.5 FT BGS	Sorbent media	0.243	Soil Gas	0.0405
GP4-04	971014	10 FT BGS	Sorbent media	1.77	Soil Gas	0.2951
GP40-44	971022	4.5 FT BGS	Sorbent media	0.193	Soil Gas	0.0322
GP41-45	971022	4.5 FT BGS	Sorbent media	ND	Soil Gas	ND
GP5-01	971014	10 FT BGS	Sorbent media	48.4	Soil Gas	8.0589
GP6-10	971014	10 FT BGS	Sorbent media	9.03	Soil Gas	1.5042
GP7-07	971014	10 FT BGS	Sorbent media	10.6	Soil Gas	1.76
GP8-11	971015	10 FT BGS	Sorbent media	3.37	Soil Gas	0.5614
GP9-26	971016	10 FT BGS	Sorbent media	5.63	Soil Gas	0.9378

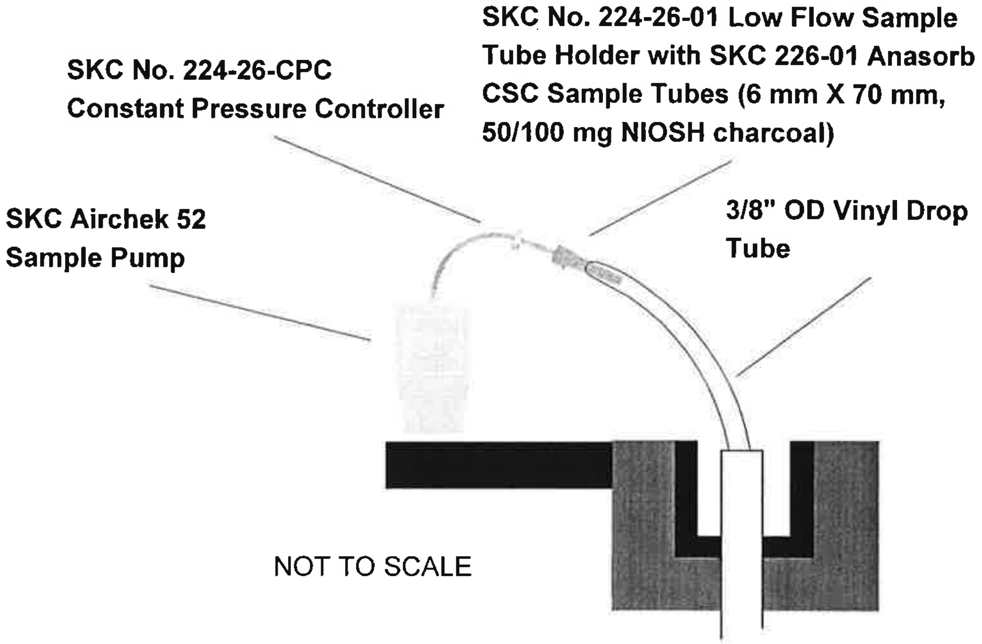
FIGURE 3
TYPICAL SOIL GAS PROBE INSTALLATION DETAIL

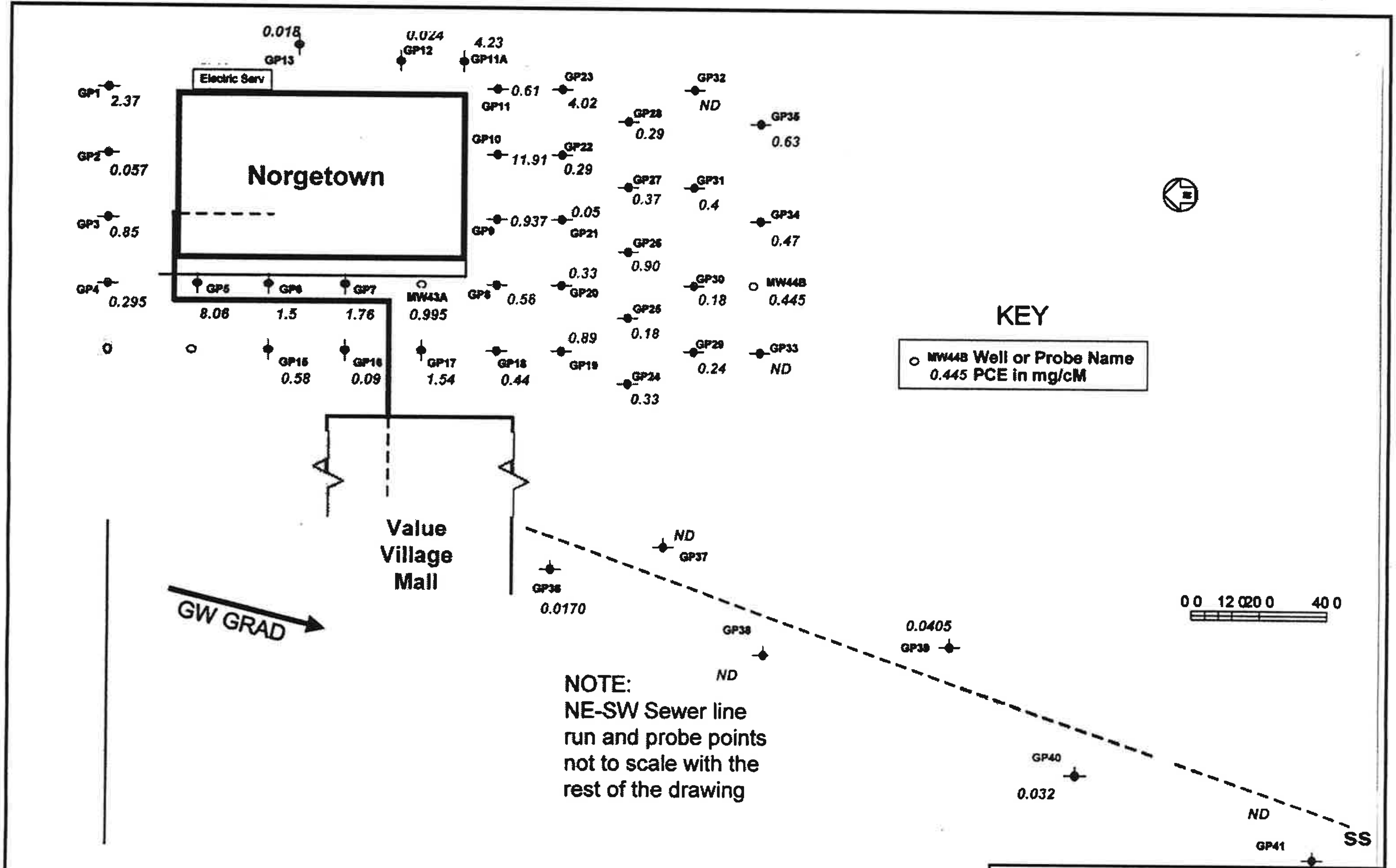


NOT TO SCALE

FIGURE 5

SOIL GAS PROBE SAMPLING TRAIN DETAIL





Norgetown Laundry
Site Characterization

SOIL GAS RESULTS

FIGURE 6

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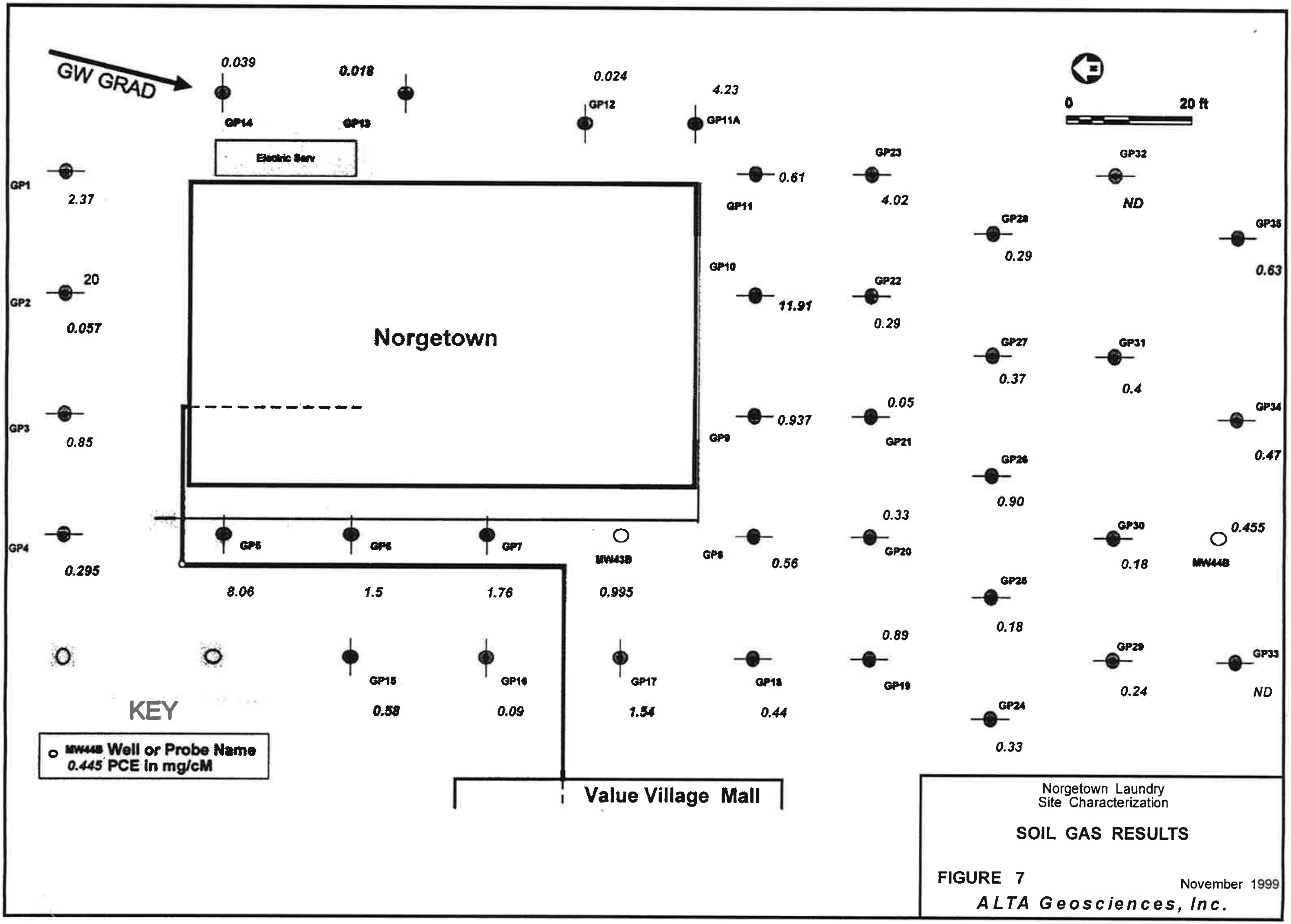

Norgetown Laundry
Site Characterization

SOIL GAS RESULTS

FIGURE 7

November 1999

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3.0
FIELD INVESTIGATION AND ANALYTICAL TESTING

3.1 APRIL/MAY 1998 SOIL BORING AND WELL INSTALLATION

Field Procedures

Nine soil borings (three of which were completed as monitoring wells) were completed between March 30th and April 3rd, 1998. A truck-mounted Mobile B-75 hollow-stem auger drill rig was used, and standard penetration test samples were collected at 1-foot intervals down to the groundwater table, and at 2-foot intervals below the groundwater table. Soil cuttings were stored on-site in steel drums (individually by boring), pending analytical results. Appendix B contains the boring and monitoring well logs. Figure 8A and 9B shows the locations of the new borings, numbered B-101 through B-106, and monitoring wells numbered MW -107 through MW -109. Because of existing site utilities, new soil boring or monitoring well locations were in some cases adjusted a few feet from the locations specified in the Work Plan (ALTA, July 1998) and amending March 5, 1998 letter. This is not considered significant in terms of producing different results than would have been obtained by using the originally planned locations. Monitoring Well MW-109 was located in Rose Street, 450 feet south of the south edge of Northern Lights Blvd., on the west edge of the pavement.

Monitoring wells were constructed in three soil borings following sampling by installation of 2-inch diameter flush-jointed pvc monitoring well pipe. Information on the depths and types of various materials used are presented on the well logs, Appendix B. Wells were given an initial phase of development/clean-up by hand bailing with a stainless steel bailer. Development water was stored in steel drums on-site along with the soil cuttings.

Soil Sampling

Soil samples were collected in a standard penetration sampler. The Work Plan called for use of a larger diameter sampler with tube inserts. However, because of sample recovery problems in gravelly soil and the difficulty of driving a large sampler in gravelly soils, the smaller diameter sampler produced better results. Samples were split into two portions immediately upon opening the samplers, with approximately one-half going into a jar for potential future testing and one-half being placed in a zip-lock bag for use in logging the boring. Soil boring and monitoring well samples were treated the same with respect to number of samples collected (except MW-109, the far-down-gradient well).

The July 1997 Work Plan (ALTA, 1997) called for taking head-space measurements on the split samples for VOC constituents. Because of problems in obtaining consistent and accurate results with the headspace measurements under the existing conditions, this was not deemed a suitable screening tool. Instead of relying on head space measurements, sufficient laboratory analyses were performed to assure proper characterization of the borehole samples. This deviation from the work plan should have produced conservative results, in that laboratory testing of samples produces more accurate results than head space measurements and the number of tested samples was significantly larger than called for by the Work Plan, leading to a more accurate characterization of the soil profile at boring locations.

A total of 47 soil samples and 15 groundwater samples were analyzed for HVOC's by EPA Method 8260. The work plan called for analysis by EPA method 8020. However, after consultation with the analytical laboratory, it was decided to change to method 8260 (gas chromatograph/mass spectrometer) as this method provides better compound definition and lower reporting limits. Table 2 presents a summary of the PCE results obtained from the soil samples. PCE concentrations in soil samples from this site investigation are shown on Figure 8A. PCE concentrations from this site investigation combined with all previous investigations (see Data Summary Report) are shown on Figure 8B.

Soils Analytical Results

PCE was identified at low levels in 43 of 47 soil samples tested, with values being reported from all borings and wells except MW-109 (far down-gradient). Laboratory testing data sheets are presented in Appendix D. The reporting limit was 2 ug/kg (ppb). Reported values ranged from a low of 5 ug/kg to a high of 460 ug/kg, with a mean of 35 ug/kg. PCE value versus sample depth trends are not well defined. Several samples had the highest reported values in the depth 9-12 feet below ground surface (above groundwater), some were highest at about 14-15 feet deep (below groundwater), and one was highest at a depth range of only 2-3 feet (this was also the highest overall value (460 ug/kg).

Other HVOC's were detected at very low levels in a few samples:

- Methylene chloride:
  B-102, 2-3 feet, 20 ug/kg
  B-103, 3-4 feet, 15 ug/kg
  B-104, 10-11 feet, 11 ug/kg
  B-104, 18-20 feet, 12 ug/kg
- Toluene:
  B-102, 2-3 feet, 4 ug/kg
  B-103, 3-4 feet, 2 ug/kg
  B-104, 10-11 feet, 5 ug/kg
  B-106, 4-5 feet, 2 ug/kg
- Tetrachloroethane (PCA):
  B-105, 12-13 feet, 2 ug/kg

Except for PCA, none of these compounds are normally associated with degradation of PCE. Methylene chloride is commonly used for cleaning in analytical laboratories and may therefore be a lab contaminant. The sporadic occurrence and extremely low concentrations indicate that none of these compounds warrants further consideration for this site.

Samples were taken in locations on all sides of the building, up-gradient and down-gradient of the building and sanitary sewer lines. Soil boring locations were selected based on a soil gas survey and were located in areas suspected to contain the highest soil PCE concentrations. The individual samples for analysis were selected based on hydrogeologic criteria to be those samples most likely to contain the highest chemical concentrations. Therefore, both the soil boring locations and the individual soil samples for analysis were biased to display the highest PCE concentrations likely to be present at the site.

Despite the bias of the sampling, the highest PCE concentration reported from soil samples taken in 1998 was less than one-half part per million. These results are comparable to and in fact generally lower than PCE concentrations reported from Boniface Parkway soils considerably north (upgradient) of the Norgetown Laundry (See Shannon & Wilson, 1993, Figure 10). For example, the Shannon & Wilson report indicates PCE concentrations of 0.2 ppm as far north as DeBarr Road (S & W Figure 13), which could not possibly be related to any releases which may have occurred at Norgetown Laundry. Nearer, but still significantly north of Norgetown, the Shannon & Wilson report (S & W Figure 10) indicates soil PCE concentrations ranging from 0.04 ppm to a high of 1.18 ppm.

As shown on Figure 8B, the highest PCE concentrations in soils reported near the Norgetown Laundry from prior borings B-1 (1.38 ppm at 7.5-9 feet) and MW-44A (1.9 ppm at 9-10.5 feet). The highest soil PCE concentration reported in the vicinity was from Shannon & Wilson boring MW-1 (4.0 ppm at 3.5-5 feet), located in the center of Boniface Parkway considerably above the groundwater table and in any event cross gradient from Norgetown Laundry.

Significantly, in addition to the generally low PCE concentrations, virtually no degradation products of PCE were detected in the soil samples even though analytical detection limits with the analytical method used are very low. This indicates that larger concentrations of PCE (such as would have been present had a large localized release occurred) have never been present in the soils.

Soil sampling and testing associated with the July 1999 sewer line replacement project are discussed in Section 4.0.

Table 2
TETRACHLOROETHENE RESULTS FROM SOILS TESTING
(1998 SOIL BORINGS)

BORING NUMBER	DEPTH (Feet)	RESULT (ug/kg)
B 101	3-4	30
B 101	6-7	8
B 101	8-9	8
B 101	11-12	41
B 101	14-15	51
B 101	20-21	8
B 102	2-3	460
B 102	4-5	260
B 102	7-8	10
B 102	8-9	10
B 102	10-11	11
B 102	12-13	15
B 102	16-18	42
B 103	3-4	8
B 103	6-7	30
B 103	10-11	43
B 103	14-15	96
B 103	16-18	7
B 104	6-7	18
B 104	8-9	7
B 104	10-11	110
B 104	12-13	31
B 104	14-16	27
B 104	18-20	26
B 105	3-4	5
B 105	6-7	9
B 105	9-10	68
B 105	12-13	21
B 105	14-16	30
B 105	18-20	<2
B 106	4-5	7
B 106	8-9	22
B 106	11-12	13
B 106	15-17	7
B 106	19-21	6

WELL NUMBER	DEPTH (Feet)	RESULT (ug/kg)
MW 107	5-6	7
MW 107	8-9	4
MW 107	10-11	32
MW 107	12-13	11
MW 107	14-15	10
MW 107	16-18	6
MW 108	3-4	<2
MW 108	6-7	9
MW 108	10-11	14
MW 108	18-20	6
MW 109	2.5-3.5	<2
MW 109	7.5-8.5	<2
MEAN:		**35**

3.2 GROUNDWATER SAMPLING

April/May 1998 Sampling Event

Groundwater samples were collected from 14 monitoring wells as described in the July 1997 Work Plan and the March 5, 1998 amendment letter. Groundwater samples were collected from newly installed wells MW-107 through MW-109 and in preexisting wells MW-8, MW-10 through MW-15, MW-43A/B and MW-44A/B. The locations of these wells is shown on Figure 9A.

Measured depth to groundwater (nearest 0.01 feet) and calculated groundwater elevation are shown on Table 3 below. Groundwater elevations and groundwater elevation contours are shown on Figure 9A. Groundwater samples were obtained using a stainless steel bailer. Depth to groundwater was measured prior to purging or sampling. Wells were purged of at least three casing volumes prior to sampling. Groundwater parameters were monitored during purging. Purge water was transferred to and stored in steel drums onsite.

Table 3
GROUNDWATER ELEVATION
(May 14, 1998)

WELL NUMBER		TOP OF CASING ELEV	DEPTH TO GROUNDWATER	GROUNDWATER ELEVATION
MW	7	196.61	nm	
MW	8	195.55	13.80	181.75
MW	9	194.43	nm	
MW	10	197.43	15.88	181.55
MW	11	192.13	10.68	181.45
MW	12	195.01	13.61	181.40
MW	13	193.20	11.67	181.53
MW	14	193.84	12.08	181.76
MW	15	192.73	11.16	181.57
MW	43A	194.36	12.71	181.65
MW	43B	194.28	12.66	181.62
MW	44A	192.62	10.46	182.16
MW	44B	192.78	11.08	181.70
MW	107	195.40	13.66	181.74
MW	108	195.08	12.93	182.15
MW	109	189.44	8.14	181.30

Table 4 presents the results from groundwater samples from this sampling event. In virtually all cases, other 8260 compounds were not found above the detection limits. Appendix D presents the laboratory data sheets for this analytical work. Figure 9B presents PCE concentrations in conjunction with the well locations.

Table 4
GROUNDWATER TESTING RESULTS (5/98)
(parts per billion)

WELL	PCE	TCE	DCE	Chloroform	Location
MW-107	8				Upgradient
MW-43A	41				Front of laundry
MW-43B	56				Front of laundry
MW-108	13				South of laundry
MW-15	7				South of Mall
MW-44A	39				South p/l
MW-44B	190				South p/l
MW-8	35				South p/l
MW-10	68	3		1	
MW-10dup	62	2			
MW-13	19				N. of E NL
MW-11	46	3		5	S. of E. NL
MW-12	<1				SW Cor Bon. & E NL
MW-109	43	6		10	Rose St.

Note: TCE=Trichloroethene
DCE=cis-1,2-Dichloroethene

PCE was detected in all groundwater samples except those from MW-12 (east cross gradient) and MW-14 (north upgradient). The highest level reported was from MW-44B (190 ug/L), located adjacent to the property line with the MAPCO station. PCE concentrations are more or less consistent from MW-43 downgradient to MW-109 (the farthest downgradient well), generally ranging between 35 to 65 ug/L. MW-44B (at the MAPCO property line) is anomalously high (190 ug/L) and MW-108 (between MW-44B and the Norgetown Laundry building) is notably low (13 ug/L).

Of possible significance is the observation that the reported concentration from the farthest downgradient well, MW-109 (43 ug/L) is nearly identical to the reported concentration from MW-11 (46 ug/L), which is located just south of East Northern Lights Blvd.. The low concentrations in MW-15 (7 ug/L) and MW-13 (19 ug/L) suggest that the western boundary of the plume is adequately defined. The result from MW-12 (not detected at 1 ug/L) indicates that the eastern boundary of the plume is also adequately defined.

Interestingly, the new upgradient well (MW-107) had a reported concentration of 8 ug/L, suggesting the possibility of some influent groundwater PCE from the northeast (e.g., possibly from the Boniface Parkway roadfill). The prior study by Shannon & Wilson for the Boniface Parkway corridor also showed detectable levels of PCE in groundwater upgradient from Norgetown, ranging from 3 to 6 ug/L in the wells tested (see Shannon & Wilson, 1993, Figure 15). The difference between the value of 8 ug/L obtained during this sampling round and the previous value of 6 ug/L is not scientifically significant (they are essentially the same).

Efforts to explain potential PCE sources have included speculation that spillage or other discharges may have occurred at the back (north) door of the laundry, or from drummed wastes or trash containers stored along the north side of the building. Well MW-107 is located approximately 25 feet from the waste storage area and 35 feet from the back door of the laundry. There is no evidence to support that such events occurred or that this was an actual cause of the groundwater impacts.

In addition to PCE, trichloroethylene (TCE) and chloroform were detected at low levels in a few groundwater samples (see Table 4). TCE was detected in wells MW-10, MW-11, and MW-109 at levels from 3 to 6 ug/L. Chloroform was also detected in these same wells at levels from 1 to 10 ug/L. Of possible significance, all three of these wells are downgradient of the MAPCO station. TCE is a widely used industrial degreaser, but may also occur from anaerobic biodegradation of PCE. Chloroform is common in chlorinated water supplies, but can also result from progressive dechlorination of PCE and TCE.

July 1999 Sampling Event

Current groundwater monitoring procedures are specified in the Groundwater Monitoring Plan (June, 1999) and in each individual groundwater monitoring report. In general, the sampling pump is placed near the top of the water column. Sampling procedures and field parameter measurements are intended to produce a representative sample of the entire screened interval. This procedure results in the most homogeneous sample from the screened interval. Studies have shown that when the pump is placed in the middle or at the bottom of the screened interval almost no aquifer water from the upper portion of the screened interval enters the sampling pump. Recent sampling events have found no significant difference in reported PCE concentrations from well pairs screened in shallow and deep portions of the aquifer (MW43A/B and MW44A/B). The saturated thickness is so thin that little stratification appears to be occurring.

Groundwater samples were collected from 13 Site monitoring wells on July 7 to 13, 1999, for analytical laboratory testing. This was the first groundwater sampling event performed as a part of the groundwater monitoring plan. The Groundwater

Monitoring Plan (ALTA, June 1999) called for sampling and analysis of wells MW8, MW11, MW12, MW13, MW15, MW43A, MW43B, MW44A, MW44B, MW107, MW108, MW109, and MW110. To obtain a sample representative of the surrounding formation, each well was purged and sampled using a low-flow technique to reduce interference associated with turbidity. Finishing the sampling took an extended time because of the installation of a new well, MW110, on July 12th, after most other samples had been collected and turned in to the lab. Sampling procedures followed the Groundwater Monitoring Plan.

Measured depth to groundwater and calculated groundwater elevation are shown on Table 5 below. Groundwater elevations and groundwater elevation contours are shown on Figure 10A.

A summary of testing results is presented in Table 6 and on Figure 10B. Results indicate PCE in the samples at concentrations ranging from non-detect to 53 ppb. Laboratory analysis certificates and further discussion of this monitoring event have been presented in the Third Quarter Monitoring Report (ALTA, August 1999). Compared to PCE results obtained just over a year ago, some wells increased slightly, and some decreased slightly. Overall, there appears to be a slight downward trend in the data values. The PCE value for well MW-44B, which was anomalously high (190 ppb) in 1998, has returned to a value more consistent with its long-term trend (52.4 ppb). PCE degradation products TCE and DCE were detected in down-gradient wells MW-11, MW-109, and MW-110, indicating that natural attenuation may be occurring in these areas. Laboratory data sheets are included in Appendix D.

The regional groundwater flow direction to the southwest is clearly established (see Data Summary Report). It is sometimes difficult to accurately establish localized flow directions from closely spaced wells when the gradient is as flat as at Norgetown. Even very minor errors of original survey and monitoring can imply “significant” differences when the elevation differences involved are only a few hundredths of a foot. Older US Geological Survey maps (1962) show the original course of the Middle Fork of Chester Creek passing well south of the laundry, approximately beneath the present MAPCO station, before crossing to the east side of Boniface Parkway. The creek was subsequently moved north of the laundry and culverted. There is no evidence to support that the former creek location has any effect on groundwater flow beneath the Norgetown Site. In fact, the creek in this area appears to be several feet higher than the groundwater table, thus even the possible presence of historic stream gravels would be above the groundwater table and have no effect on groundwater flow under present conditions.

Table 5
GROUNDWATER ELEVATION
(July, 1999)

WELL NUMBER		TOP OF CASING ELEV	DEPTH TO GROUNDWATER	GROUNDWATER ELEVATION
MW	7	196.61	nm	
MW	8	195.55	13.65	181.90
MW	9	194.43	nm	
MW	10	197.43	nm	
MW	11	192.13	10.53	181.60
MW	12	195.01	13.32	181.69
MW	13	193.20	11.59	181.61
MW	14	193.84	nm	
MW	15	192.73	11.00	181.73
MW	43A	194.36	12.37	181.99
MW	43B	194.28	12.31	181.97
MW	44A	192.62	10.66	181.96
MW	44B	192.78	11.10	181.68
MW	107	195.40	13.44	181.96
MW	108	195.08	13.10	181.98
MW	109	189.44	7.87	181.57
MW	110	188.88	7.50	181.38

Table 6
GROUNDWATER TESTING RESULTS (7/99)
(parts per billion)

WELL	PCE	TCE	DCE	Chloroform	Location
MW-107	6.3				Upgradient
MW-43A	46.2				Front of laundry
MW-43B	38.5			1.1	Front of laundry
MW-108	4.4				South of laundry
MW-15	8.5				South of Mall
MW-44A	27.3				South p/l
MW-44B	52.4				South p/l
MW-8	16.8				South p/l
MW-13	27.1				N. of E NL
MW-11	53.6	3.5	3.6		S. of E. NL
MW-12	nd				SW Cor Bon. & E NL
MW-109	42.4	5.1	6.3		Rose St.
MW-110	5.9		1.1	3.2	E. 30th Ave.
MW-118	39.8	4.7	6		MW-109 Duplicate

Note: TCE=Trichloroethene
DCE=cis-1,2-Dichloroethene

Long Term PCE Trends In Selected Wells

Figure 11 presents all available PCE testing data for Wells MW-11, MW-13, MW-15, MW-43B and MW-44A. Both MW-43B and MW-44A show dramatic reductions from their initial sampling event in September 1993 (PCE = 220 and 290 ug/L respectively) to their second sampling event in April 1998 (PCE = 56 and 39 respectively) and the reduction trend appears to be continuing in 1999. After a brief spike in 1990 and 1991, MW-11 and MW-15 have shown a distinct downward trend through 1999. MW-13 also showed a brief spike in the early 1990, then a moderate reduction. It appears to be fluctuating within a range of values from 10 to mid-20's (ug/L PCE).

Conclusions From Groundwater Sampling and Analysis

Comparing the results from the groundwater sampling and analysis from the 1998 and Third Quarter 1999 sampling events to prior events as described in the Data Summary Report indicates that in general the PCE plume is decreasing in size and in concentration. New monitoring well MW-110 appears to have determined the effective downgradient extent of the plume. The presence of PCE degradation products (TCE and DCE) in downgradient wells suggests that natural degradation is occurring. Because of some uncertainty regarding the exact down-gradient direction and extent of the PCE plumb, it has been suggested that MW-110 may not be on the centerline of the plumb. Also, this well only samples the shallow aquifer. Therefore, two additional wells will be installed in the Summer of 2000 at a location 1/2 block east of MW-110 on East 30th Avenue. One well will tap the shallow aquifer and the second well will tap a deeper aquifer (approximately 70-80 feet deep).

3.3 DOWN-GRADIENT WELL SURVEY

A March 1992 Shannon & Wilson report indicated the presence of a water well at 2642 Rose Street. Since this address does not exist, ADEC expressed the opinion that the correct address might be 2942 Rose Street, which would be directly down-gradient from the Site. An evaluation of all available information on this well concluded there were no known wells on Rose Street in the 2900 block. Based on the well number, block and lot numbers, and information from the well log, the subject well is located at 3012 Boniface Parkway, and is not down-gradient of the Site (ALTA, June 1, 1999).

In accordance with the June 1999 Site Characterization Work Plan, for the Norgetown Laundry Site, Anchorage, Alaska, ALTA made an inventory of the well data bases at the U.S.G.S. and State of Alaska. We asked for wells in the East Half of Section 27, T.13N., R.3W. A review of State of Alaska well records was made by Roy Ireland, Hydrologist, Department of Natural Resources, Division of Mining & Water Management. A search was also made by Erik Kletka, Hydrologic Technician, at the U.S.G.S. office in Anchorage. Data from unknown sources has also been published by Shannon & Wilson, Inc. in a June 27, 1991 report for the Alaska Department Of Transportation. These sources were all reviewed for the present report and the data are summarized below.

Table 7
WELL SURVEY FINDINGS

WELL NO. ON FIGURE	LOCAL WELL NO.	INSTALL DATE	WATER DEPTH	LOCATION
1	Unknown	Unknown	Unknown	2922 Boniface Parkway
2	Unknown	Unknown	Unknown	2932 Boniface Parkway
3	Unknown	Unknown	Unknown	2942 Boniface Parkway
4	SB01300327AAAC1 007	10-30-78	Unknown	3012 Boniface Parkway
5	Unknown	Unknown	Unknown	3034 Boniface Parkway
6	Unknown	Unknown	Unknown	3102 Boniface Parkway
7	Unknown	Unknown	Unknown	3024 Boniface Parkway
8	SB01300326BCBC2 022	1/30/69	Unknown	3307 Boniface Parkway
9	SB01300327DADD1 006	8/26/62	58	3800 Boniface Parkway
10	SB11300327DADD2 006	1/1/63	60	3802 Boniface Parkway
11	Unknown	Unknown	Unknown	4033 Boniface Parkway
12	SB01300326CBCB1 024	Unknown	70	3920 Bryant Ridge Place
13	SB11300326CBCC1 001	7/28/77	77	3930 Bryant Ridge Place
14	SB01300327DAAA1 005	06-01-56	55 feet	3637 Lynn Drive

15	SB01300327DAAC1 009	08-26-52	35 feet	3700 Lynn Drive
16	SB01300327DADD1 006	05-01-54	58 feet	3947 Lynn Drive
17	SB01300327DADD2 006	01-03-53	60 feet	3900 block Lynn Drive

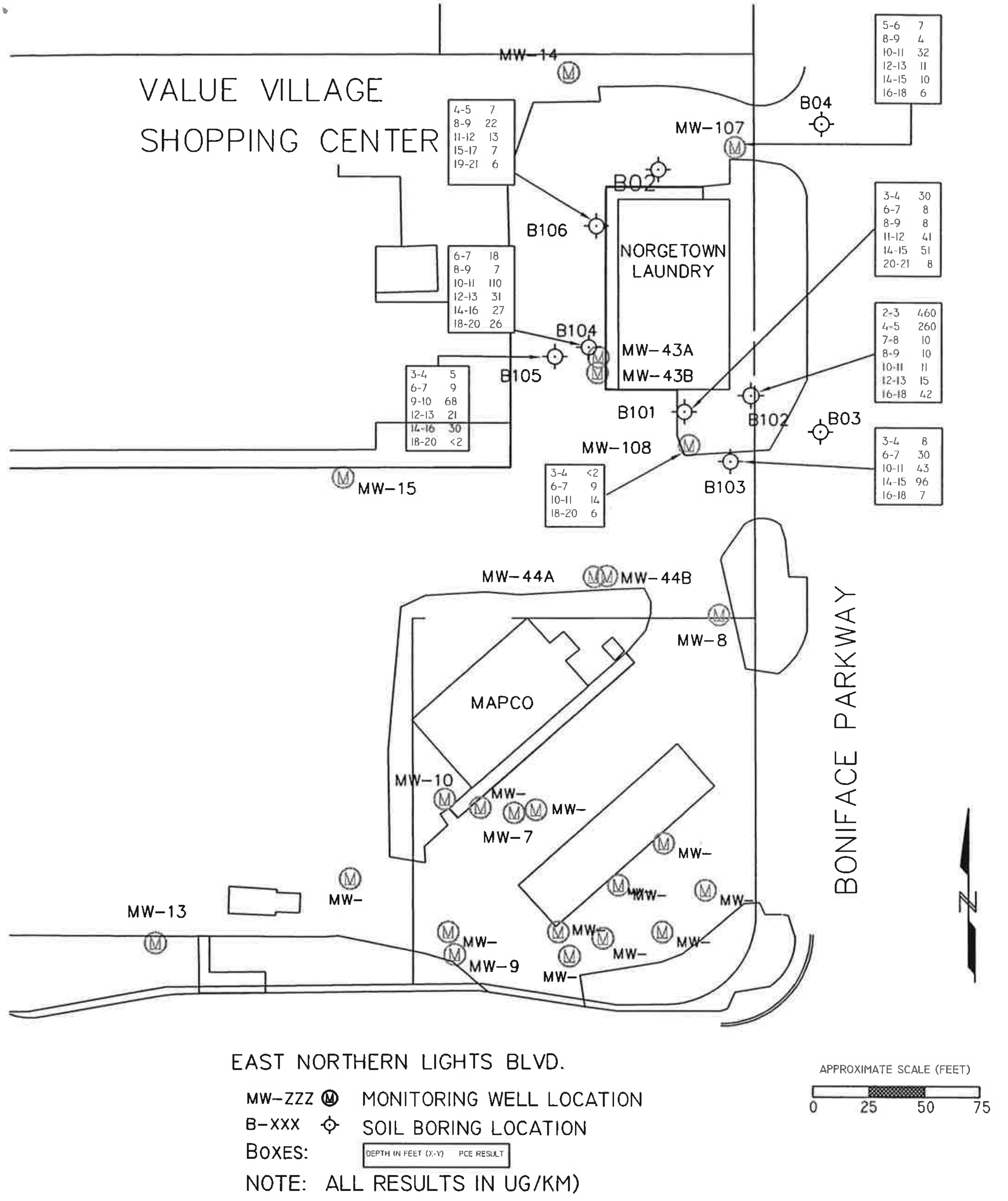
The approximate locations of these wells has been plotted on Figure 12. The Boniface Parkway wells are located east of the presently defined down-gradient vector of groundwater migrating from the Site. The Lynn Drive and Bryant Ridge Place wells are 0.5 to 0.8 miles from the Site and to the east of the groundwater vector as presently known. It is therefore improbable that water moving in the shallow aquifer could reach the four wells located on Lynn Drive. The status of these wells as far as current usage is unknown. The entire area is served by piped drinking water from the Municipality of Anchorage.

Based on the water and well depths reported for these wells, all appear to draw from below the glacial till aquitard which separates the shallow water bearing zone (including the PCE plume) from the lower aquifer.

3.4 SURFACE WATERS

The only potential surface water receptor in the downgradient plume area is a small section of Chester Creek south of East 30th Avenue, approximately 50 feet southwest of monitoring well MW-110 (Figure 10A). Chester Creek is one of north Anchorage's "piped rivers", which was largely placed in culverts during the 1960's. The section south of East 30th Avenue extends in an open channel southwards for about one block before returning to culvert. North of East 30th Avenue, Chester Creek is in culvert until well north of the project area. Survey measurements made by ALTA Geosciences on September 29, 1999, show that the water level in Chester Creek is about 4 feet higher than the groundwater level in the adjacent monitoring well (MW-110). Therefore, water flow is from the creek to the groundwater and there is no potential for contaminated groundwater entering the creek water.

There is no reason to believe this portion of Chester Creek has any significant effect on the groundwater plume. First, the creek is in open channel only south of the distal end of the plume south of MW110. Second, the water surface level in the creek is considerably higher than the groundwater table (approximately four feet higher than MW110, and 3.5 feet higher than upgradient well MW107). The creek is no more than two feet deep, so the channel bottom is apparently above the groundwater table. No construction records exist as to whether the channel is lined. Considering the high hydraulic conductivity of the aquifer soils, the only affect of the creek might be a slight groundwater mounding south of East 30th Avenue.

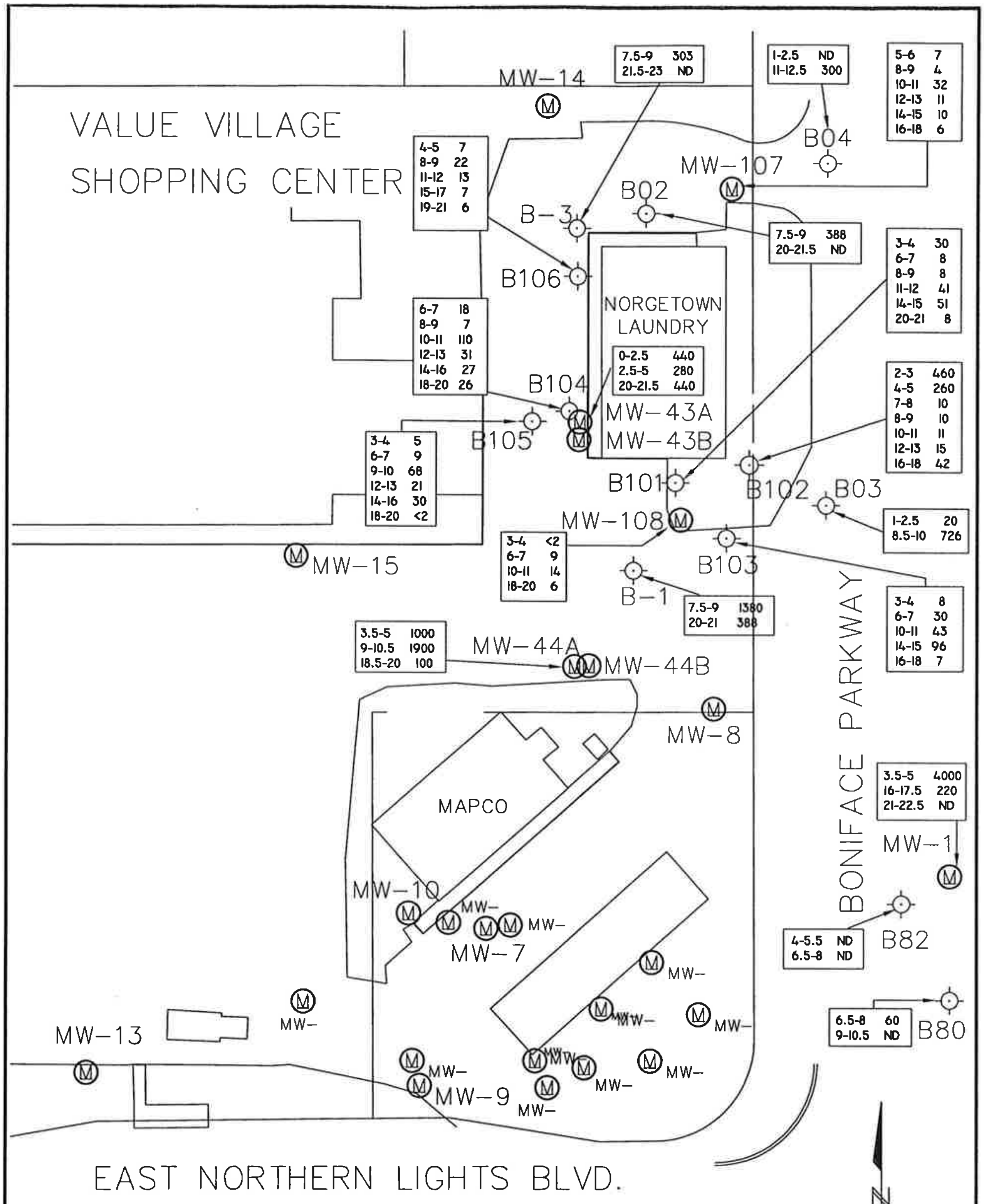


NORGETOWN LAUNDRY
SITE CHARACTERIZATION REPORT

PCE CONCENTRATIONS IN SOIL (APRIL 1998)

FIGURE 8A JUNE 2000

ALTA GEOSCIENCES, INC.



MW-ZZZ Ⓜ **MONITORING WELL LOCATION**

B-XXX ⌖ **SOIL BORING LOCATION**

BOXES: DEPTH IN FEET (X-Y) PCE RESULT

NOTE: ALL RESULTS IN (UG/KM)

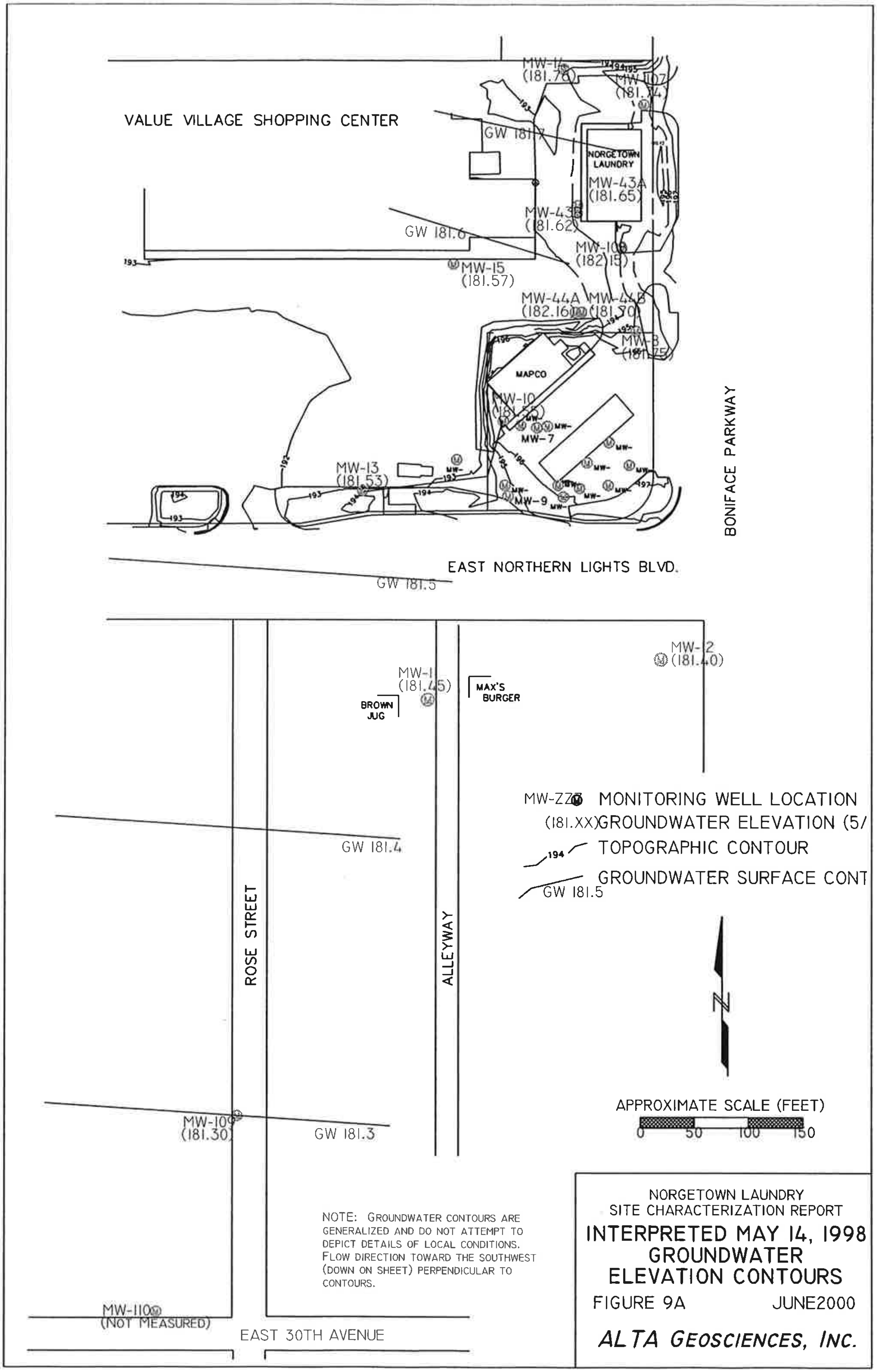
APPROXIMATE SCALE (FEET)
0 25 50 75

NORGETOWN LAUNDRY
SITE CHARACTERIZATION REPORT

PCE CONCENTRATIONS IN SOIL (ALL DATA)

FIGURE 8B JUNE 2000

ALTA GEOSCIENCES, INC.



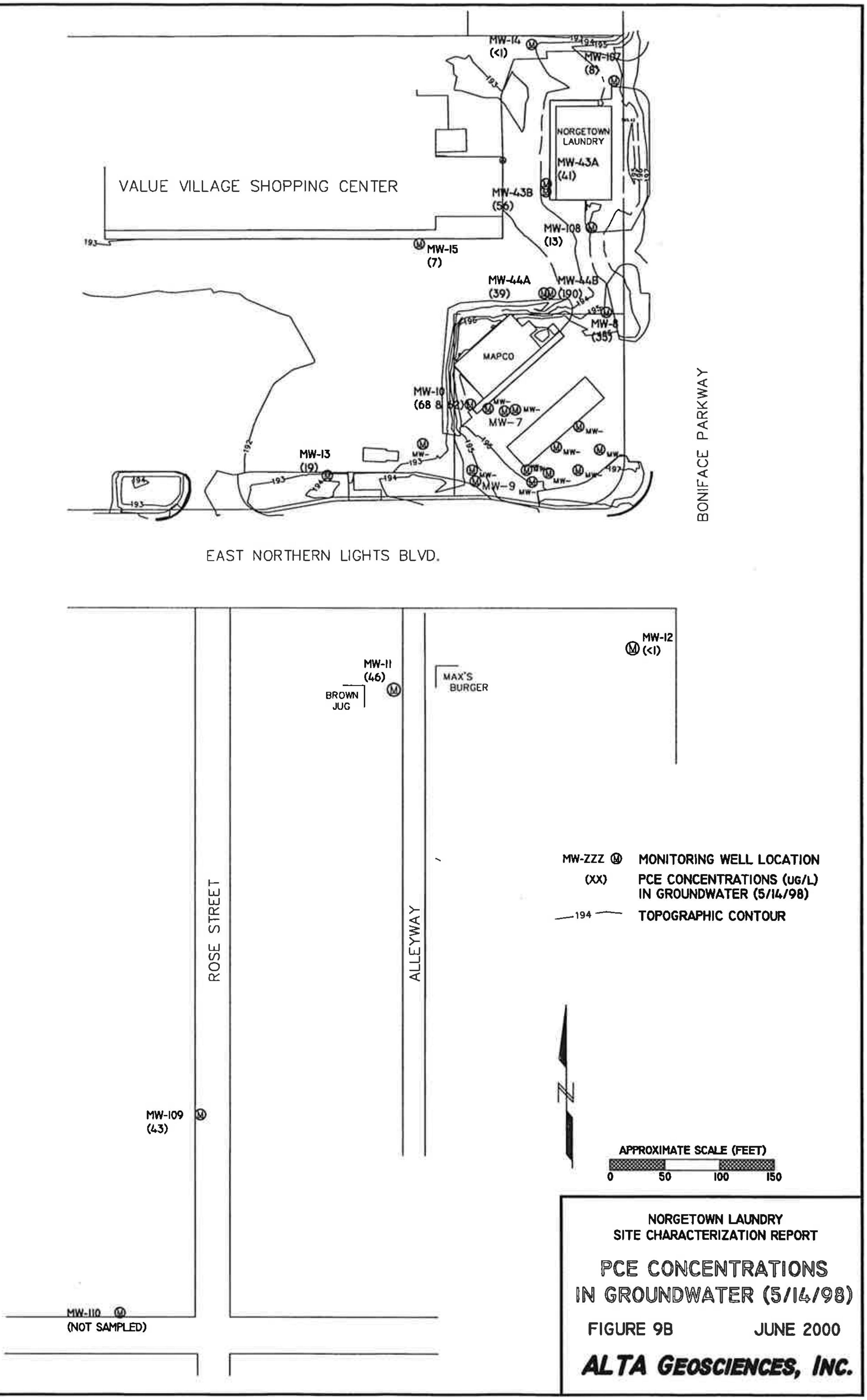
NOTE: GROUNDWATER CONTOURS ARE GENERALIZED AND DO NOT ATTEMPT TO DEPICT DETAILS OF LOCAL CONDITIONS. FLOW DIRECTION TOWARD THE SOUTHWEST (DOWN ON SHEET) PERPENDICULAR TO CONTOURS.

NORGETOWN LAUNDRY
SITE CHARACTERIZATION REPORT

INTERPRETED MAY 14, 1998 GROUNDWATER ELEVATION CONTOURS

FIGURE 9A JUNE2000

ALTA GEOSCIENCES, INC.

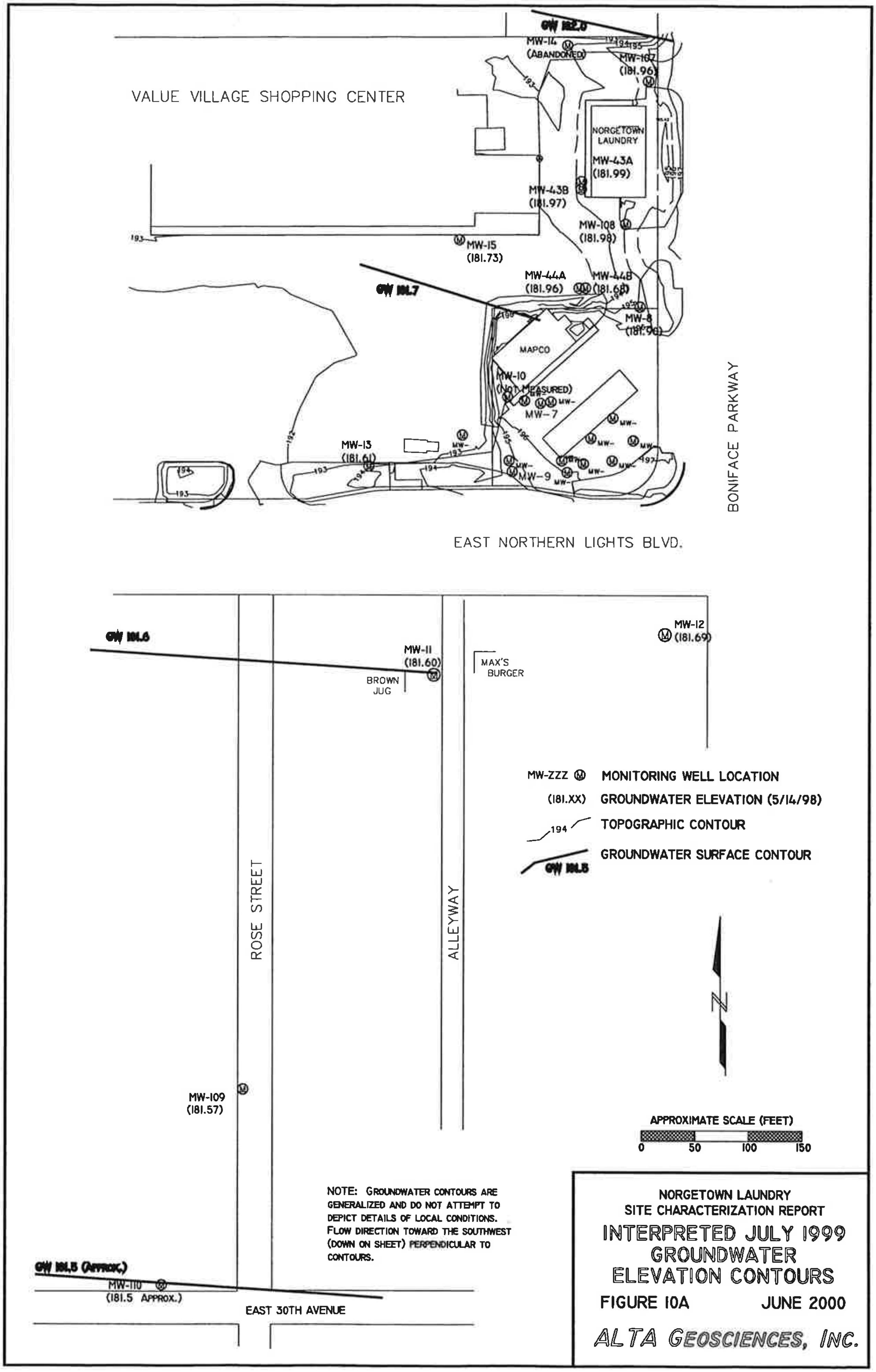


NORGETOWN LAUNDRY
SITE CHARACTERIZATION REPORT

PCE CONCENTRATIONS
IN GROUNDWATER (5/14/98)

FIGURE 9B JUNE 2000

ALTA GEOSCIENCES, INC.



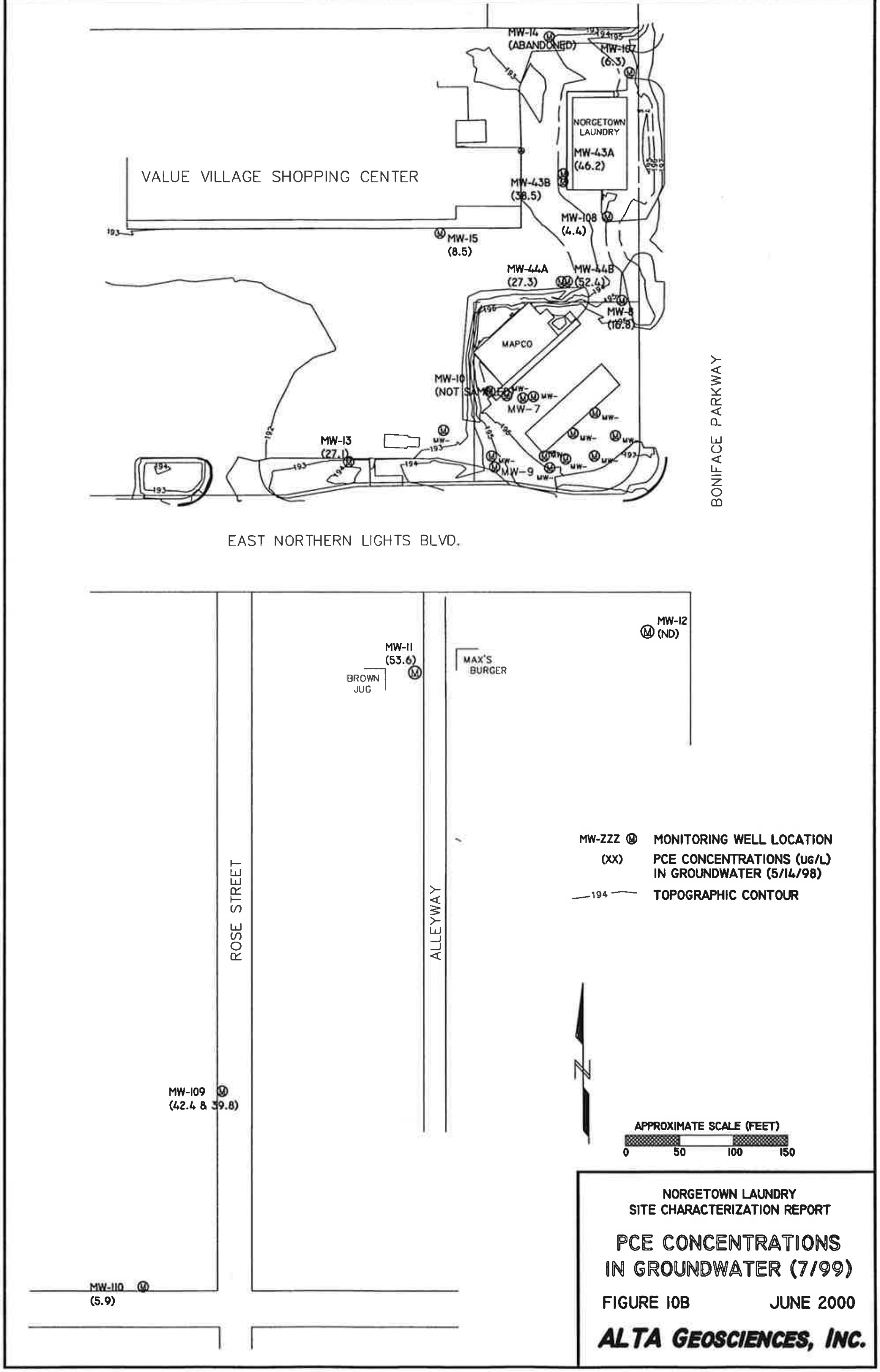
NOTE: GROUNDWATER CONTOURS ARE GENERALIZED AND DO NOT ATTEMPT TO DEPICT DETAILS OF LOCAL CONDITIONS. FLOW DIRECTION TOWARD THE SOUTHWEST (DOWN ON SHEET) PERPENDICULAR TO CONTOURS.

NORGETOWN LAUNDRY
SITE CHARACTERIZATION REPORT

INTERPRETED JULY 1999
GROUNDWATER
ELEVATION CONTOURS

FIGURE 10A JUNE 2000

ALTA GEOSCIENCES, INC.



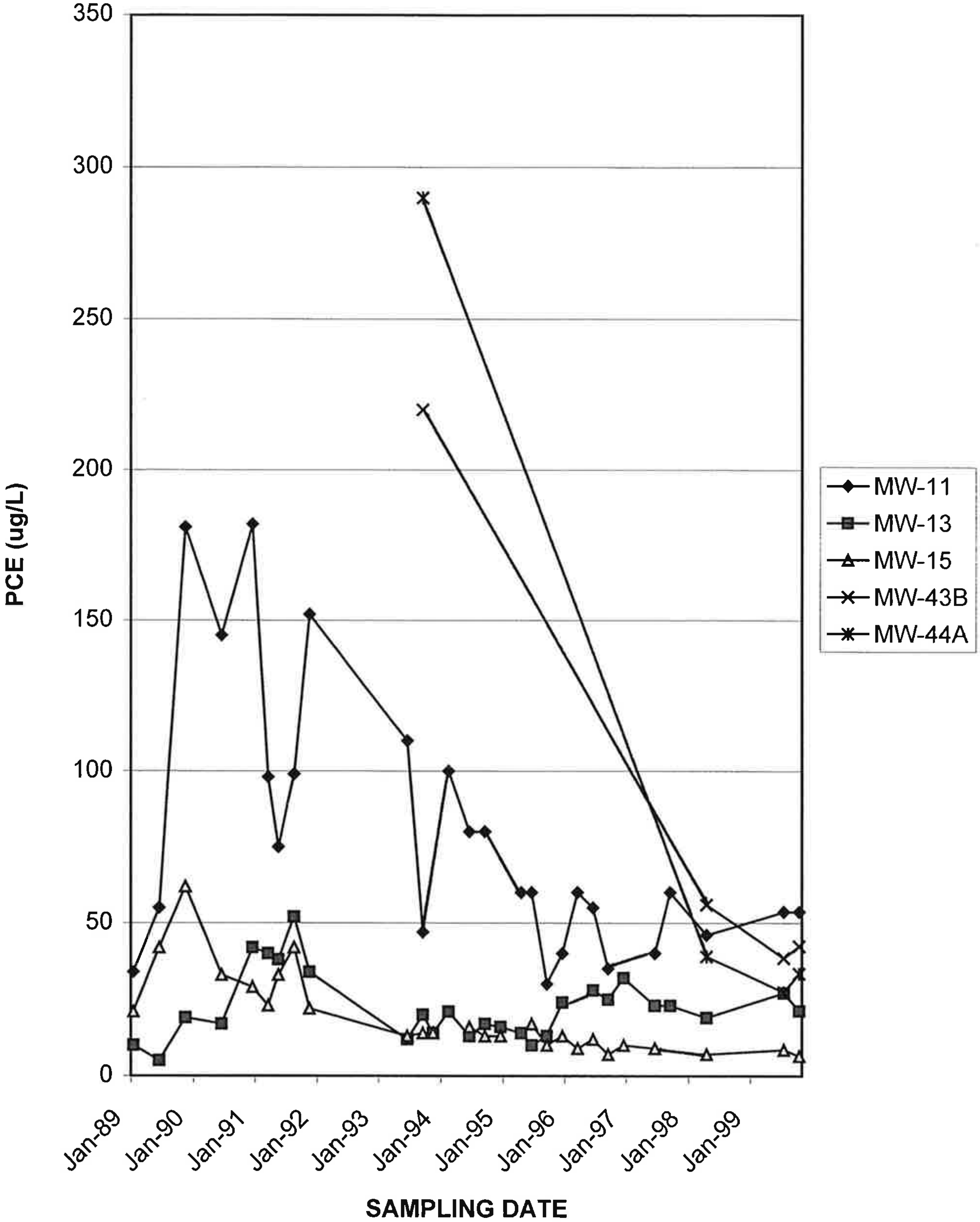
NORGETOWN LAUNDRY
SITE CHARACTERIZATION REPORT

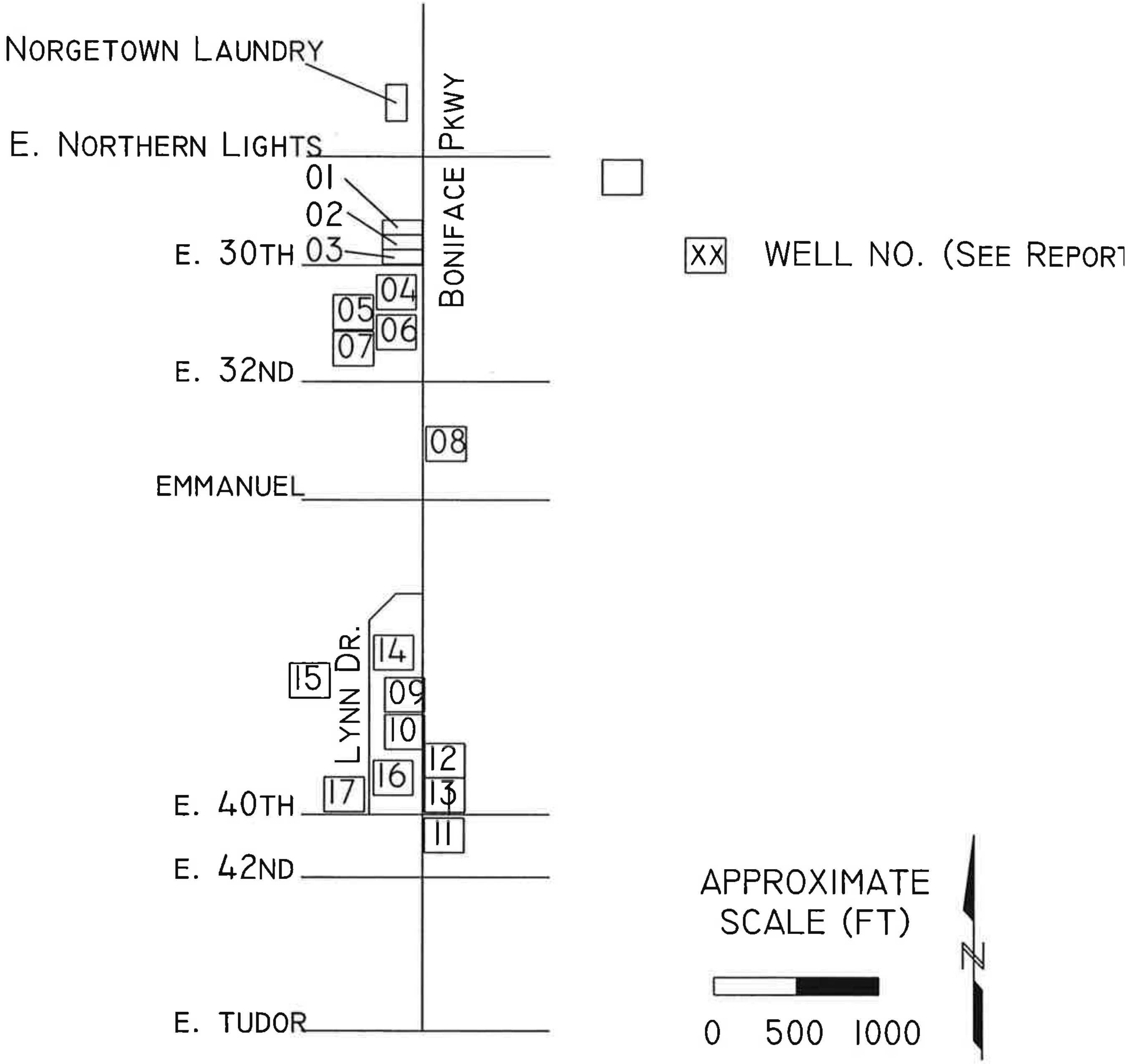
PCE CONCENTRATIONS IN GROUNDWATER (7/99)

FIGURE 10B JUNE 2000

ALTA GEOSCIENCES, INC.

Figure 11
PCE VALUES (ug/L) FOR SELECTED WELLS





Well locations are approximate, based on data base searches and published consultant's reports.

NORGETOWN LAUNDRY
SITE CHARACTERIZATION REPORT

OFFSITE WATER WELL LOCATIONS

FIGURE 12 JUNE 2000

ALTA GEOSCIENCES, INC.

4.0
SEWER LINE REPLACEMENT

Between July 5 and July 9, 1999, a section of the sewer line outside the laundry building was excavated and replaced. This work was in fulfillment of Task 3 in the June 1999 Site Characterization Work Plan. Figure 11 shows the location of the replaced section. In conjunction with this work, soil samples were collected and tested from beneath the pipe joints. A summary of this work is presented in the following sections. Laboratory data sheets are presented in Appendix D.

4.1 SUMMARY OF REPLACEMENT WORK

Sewer line replacement started at an existing cleanout about 5 feet west of the northwest corner of the laundry building. The pipe consisted of single gasket bell and spigot cast iron pieces 4-inches in diameter and a maximum of 10 feet long. The pipe depth varied from about 3 feet to 5 feet below the surface. The area to be excavated was entirely in the laundry parking lot (see Figure 11). Approximately 1.5 inches of asphalt concrete was first removed, then the underlying soil down to the pipe. Overlying the pipe was a 2-inch layer of foam insulation, which was removed, brushed off, and discarded as municipal solid waste. When the pipe joints were exposed, the distance of these from the upstream origin was measured and marked with paint in the field. As the pipe was removed, it was examined for damage, and the condition of the subgrade soil, especially at the joints, was observed for evidence of leakage. Except at one location, no evidence of leakage could be found, and the pipe appeared undamaged. The one point of damaged pipe was on the outside of the 90-degree elbow (65 feet from the origin). A hole in the pipe about ¾-inch across was found at this point. This hole was believed to have been caused by drilling work in 1998. After the subgrade was examined, soil samples were collected from 6-inches and 18-inches below each joint location. The results of this testing is summarized in the next section.

As a condition of allowing the pipe replacement, the Anchorage Water and Wastewater Utility (AWWU) required that the replaced pipeline be brought to current construction standards. This included:

- Installation of a control manhole; and,
- Because of the shallow burial depth of the pipe and the potential for pipe freezing, the) required a special arctic pipe, which included 4-inch diameter dual gasket cast iron pipe having 4-inches of insulation and an outer impermeable coating.

After the pipe was installed and functioning, the trench was backfilled with compacted soil and the pavement was patched.

4.2 SUBGRADE SOIL AND PIPE SLUDGE TESTING

As required by the Work Plan, pipe subgrade soil below the pipe joints was sampled and tested for EPA 8260B compounds. The only compound detected in any of the samples was PCE, which was detected in every sample at concentrations ranging from 130 ug/Kg to 654 ug/Kg. The mean of all the data was 217 ug/kg. Table 8 presents the results of this testing. Table 9 presents a summary of results for testing on pipe sludge removed from three (inside) locations in the old pipe. This sludge was a stiff fibrous material containing hair and cloth fibers cemented into solid chunks.

Table 8
SUBGRADE SOIL TESTING RESULTS

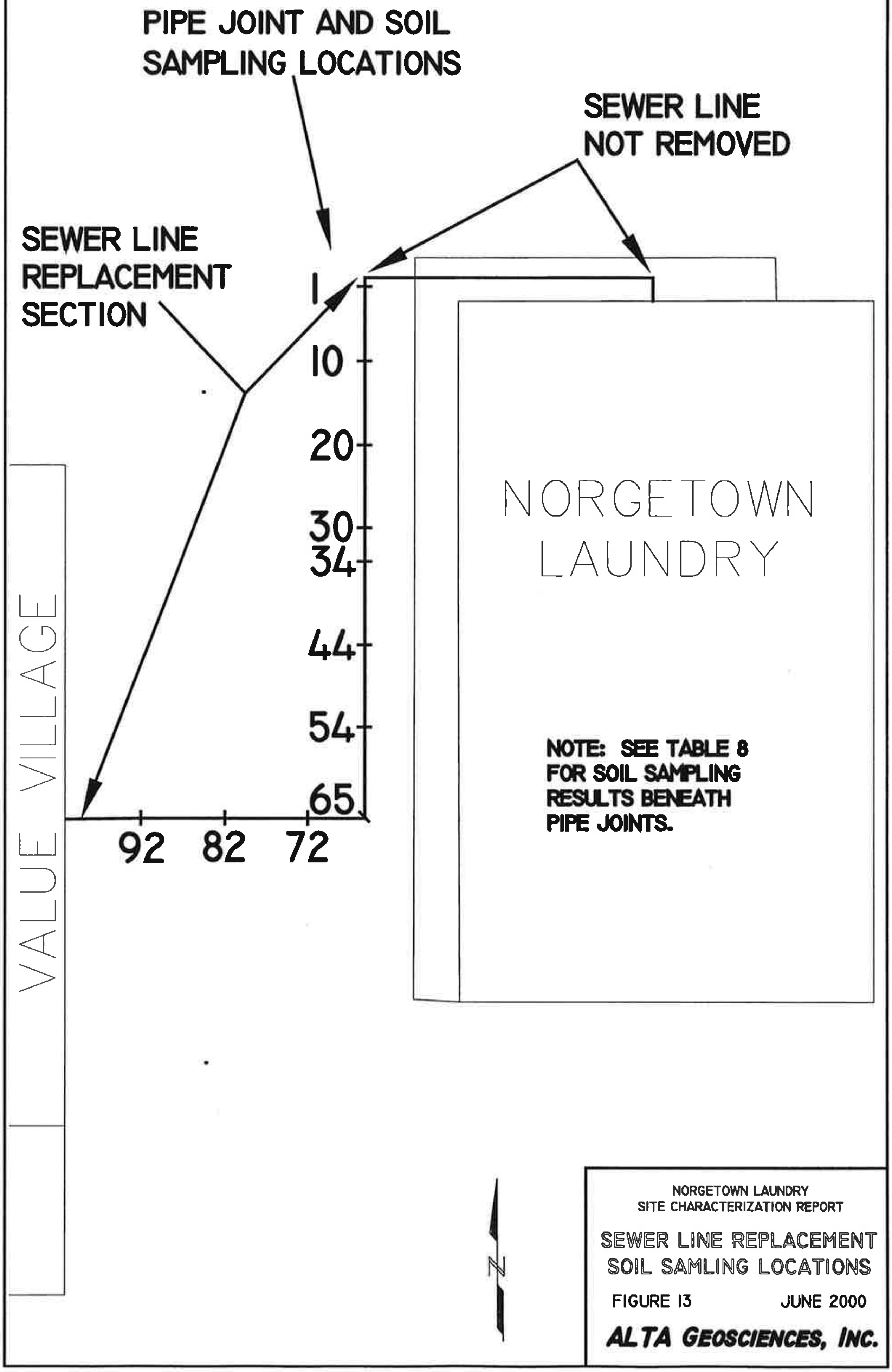
JOINT LOCATION FROM ORIGIN (FEET) (1)	SAMPLE DEPTH BELOW PIPE (FEET)	SAMPLE DEPTH BELOW SURFACE (FEET)	PCE (ug/kg)
1	0.5	3.1	261
1	1.5	4.1	156
10	0.5	3.3	156
10	1.5	4.3	181
20	0.5	3.8	147
20	1.5	4.8	228
30	0.5	4.1	308
30	1.5	5.1	166
34	0.5	4.2	290
34	1.5	5.2	247
44	0.5	4.4	159
44	1.5	5.4	201
54	0.5	4.7	654
54	1.5	5.7	178
65	0.5	4.8	267
65	1.5	5.8	160
72	0.5	4.5	255
72	1.5	5.5	130
82	0.5	4.4	196
82	1.5	5.4	150
92	0.5	4.5	134
92	1.5	5.5	153
		MEAN:	217

(1) Note: Sewer pipe origin is shown on Figure 11.

Table 9
PIPE SLUDGE TESTING RESULTS (MG/KG)

JOINT LOCATION FROM ORIGIN (FEET) (1)	PCE	TCE	DCE	PBZ	1,3,5-TMB	1,2,4-TMB
Pipe 5	4.44	0.264	0.06			
Pipe 65	182	5.77	12	0.1	0.248	0.5
Pipe 70	574	4.33	17.6		0.06	0.138

TCE=Trichloroethene
DCE=cis-1,2-Dichloroethene
PBZ=n-propylbenzene
TMB=trimethylbenzene
Other Compounds: BLANK = not detected
(1) Note: Sewer pipe origin is shown on Figure 11.



NOTE: SEE TABLE 8 FOR SOIL SAMPLING RESULTS BENEATH PIPE JOINTS.

NORGETOWN LAUNDRY
SITE CHARACTERIZATION REPORT

SEWER LINE REPLACEMENT
SOIL SAMLING LOCATIONS

FIGURE 13 JUNE 2000

ALTA GEOSCIENCES, INC.

5.0
WASTE DISPOSAL

5.1 BACKGROUND

Potentially regulated wastes from past investigations and remediation activities are presently stored at the Site. These include:

1. Soil cuttings from soil borings and monitoring well installation (16 drums);
2. Purge and development water from monitoring wells (5 drums, partially full);
3. Pipe from replacement of the sewer line from the laundry building to the adjacent mall building (approximately 100 lineal feet, 1500 pounds)

These three waste streams are considered “nonwastewaters”, “wastewaters”, and “debris” respectively under RCRA.

Based on the analytical results from the soil samples from the borings and monitoring wells, the soil cuttings contain from 0 to 0.5 mg/kg PCE (averaging less than 35 ug/kg). The purge and development water contains less than 25 ug/L PCE on average. Sludge scraped from inside the pipes contains from 5 mg/kg to 600 mg/kg PCE.

5.2 REGULATORY STATUS

Under the Resource Conservation and Recovery Act (RCRA) regulations (40 CFR 261), a waste containing PCE may be designated as a hazardous waste due either to:

1. Being considered a “characteristic waste”) by failing the Toxicity Characteristic Leaching Procedure (TCLP) test for PCE (waste code D039); or
2. Being considered a “listed waste” as a “spent halogenated solvent” (waste code F001).

The TCLP criteria for PCE for these waste streams is as follows:

1. Nonwastewaters:	0.7 mg/L in the TCLP leachate
2. Wastewaters:	700 ug/L total concentration
3. Debris:	Not applicable

Characteristic Wastes

In order for the nonwastewaters to have a concentration of 0.7 mg/L in the TCLP leachate, the total concentration of PCE in the original waste would have to exceed 14 mg/Kg (the so called “twenty to one” rule). Therefore, neither the soil cuttings nor the well purge and development water would be considered characteristic wastes. The sludge inside the sewer pipes would likely fail the TCLP criteria, if it could be effectively separated from the pipes themselves.

Listed Wastes

The soil cuttings, well purge water, and pipe sludge could be considered "listed wastes" (and thus be assigned the hazardous waste code F002) if the process generating the waste could be clearly identified as

> F001 The following spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1–trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.

From this description, it is clear that the pipe sludge would meet this criteria and be considered an F001 listed hazardous waste. The volume of sludge in the pipe is very small, however, and could be disposed of under the laundry's routine Small Quantity Exempt generator program.

Designation of the soil cuttings and well purge and development water is more problematical, since a clear source and release mechanism for the PCE has not been identified, and the concentrations are extremely low.

"Contained In" Policy

EPA's "contained in" policy states that when a listed hazardous waste (i.e., F001 spent solvent) is "contained in" another media (such as soil or water), then the entire contaminated media must be considered as hazardous waste. For environmental media with such low concentrations as are present in the soil cuttings and well purge and development water at the Site, EPA will grant a "contained in" determination, essentially declaring that the hazardous waste is not contained in the environmental media and allowing for disposal as a solid waste. While this option is initially attractive, such contained in determinations are granted only on a case by case basis, requiring substantial documentation and 6 to 9 months. This would not be applicable to the pipe sludge, however.

Land Disposal Restrictions

EPA's Land Disposal Restrictions (40 CFR 261 part 148), prohibit the land disposal of hazardous wastes without treatment. The treatment standards relevant to PCE are:

1. Nonwastewaters:	6.0 mg/Kg
2. Wastewaters;	0.056 mg/L

Thus, the soil cuttings could be direct land disposed in a hazardous waste landfill without further treatment. This would also seem applicable to the well purge and development water. However, the practical reality is that the well purge and development water would need to be treated in order to meet the discharge requirements of the receiving facility.

EPA recognized that the treatment standards for nonwastewaters were inapplicable to debris and therefore ruled (the "debris rule") that alternative treatment standards were appropriate. These alternative treatment standards are process-specific, rather than concentration based. The most applicable alternative treatment method for the pipelines would appear to be "macroencapsulation", whereby the pipes are sealed in plastic boxes before being placed in the landfill. This "treatment" is performed at the landfill.

5.3 DISPOSAL FACILITIES

There are no permitted hazardous waste landfills in Alaska. The nearest permitted hazardous waste landfill is at Arlington, Oregon, operated by Chemical Waste Management, Inc.. There are permitted treatment facilities in Anchorage for F001 wastewaters (i.e., Philip Environmental).

5.4 WASTE DESIGNATION

Although the concentration of PCE in the soil cuttings is very low, the extensive documentation and lengthy time delay needed to obtain a "contained in" determination from EPA does not appear cost effective. Therefore, it is proposed to designate these as F002 non-wastewaters for disposal purposes.

Similarly, it is proposed to designate the well development and purge water as F002 wastewater for disposal purposes.

The sludge in the pipelines clearly meets the criteria for F001 waste. Although the quantity of such sludge is very small, it is probably not cost effective to attempt to separate it from the pipes in which it is hardened. Therefore proposed to designate the pipes together with the sludge as F001 debris for disposal purposes.

5.5 DISPOSAL PLANS

Site ID Number

For disposal, it will be necessary to file a Notification of Regulated Waste Activity with EPA and obtain an EPA Generator's ID number ("AKD" number). Waste profiles will need to be filed with the disposal facilities.

Soils

The soils are already contained in DOT approved drums. Drums will be appropriately labelled and shipped to the disposal facility under hazardous waste manifesting procedures in accordance with DOT regulations. The soil will then be landfilled in the permitted hazardous waste landfill (Chemical Waste Management, Inc., Arlington, Oregon).

Pipe

Per instructions from the disposal facility, the pipe will be banded together, wrapped in plastic, strapped to palletts and transported to the disposal facility as for soils. Small pipe fittings and segments will be placed in a DOT approved drum. Upon reaching the disposal facility (Chemical Waste Management, Inc., Arlington, Oregon), the pipe debris will be "macroencapsulated" and land disposed as hazardous waste.

Water

Two alternatives are available for the well purge and development water:

1. The drums could be disposed of at the local treatment facility (Philip Environmental).
2. The facility routinely disposes of a small amount of dry cleaning residuals under their small quantity generator program. As only a comparatively small amount of water is present on the site, it could be combined with other dry cleaning residuals and so legally disposed of.

5.6 FOLLOWUP

Subsequent to the preparation of the first draft of this report, the following actions were taken:

1. An EPA ID number was obtained for the site: AKD982656894
2. Solid wastes were removed from the site on June 8, 2000, and transported under manifest to the specified disposal facility.

A summary report will be prepared once the disposal certificates are received.

One deviation was made from the original work plan. Soil onsite in drums was transferred to flexible intermediate bulk containers ("supersacks") for transportation and disposal. The empty drums in good condition have been retained onsite for use in future investigation/remediation activities. The empty drums are not regulated under RCRA.

6.0
CLEANUP LEVELS

Cleanup levels are discussed for the two affected media (groundwater and soils) in accordance with the procedures set forth in 18 AAC 75.340 through 350.

6.1 GROUNDWATER CLEANUP LEVELS

Standard Groundwater Cleanup Level

Groundwater cleanup levels are shown in 18 AAC 75.345, Table C, for conditions where "the current use or the reasonably expected potential future use of the groundwater is a drinking water source." The specified groundwater cleanup level for PCE is 0.005 mg/L (5 ug/L), corresponding to the drinking water Maximum Contaminant Level (MCL).

Alternate Groundwater Cleanup Levels

18 AAC 75.345(b)(2), makes the following alternate provision:

> *"a concentration equal to 10 times the cleanup standards in the Table C, not to exceed the solubility limit of the contaminant, based on a determination of groundwater use under 18 AAC 75.350 ... the groundwater is not a current source of drinking water or a reasonably expected future source of drinking water "*

Such an alternative cleanup level, however, results in a requirement for burdensome institutional controls as described in 18 AAC 75.375 which would require:

1. Consultation and concurrence with each affected landowner and government agency; and,
2. Deed restrictions preventing installation of groundwater wells in the affected area.

Further discussion of alternative groundwater cleanup levels is therefore provided only for possible application to the onsite areas of the Norgetown Laundry site.

The groundwater in the affected area meets the provisions of 18 AAC 75.350 because:

1. The groundwater in the affected area is not a current source of drinking water as determined in Section 2.3 of this Site Characterization Report.
2. Alternate drinking water sources are available. The entire area is served by piped drinking water from the Municipality of Anchorage.
3. Enforceable municipal ordinances prevent installation of water wells in the affected zone.

4. No surface water are affected, as shown in Section 2.4 of this Site Characterization report.

Concerning point 3 above, the Municipality of Anchorage requires water well permits for all water well installations. Anchorage Municipal Code Chapter 15.55.060 ("General standards for domestic wells") provides the following restrictions:

> *"Water wells shall be drilled and cased with non-perforated pipe to minimum depth of 40 feet in unconsolidated materials ..."*

This code further requires that the annular space between the well casing and the surrounding formation be grouted with bentonite to a minimum depth of 20 feet below ground surface.

In the project vicinity, the glacial till aquitard (clayey sand and gravel) is present at a depth of about 20 feet. Thus, a legal well would need to penetrate at least twenty feet below the base of the affected shallow aquifer. Most water wells in the region produce from depths of 70 to 80 feet, in the lower aquifer. Further, the well casing would need to be grouted for virtually the entire penetration through the affected shallow aquifer.

Conclusion

Groundwater cleanup level for offsite areas should be retained at 5 ug/L. The cleanup goal for groundwater onsite should also be 5 ug/L to minimize institutional difficulties. However, if it proves infeasible to remediate onsite groundwater to this level (assuming offsite goals are met), it may be advantageous to consider an alternate cleanup level for groundwater onsite.

6.2 SOIL CLEANUP LEVELS

Soil cleanup levels are set forth in 18 AAC 75.340. Three methods for determining soil cleanup levels are provided. Method 1 applies only to petroleum hydrocarbons and will not be discussed further.

Method 2 Soil Cleanup Levels

Method 2 soil cleanup levels for PCE are presented on Table B1 for three exposure scenarios. For the "Under 40 inch" annual rainfall zone, these are:

• Ingestion:	160 mg/kg
• Inhalation:	80 mg/kg
• Migration to Groundwater:	0.03 mg/kg

By inspection, site soil concentrations are orders of magnitude below the ingestion and inhalation cleanup levels. Therefore, only the Migration to Groundwater cleanup level is of concern, as it is exceeded by many soil sample results.

Method 3 Soil Cleanup Levels

The Method 2 soil cleanup levels are based on ADEC's Cleanup Standards Equations, using many default parameters. Many of these parameters are intentionally conservative to cover "worst case" scenarios. Method 3 allows modifications of these parameters to account for site specific conditions. The procedures for calculating site specific cleanup levels are set forth in two ADEC guidance documents: *Draft Guidance on Developing Soil Cleanup Levels Under Methods Two and Three* (ADEC, March 22, 1999); and *Guidance on Cleanup Standards Equations and Input Parameters* (ADEC, September 16, 1998). Examining the cleanup standards equations for the Migration to Groundwater pathway (Equations 11, 12 and 13), we found several areas where the default parameters significantly differed from site conditions. These are:

- Fraction organic carbon in soil (foc). The default value is 0.001 g/g (0.1%). At the Norgetown site, four soil samples were analyzed for Total Organic Carbon. Two samples were from beneath the replaced sewer line at stations 42 and 76 (see Figure 11). These samples were collected from native soils 12 inches below the base of the original trench excavation (about. 5 feet bgs). Two additional samples were also analyzed for TOC. These were composites of all vadose zone soils from borings B105 and B107. The results of these analyses are:

STA42	0.71%
STA76	0.25%
B105 Comp	0.23%
B107 Comp	0.25%"

  The four values are consistent and reasonably distributed around the site. They should be considered adequately representative. The mean of these analyses is 0.36%, and the median value is 0.25%. As a conservative measure, the median value (0.25%) was used.
- Aquifer hydraulic conductivity (K). The default value is 876 meters per year. As discussed in Section 1.5 of this Site Characterization Report, the hydraulic conductivity for the affected zone has been determined to be 0.39 cm/sec, based on pump tests. This converts to a value of 122,990 m/yr, which was used.
- Hydraulic gradient (I). The default hydraulic gradient is 0.002 m/m (actually dimensionless). As described in Section 1.5 of this Site Characterization Report, the regional hydraulic gradient in the area is relatively flat, previous studies (Shannon & Wilson, 1993) citing a value of 0.001. To evaluate the groundwater gradient over the affected area of the Norgetown site, we compared groundwater gradients using three well pairs: MW107/MW13, MW107/MW44B, and MW107/MW108. To incorporate consideration for seasonal variability, we made this evaluation for three groundwater monitoring periods: third quarter 1999, fourth quarter

1999, and first quarter 2000. This analysis is shown in Appendix C. There is a good deal of apparent variability in these results, ranging from 0.00035 to 0.00280. In our opinion, this variability is due to small imprecisions in surveys and field measurements which in areas of relatively flat gradients and short measurement distances produces variable results. The average of these values was 0.00096, which was rounded to 0.001 which was used.

- Source length parallel to groundwater flow (L). The default value is 32 meters. We considered the source length as extending from MW-107 to MW-108, encompassing the entire laundry building and considerable distance both up and down gradient. This corresponds to a distance of 130 feet (39 meters), which was used. This is conservative, as it assumes the potential soil sources exist throughout the site.
- Infiltration rate (I). The infiltration rate is calculated as 1/5 of the mean-plus-one-standard-deviation of the yearly rainfall. The default value for the "under 40 inch" zone is 0.13 m/yr. This translates to a the mean-plus-one-standard-deviation of 25.6 inches annually. We reviewed records from the National Weather Service, Alaska Regional Office (see Appendix C). For the 46 years of records available electronically, the mean-plus-one-standard-deviation for total precipitation (including snowfall) is given as 19.02 inches. However, this includes all precipitation (including snowfall). To adjust to yearly rainfall, we omitted the precipitation data from November through February, since this precipitation is almost inevitably snowfall. This yielded a mean-plus-one-standard-deviation of 15.01 in/yr. Discounting the snowfall portion is especially relevant for the Norgetown site as the site is a paved parking lot which is routinely plowed all winter. The standard defaults also use an infiltration rate of 20 percent of the rainfall, the remaining 80 percent presumably being lost to runoff and evapotranspiration. This yielded an infiltration rate of 0.076 m/yr which was used.
- Aquifer thickness (da). The default value is 10 meters. The actual aquifer thickness in the Norgetown area is about 4 meters, which was used. Further, the Mixing Zone Depth (Equation 13) was capped at 4 meters.

Applying these site specific modifications to the ADEC soil cleanup equations yields a Soil Cleanup Level of 0.6 mg/Kg.

Conclusion

Application of a Method 3 soil cleanup levels requires a modest institutional control under ADEC policy. Specifically, there is a requirement for a deed notice that soils do not meet Method 2 criteria and offsite transportation requires ADEC approval. This is not particularly burdensome for this site as it is already fully developed. Therefore, the Method 3 soil cleanup level is appropriate.

7.0

CLEANUP TECHNIQUE EVALUATION

This section discusses several potential cleanup techniques which may be applicable to the Norgetown site.

7.1 SOILS

The Method 3 cleanup level for soil (0.6 mg/kg) has been exceeded in past sampling events by the following samples:

Boring	Depth (ft)	PCE (mg/kg)
Sewer Line Sta 54	4.7	0.654
B-1	7.5-9	1.38
MW-44	3.5-5	1.0
MW-44	9-10.5	1.9

The sewer line sample (from 0.5 feet below the bottom of the sewer line trench) is relatively insignificant and the sample from one foot deeper (178 mg/kg) does not exceed the criteria. The MW-44 boring is located on the MAPCO station property line, at a considerable distance from the laundry and any potential points of release. Therefore, there is some question about the relevance of these data points. Not including the MW-44 soil samples, a total of 73 soil samples have been analyzed for PCE on site (45 samples from the 1998 soil borings, 22 samples from the sewer line removal, and 6 samples from prior soil borings). Considering that only the single sample from B-1 significantly exceeds the Method 3 cleanup level, the site should be considered in statistical compliance and no further remedial action should be required for soils based on existing data.

A small section of sewer line along the north edge of the laundry building was not replaced during the 1999 sewer line replacement. Considering the high PCE levels detected in the pipeline sludge, it would seem appropriate to remove this section of the pipeline as well. Additional soil tests should be conducted beneath this section of the sewer line as it is removed. If these soil analyses show significant exceedence of the soil cleanup level, then some focussed remediation may be appropriate in this area.

7.2 GROUNDWATER

Groundwater both onsite and offsite exceeds 5 ug/L. Maximum plume concentrations are presently in the 40 to 50 ug/L range. The groundwater plume extends downgradient for a distance of about 900 feet southwest from the southern property line. It is considered inappropriate to attempt to remediate the offsite portions of the groundwater plume for the following reasons:

1. Declining PCE concentrations as documented in Section 3 indicate that intrinsic remediation (natural attenuation and dilution) is in action to reduce these offsite concentrations.
2. There are no downgradient receptors (e.g., wells or surface water bodies) being impacted.
3. The plume covers such a large area that active remediation would be prohibitively expensive considering the limited benefit compared to intrinsic remediation.

Therefore, no potential remedial measures are evaluated for the offsite portion of the plume except for intrinsic remediation and continued monitoring.

The onsite portion of the plume represents the highest concentrations of PCE presently being detected in groundwater. An active remediation activity focussed on this area would have an added benefit of accelerating the decline of PCE concentrations in the offsite portion of the plume.

The technologies described below may be applicable to remediation of the onsite portion of the plume. This is not intended to be an exhaustive analysis as would be performed for an RI/FS, but rather focuses on a few technologies which, in our opinion, may be appropriate for this site.

Intrinsic Remediation

As documented in Section 3, PCE concentrations are declining in onsite wells with no additional remedial action. This suggests that given enough time, cleanup levels will be reached throughout the onsite portion of the plume area. The disadvantages with this option is that it is impossible to predict the length of time this might take, and there would be consequent lengthy time before offsite portions of the plume would be expected to reach cleanup levels. The advantage of this option is zero capital cost, however the lengthy period of groundwater monitoring could result in present worth costs equal to more aggressive remediation strategies.

Air Sparging

Air sparging has long been used for groundwater cleanup of volatile organic compounds. Air sparging would involve injecting air into the groundwater zone through injection wells. The air bubbles through the saturated zone, and volatile organic chemicals (like PCE) volatize into the air bubbles, and are then transferred to the vadose zone. Air sparging is usually operated with soil vapor extraction (SVE) systems that capture volatile contaminants stripped from the saturated zone. These are then treated above ground, typically via granular activated carbon systems. The advantage of this system is that it is a well known technology and can be easily implemented. The disadvantages include: 1) the need for above ground treatment and disposal; 2) experience has shown that conventional air sparging systems while effective at reducing high contaminant concentrations often have difficulty reaching the low cleanup levels for compounds like PCE; and 3) the restoration time is often lengthy.

Permeable Reactive Barriers

Permeable reactive barriers consist of iron granules installed in a trench across the flow path of a contaminant plume. This type of barrier allows the passage of water while removing dissolved contaminants (PCE and its degradation products) by chemical dechlorination. The iron is oxidized, releasing electrons, which are then used to remove a chlorine atom from the contaminant (e.g., PCE). The process continues until the chlorine atoms are sequentially removed from PCE, leaving non-toxic degradation products, such as ethene. The iron granules are dissolved by the process, but the metal disappears so slowly that the remediation barriers can be expected to remain effective for many years, possibly even decades. The advantages of this system are: 1) No active treatment processes are present which require maintenance, and no treatment residuals require disposal; 2) This system would have an immediate positive impact on downgradient water quality. The disadvantages of this system include: 1) A deep (22 foot) trench would need to be constructed across the entire groundwater flow path leaving the site, this construction within the saturated zone in coarse grained cohesionless soils would be difficult and expensive; 2) Since the onsite portion of the plume is not treated, the time to achieve cleanup goals onsite is similar to that for the intrinsic remediation alternative (e.g., potentially decades).

In-Situ Chemical Oxidation Using Ozone Injection

In this alternative, an onsite ozone generator is used to create ozone, which is mixed with ambient air. The resulting mixture (consisting of 2 to 3 percent ozone) is pumped into the aquifer through specially designed “sparge points”. The sparge points create microbubbles of ozone bearing air which migrate up through the groundwater column. PCE is stripped from the groundwater into the air microbubbles, where it is oxidized (destroyed) by the ozone. Any ozone not consumed in the saturated zone will escape into the vadose zone and continue to oxidize any vadose zone contaminants.

This system (the patented C-Sparge system manufactured by K-V Associates).has had great success at rapid remediation of PCE at many other dry cleaning sites. In many cases, cleanup goals can be fully reached in as little as six weeks. This system has several significant advantages over other technologies:

1. The contaminant is oxidized (destroyed) with no production of undesirable chemical intermediates.
2. Vadose zone soils are treated together with the saturated zone in a single process.
3. No waste products are generated.
4. No above ground treatment components are needed.

The C-Sparge process consists of a combination of in-situ air stripping, where dissolved solvents are extracted from the aqueous solution into small bubbles. The extracted PCE then reacts with the encapsulated ozone in a gas/gas reaction described by the Criege Mechanism as a primary ozonide. The ozonide is very unstable, decomposing to form carboxyl oxide, which reacts with water (hydrolyzed) as it exits the bubble to yield the reaction end products hydrochloric acid, water and carbon dioxide. This is an extremely clean reaction since the PCE is concentrated in the fine bubbles to react with ozone on a mole to mole basis. The process focuses the ozone reaction selectively to air-strippable compounds which invade the bubbles. As a result, if the encapsulated ozone concentration is maintained at a low multiplier of the strippable VOCs, then no additional ozone is available for side reactions with other dissolved organic compounds which have low Henry's Constant values. Primary reactions do not create any intermediate products because the reactions proceed so rapidly and the bubble rise times are quite long. The only identified end products for this system have been inorganic (chloride, carbon dioxide, bicarbonate, nitrate, sulfate and dissolved oxygen). The generation of hydrochloric acid is insignificant because of the high buffering capacity of the soils and the very low concentration of PCE present in the first place.

Conclusions

In-situ oxidation using ozone injection appears to have a high potential of achieving groundwater cleanup levels in the onsite area rapidly and cost effectively.

8.0
CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS FROM SOILS INVESTIGATIONS

Conclusions that can be drawn from the data collected from this study, especially when considered with past data are:

- None of the soil or groundwater analytical data indicate the presence of nonaqueous phase liquids which could provide a continuing source of PCE contamination to groundwater.
- Despite highly focussed sampling, none of the soil analytical data to date has been able to identify an area of significantly elevated PCE (or PCE degradation products) concentrations suggesting a release location or an area warranting soil remedial actions.
- Very low level PCE impacts to soil are widespread, apparently on all sides of the building, extending to at least the south property line with the MAPCO station. These impacts are comparable to those present upgradient to the Norgetown Laundry in the Boniface Parkway road fill.
- The highest detected value of PCE in the 1997 Site Investigation work was in boring B-102 (460 ug/kg), adjacent to Boniface Parkway, in near-surface material that appeared to be fill, and distant from laundry doorways, operations and sewer lines. Disposal of laundry solutions at this location by surface dumping is very unlikely.
- Prior investigations found PCE concentrations in soils near the Laundry higher than those found in this Site Characterization. Most notable of these was at B-1 (1380 ug/kg) and at MW-44A (1900 ug/kg). The location of these borings is equally improbable with respect to releases from the laundry. B-1 is in the middle of a paved driveway, MW-44A is located adjacent to the MAPCO property line. As discussed above, even higher values have been reported in areas that cannot reasonably be connected with releases from the Laundry.
- PCE impacted soil is present surrounding the Site at depths both above and below the groundwater. At location B-102, the highest PCE detections found onsite were in the range of 2-5 feet deep, clearly unassociated with the saturated zone beneath the Site. Similarly, the offsite sample from B-1 (4,000 ug/kg) described above was also located above the saturated zone and cannot reasonably be attributed to groundwater transport.
- Widespread, low level PCE impacts (about 150 to 650 ug/kg) to soils are present in the soils beneath the sewer line pipe joints. This conclusion and the PCE levels encountered are consistent with previous site investigation findings. However, the consistency with which PCE was detected in every soil sample analyzed is significant.
- There was no visual indication of leakage from pipe joints, such as staining or wet soil. The soil testing results were not substantially higher than results obtained for site soils distant from the pipeline. The pipe was in sound condition, without

corrosion holes. The only hole identified (at the elbow) was mechanically produced by prior construction work in 1997. Recent sample results and those from Boring B104 at this location do not indicate this was a significant PCE discharge area.

- Because of the presence of residual PCE in the pipe sludge, PCE was apparently disposed of into the sewer at some time in the past, possibly in the form of dry cleaner sludge.

8.2 CONCLUSIONS FROM GROUNDWATER WORK

- Significant PCE impacts to groundwater extend to the southwest southwest to MW-110 (about 1,000 feet southwest of Norgetown Laundry). The highest PCE concentrations continue to be reported around the MAPCO station, a pattern that has remained constant for at least the past 10 years. PCE impacted groundwater appears to be entering the Norgetown Laundry site from the northeast, although at much lower levels than the concentrations reported southwest of the Laundry.
- Considered in a historical context, PCE concentrations in groundwater have shown a consistently decreasing trend in all wells for which historical data is available. The very flat groundwater gradient indicates that groundwater transport occurs at a relatively slow rate.
- The existence of PCE degradation products in several groundwater samples indicate that natural degradation of the PCE is occurring.
- The southwest extent of the PCE plume is effectively defined by monitoring well MW-110.
- There are no downgradient domestic water wells within one mile of the Site. Domestic water wells in the area appear to withdraw water from a deeper aquifer level, separated from the shallow water bearing zone by a substantial aquitard.
- Anchorage Municipal Code requirements prohibit installation of wells in the shallow water bearing zone affected by PCE.
- The entire downgradient area is served by piped municipal drinking water.
- There are no potential downgradient surface water receptors.

8.3 CONCLUSIONS FROM CLEANUP LEVELS ANALYSIS

- .The appropriate cleanup level for site soils is 0.6 mg/Kg, based on a Method Three analysis. the site should be considered in statistical compliance and no further remedial action should be required for soils based on existing data.
- The appropriate groundwater cleanup level for the site is 5 ug/L, Groundwater in the affected area exceeds this level both onsite and offsite. However, the overall trend of the monitoring results indicates that groundwater PCE concentrations are decreasing with time.

8.4 CONCLUSIONS REGARDING CLEANUP TECHNIQUES

- No specific soil remediation appears needed, except for removal of the remaining portion of the sewer line.

- Remediation of the offsite portion of the groundwater plume (other than intrinsic remediation) is prohibitively expensive and unwarranted in view of the lack of potential offsite receptors.
- Remediation of the onsite portion of the groundwater plume appears feasible, and several technologies are available. Remediation of the onsite portion of the plume should have a significant positive impact on downgradient water quality, resulting in more rapid attainment of cleanup goals in the offsite portion of the plume.
- In-situ oxidation using ozone injection appears to offer a rapid, cost effective approach to remediation of the onsite portion of the plume.

8.5 GENERAL CONCLUSIONS

Based on the available data low-level PCE impacts are widespread in soils in the vicinity of the laundry, suggesting multiple minor contaminant releases.

The most likely source for the groundwater impacts resulting from Laundry operations is leakage from the sewer line:

- Every soil sample from beneath sewer line joints contained detectable (though low) levels of PCE.
- The sludge from inside the sewer pipes contained relatively high levels of PCE.
- The sewer line is very shallow, within the soil zone which would be affected by freeze-thaw cycles which could induce leakage.
- The sewer line was constructed to old building codes, and was substandard to modern, more leak resistant codes.
- The shape of the groundwater plume between the laundry and the south property line is consistent with the sewer line being the primary source.

The apparent scenario leading to groundwater impacts is thus that laundry wastewater has picked up minor levels of PCE by flowing through the pipes containing the PCE sludge. A small percentage of this wastewater leaked from pipe joints which were affected by poor original construction and deterioration resulting from freeze-thaw cycles. This PCE bearing wastewater then transported small amounts of PCE through the soils underlying the pipe joints eventually reaching the groundwater.

The above analysis should not be interpreted to imply that leakage from the laundry sewer line is the only source or potential source of PCE which has affected groundwater in the area. Past studies and current monitoring of MW-107 indicate that low level PCE impacts are present in the groundwater in much of the upgradient area. The very high PCE levels reported centered on the MAPCO station for many further suggest additional sources contributing to PCE contamination downgradient of Northern Lights Boulevard. However, PCE impacted soils, if any, in the MAPCO station area should have been largely remediated by now as a result of the operation of the hydrocarbon remediation system at that facility.

8.6 RECOMMENDATIONS

Based on the above, we recommend that an Interim Action Plan be prepared for remediation of the onsite portion of the plume by in-situ oxidation using ozone injection. The Interim Action Plan should include replacement of the remaining exterior portion of the sewer line. If this system is successful in permanently reducing groundwater contamination to cleanup levels in the on-site area, then ADEC should consider a determination of no further remedial action.

9.0
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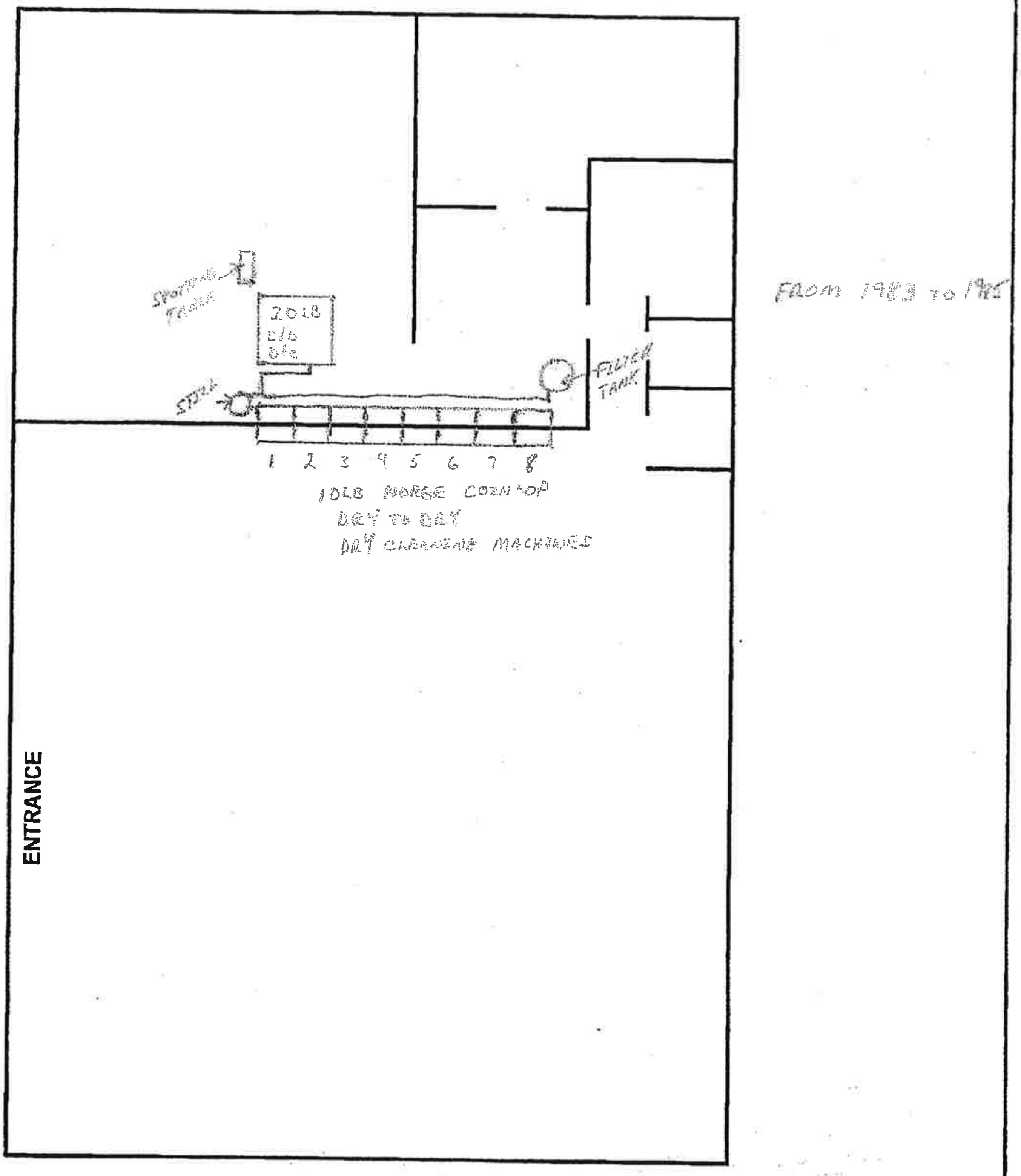
APPENDIX A

HISTORICAL BUILDING LAYOUTS



10LB NORGE COIN-OP
DRY TO DRY
DRY CLEANING MACHINES

FROM 1983 TO 1985

Norgetown Laundry
Site Characterization Report

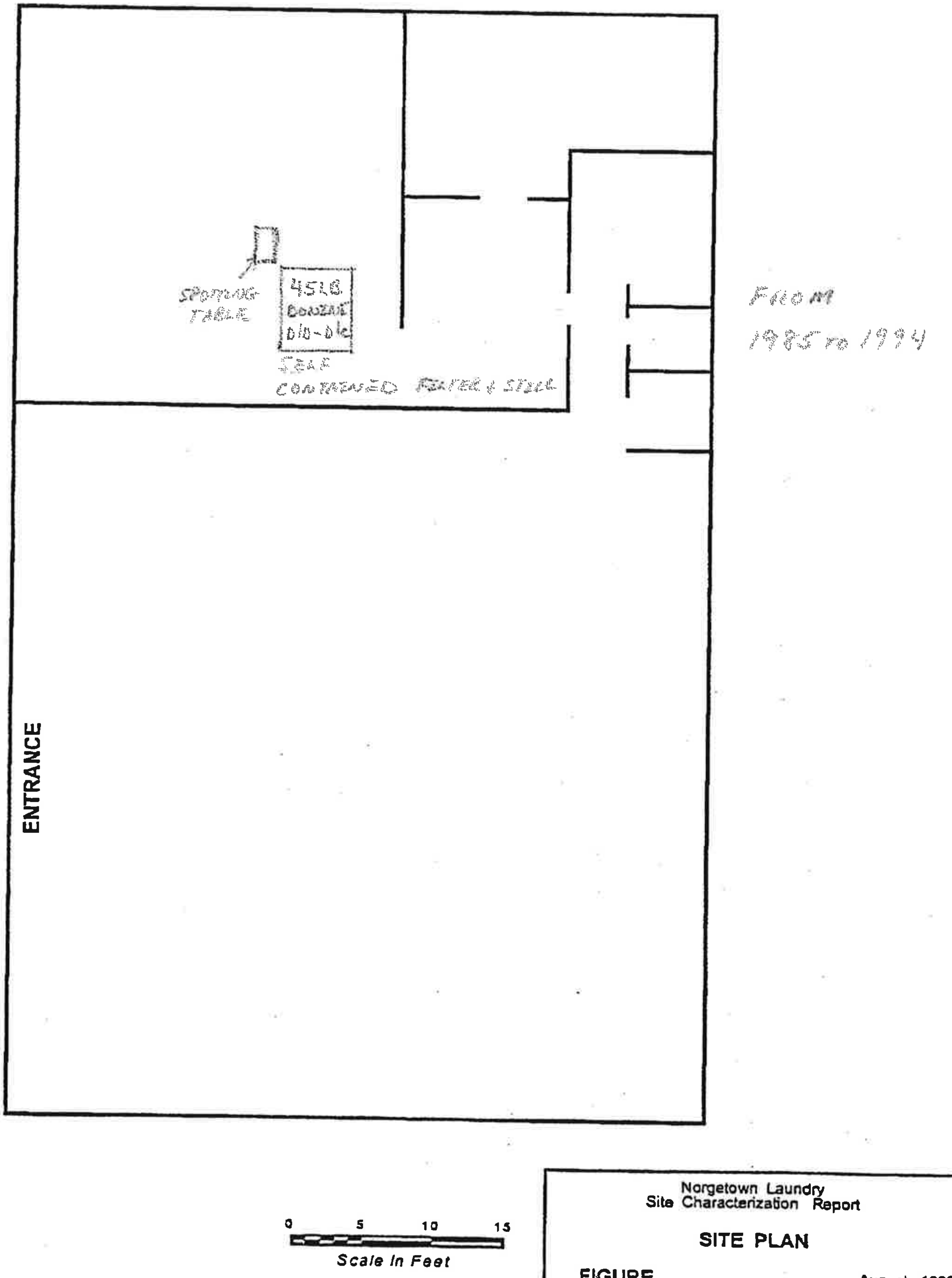
SITE PLAN

FIGURE

August, 1999

ALTA Geosciences, Inc.

F97-1029



Norgetown Laundry
Site Characterization Report

SITE PLAN

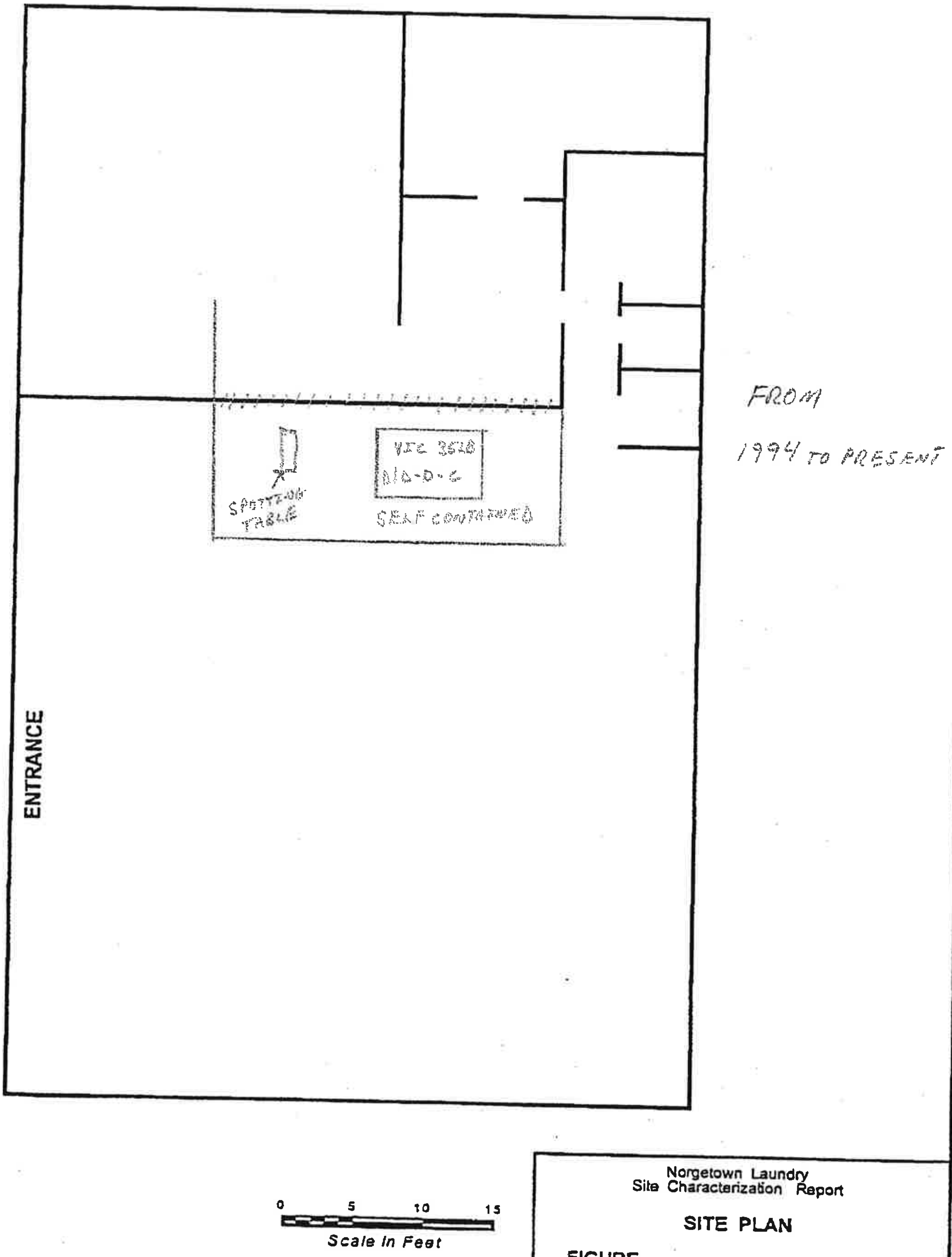
FIGURE

August, 1999

ALTA Geosciences, Inc.

F97-1029

222-7799



Norgetown Laundry
Site Characterization Report

SITE PLAN

FIGURE

August, 1999

ALTA Geosciences, Inc.

APPENDIX B

BORING LOGS

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry

BORING NO: B101

BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 15.5' BGS

LOCATION: 3' W. GP10
CONTRACTOR: Denali Drilling
START: 4/1/98, 0800
FINISH: 1030

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1					Sod at surface, underlain by silty sand and sandy		
2					silt, brown, moist, soft	ML	
3	2-3		Good	Moderate	Silty gravelly sand, gray-brn, moist, mod. dense	SM	
4	3-4		Good	Moderate	Same	SM	
5	4-5		Good	Moderate	Same	SM	
6	5-6		Good	Moderate	Grav. sand, little silt, gray-brn, moist, mod. dens	SW	
7	6-7		Good	Moderate	Same	SW	
8	7-8		Good	Moderate	Same	SW	
9	8-9		Good	Moderate	Sl. grav. med-crs Sand, gray-brn, moist, mod.de	SW	
10	9-10		Good	Moderate	Same	SW	
11	10-11		Good	Moderate	Same	SW	
12	11-12		Good	Moderate	Silty gravelly sand, moist, brown, mod. dense	SM	
13	12-13		Good	Moderate	Sl. silty gravelly sand, brown, moist	SW	
14	13-14		Good	Moderate	Same	SW	
15	14-15		Good	Moderate	Gravelly sand, gray-brn., moist, mod. dense	SW	
16	15-16		Good	Moderate	Same, wet	SW	Sample saturated at 15.5'
17	16-18		Good	Moderate	Clean gravelly sand, gray-brn, wet	SW	
18					Same	SW	
19	18-20		Good	Moderate	Same	SW	
20					Silty gravelly sand, brown, wet, dense	SM	
21	20-21		Good	Very High	Same	SM	
22					Same	SM	
23	22-23		Good	Very High	Gravelly sandy clay/Clayey sand, very dense,	GC/	
24					brown, wet	SC	
25							
26					**END BORING AT APPROXIMATELY 23 FEET**		
27							
28							
29							
30							

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry
BORING NO: B-102
BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 16' BGS

LOCATION: 3' S. GP11A
CONTRACTOR: Denali Drilling
START: 3/31/98, 1400 Hrs.
FINISH: 1545 Hrs.

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1					Sod at surface, silty gravelly sand, brown, moist		Top 4-5 feet appear to be fill
2					Silty gravelly sand, brown, moist	SM	
3	2-3		Good	Moderate	Sl. gravelly silty sand, gray, moist, med. dense	SM	
4	3-4		Good	Moderate	Same	SM	
5	4-5		Good	Moderate	Silty Sand, brown,	SM	
6	5-6		Good	Moderate	Gravelly sand, brown, moist, mod. dense	SW	
7	6-7		Poor	Moderate	Same	SW	Very Gravelly, poor recovery
8	7-8		Poor	Moderate	Same	SW	Very Gravelly, poor recovery
9	8-9		Fair	Moderate	Gravelly sand, gray-brown, moist, mod. dense	SW	
10	9-10		Fair	Moderate	Same	SW	
11	10-11		Good	Moderate	Same	SW	
12	11-12		Good	Moderate	Same	SW	
13	12-13		Good	Moderate	Same	SW	
14	13-14		Good	Moderate	Same	SW	
15	14-15		Good	Moderate	Same	SW	
16	15-16		Good	Moderate	Same	SW	Wet on Spoon @ 16'
17	16-18		Good	Moderate	Silty gravelly sand, brown, wet	SM	
18					Same	SM	
19	18-20		Good	Very High	Change at 18.5' to clayey sand and gravel and	GC/	
20					at 19' to sandy clay, very dense	SC	
21							
22							
23							
24							
25							
26							
27							
28							
29					**END BORING AT APPROXIMATELY 20 FEET**		
30							

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry

BORING NO: B-103

BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 16'

LOCATION: 4' SW GP23
CONTRACTOR: Denali Drilling
START: 4/1/98, 1030
FINISH: 1230

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1					Asphalt concrete, base rock at surface		Top 3-4 feet appear to fill
2							
3	2-3		Fair	Very High	Sillty sandy gravel, brown, sl. moist, dense	SM	
4	3-4		Fair	Very High	Same	SM	
5	4-5		Good	Very High	Same	SM	
6	5-6		None	Refusal @ 5'	(Large rock caused refusal of sampler)		
7	6-7		Fair	Very High	Clean sand and gravel, gray-brown, moist	SW	
8	7-8		Fair	Very High	Clean sand and gravel, gray-brown, moist	SW	
9	8-9		Good	Very High	Gravelly sand, slightlly moist, dense	SW	
10	9-10		Good	Very High	Same	SW	
11	10-11		Good	Moderate	Same	SW	
12	11-12		Good	Moderate	Same, 6" layer of sandy silt, brown	ML/	
13	12-13		Good	Moderate	Gravelly sand, slightly moist, moderately dense	SW	
14	13-14		Good	Moderate	Same	SW	
15	14-15		Good	Moderate	Same	SW	
16	15-16		Good	Moderate	Same	SW	
17	16-18		Good	Moderate	Same, wet, very angular dark particles, change	SW	
18					@ 17.5' to hard gravelly sandy clay, gray, wet	GC	
19	18-20		Good	Moderate	Sandy clay, hard, moist to wet, gray	SC	
20							
21							
22							
23							
24							
25							
26							
27							
28							
29					**END BORING AT APPROXIMATELY 20 FEET**		
30							

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry
BORING NO: B-104
BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 14'

LOCATION: 3' S. 90^0 Angle In Sewer
CONTRACTOR: Denali Drilling
START: 3/31/98, 0800 Hrs
FINISH: 1030 Hrs

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1							
2							
3	2-3		Poor	Moderate	(Sand and gravel, little recovery)		
4	3-4		Poor	Moderate	(Sand and gravel, little recovery)		
5	4-5		Good	Moderate	Gravelly Sand, gray-brown, moist, mod. dense	SW	
6	5-6		Good	Moderate	Gravelly Sand, gray-brown, moist, mod. dense	SW	
7	6-7		Good	Moderate	Same, wet, odor of detergent	SW	Possible leak in sewer line
8	7-8		Good	Moderate	Same, moist	SW	PID gives no elevated reading
9	8-9		Good	Moderate	Same, moist to wet	SW	on wet soil
10	9-10		Good	Moderate	Same, moist to wet	SW	
11	10-11		Good	Moderate	Same, moist	SW	
12	11-12		Good	Moderate	Same, moist	SW	
13	12-13		Good	Moderate	Same, streaks of brown silt	SW	
14	13-14		Good	Moderate	Same	SW	
15	14-16		Good	Moderate	Same, wet	SW	Wet on spoon @ 14'
16							
17	16-18		Good	Moderate	Gravelly Very Coarse Sand, gray, wet, mod. den	SW	
18							
19	18-20		Good	High	Same,	SW	
20							
21	20-21		Poor	Very High	Hard at 20', Same	SW	
22							
23	22-22.5		Poor	Refusal @ 6"	Clayey Gravel, gray, very dense	GC	
24							
25							
26							
27							
28							
29					**END BORING AT APPROXIMATELY 22.5 FEET**		
30							

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry
BORING NO: B-105
BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 13' to 13.5'

LOCATION: 2.5' NE GP17
CONTRACTOR: Denali Drilling
START: 3/31/98, 1100 Hrs.
FINISH: 1230 Hrs.

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1					AC-Base rock at surface		
2					(Gravelly sand, gray-brown, moist)		
3	2-3		Good	Moderate	Gravelly sand, gray-brown, moist, mod. dense	SW	
4	3-4		Good	Moderate	Gravelly sand, gray-brown, moist, mod. dense	SW	
5	4-5		Fair	High	Sandy Gravel, gray-brown, moist, dense	GW	
6	5-6		Fair	High	Sandy Gravel, gray-brown, moist, dense	GW	
7	6-7		Good	High	Sandy Gravel, gray-brown, moist, dense	GW	
8	7-8		Good	Moderate	Sandy Gravel, gray-brown, moist, dense	GW	
9	8-9		Good	Moderate	Sl. gravelly medium sand, brown/gray layers	SW	
10	9-10		Good	Moderate	Medium sand, gray, moist, mod. dense	SP	
11	10-11		Good	Moderate	Same, changing to gravelly Sand near 11	SP/	
12	11-12		Good	Moderate	Gravelly sand, gray-brown, moist, mod. dense	SW	
13	12-13		Good	Moderate	Gravelly sand, gray-brown, moist, mod. dense	SW	
14	13-14		Good	Moderate	Gravelly sand, gray-brown, moist, mod. dense	SW	
15	14-15		Good	Moderate	Same, Wet	SW	
16	15-16		Good	Moderate	Same, Wet	SW	
17	16-18		Poor	Moderate	Same, Wet	SW	
18							
19	18-20		Fair	High	Same, Wet	SW	
20							
21	20-22		Fair	Very High	Same, changing to clayey gravel at 21.5', gray,	SW/	
22					dense	GC	
23							
24							
25							
26							
27							
28							
29					**END BORING AT APPROXIMATELY 22 FEET**		
30							

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry
B106

BORING NO: B-106

BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 12.5 Feet

LOCATION: 4' S. GP5, 3.5' W. Curb
CONTRACTOR: Denali Drilling
START: 3/30/98, 1300 Hrs.
FINISH: 1700 Hrs.

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1					AC-Road Base at surface		
2	1-2		Good	Moderate	Gravelly Sand, gray-brown, moist, mod. dense	SW	
3	2-3		Good	Moderate	Same	SW	
4	3-4		Good	Moderate	Same	SW	
5	4-5		Good	Moderate	Same	SW	
6	5-6		Good	Moderate	Sandy Gravel, gray-brown, moist, mod. dense	GW	
7	6-7		Good	Moderate	Same	GW	
8	7-8		Good	Moderate	Gravelly Sand, gray-brown, moist, mod. dense	SW	
9	8-9		Good	Moderate	Same	SW	
10	9-10		Good	Moderate	Same	SW	
11	10-11		Good	Moderate	Same	SW	
12	11-12		Good	Moderate	Same	SW	
13	12-13		Good	Moderate	Sl. Gravelly sand, moist, gray-brown	SW	
14	13-15		Good	Moderate	Same, wet	SW	Wet on spoon about 12.5'
15							
16	15-17		Good	Moderate	Same, wet	SW	
17							
18	17-19		Good	Moderate	Same, wet	SW	
19							
20	19-21		Good	Very High	Sandy Silt, silty sand, slightly clayey, gray, dens	SM	
21							
22	21-23		Good	Very High	Clayey gravelly sand, moist, v. hard.	SC	
23							
24							
25							
26							
27							
28							
29					END BORING AT APPROXIMATELY FEET		
30							

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry

BORING NO: MW-107

BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 15.5'

LOCATION: 3' N. GP1
CONTRACTOR: Denali Drilling
START: 4/2/98, 0800 Hrs.
FINISH: 1100 Hrs.

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1					Fill at the surface		6" Aluminum well box at surface
2							
3	2-3		Good	Moderate	Hard, nearly dry silt, brown	ML	Bentonite chips 0-10'
4	3-4		Good	Moderate	Hard, nearly dry silt, brown	ML	Sand, 10'-22'
5	4-5		Poor	Moderate	Same, changing to sandy gravel, gray-brown	ML/	Unslotted 2" pipe, 0-12'
6	5-6		Poor	Moderate	Sandy Gravel, gray-brown, moist, mod. dense	GW	0.020" Slotted 2" pipe, 12'-22'
7	6-7		Fair	Moderate	Sandy Gravel, gray-brown, moist, mod. dense	GW	All pipe flush jointed, threaded,
8	7-8		Fair	Moderate	Sandy Gravel, gray-brown, moist, mod. dense	GW	with end caps top and bottom
9	8-9		Fair	Moderate	Gravelly Sand, gray-brown, moist, mod. dense	SW	
10	9-10		Fair	Moderate	Same	SW	
11	10-11		Fair	Moderate	Same	SW	
12	11-12		Good	Moderate	Same	SW	
13	12-13		Good	Moderate	Same	SW	
14	13-14		Good	Moderate	Same	SW	
15	14-15		Good	Moderate	Same	SW	
16	15-16		Good	Moderate	Same, wet @ 15.5'	SW	
17	16-18		Good	Moderate	Same, wet	SW	
18							
19	18-20		Good	High	Same, changing to clayey gravel @ 19', gray,	SW/	
20					wet, dense	GC	
21	20-21		Poor	Very High	Sandy Clay, gray, wet, dense	SC	
22							
23							
24							
25							
26							
27							
28							
29					**END BORING AT APPROXIMATELY 22 FEET**		
30							

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry
BORING NO: MW-108
BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 16'

LOCATION: 15' S. GP10
CONTRACTOR: Denali Drilling
START: 4/1/98, 1400 Hrs.
FINISH: 1700 Hrs.

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1					AC-Road Base at surface		6" Aluminum well box at surface
2							
3	2-3		Good		Gravelly sand, gray-brown, moist, mod. dense	SW	Bentonite chips 0-12'
4	3-4		Good		Same	SW	Sand, 12'-24'
5	4-5		Good		Silty gravelly sand, gray-brown, moist, mod. de	SM	Unslotted 2" pipe, 0-14'
6	5-6		Good		Same	SM	0.020" Slotted 2" pipe, 14'-24'
7	6-7		Fair		Same	SM	All pipe flush jointed, threaded,
8	7-8		Fair		Same	SM	with end caps top and bottom
9	8-9		Good		Clean gravelly sand, gray-brn, moist, mod. den.	SW	
10	9-10		Good		Clean gravelly sand, gray-brn, moist, mod. den.	SW	
11	10-11		Good		Clean sl. gravelly medium sand, gray-brn, dense	SW	
12	11-12		Good		Clean sl. gravelly medium sand, gray-brn, dense	SW	
13	12-13		NR		No Recovery in sandy gravel, cuttings from this		
14	13-14		NR	Refusal @ 13.5'	section show 1" - 4" gravel, with little sand		
15	14-15		NR		Same		
16	15-16		NR		Same		
17	16-18		Fair		Slightly silty gravelly sand	SW	
18							
19	18-20		Good		Same	SW	
20							
21	20-20.5		Fair	Refusal @ 21.5'	Same	SW	
22							
23	22-23		Fair	Very High	Same, changing to sandy clay @ 22.25', gray	SC	
24					wet, hard		
25	24-25		Good	Very High	Sandy clay, gray, wet, hard	SC	
26							
27							
28							
29					**END BORING AT APPROXIMATELY 25 FEET**		
30							

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry

BORING NO: MW-109

BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 10.5'

LOCATION: 450' S. NLB, Rose St.
CONTRACTOR: Denali Drilling
START: 4/2/98, 1200 Hrs.
FINISH: 1500 Hrs.

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1					AC- Road Base at surface		W. side of roadway
2							
3	2.5-3.5		Fair	High	Sandy Gravel, gray-brown, moist, dense	GW	6" Aluminum well box at surface
4							
5							Bentonite chips 0-6'
6	5-6		Fair	High	Same	GW	Sand, 6'-18'
7							Unslotted 2" pipe, 0-8'
8	7.5-8.5		Fair	High	Gravelly Sand, gray-brown, moist, dense	SW	0.020" Slotted 2" pipe, 8'-18'
9							All pipe flush jointed, threaded,
10							with end caps top and bottom
11	10-11.5		Fair	Moderate	Fine-Coarse sand, dark gray, wet, mod. dense	SW	
12							
13	12.5-14		Fair	Moderate	Sandy gravel & gravelly sand, gray, wet, dense		
14					13.5'-14', silty gravelly sand		
15							
16	15-16.5		Fair	Moderate	Same	SW	
17							
18	17.5-19		Fair	Moderate	Same	SW	
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29					END BORING AT APPROXIMATELY 19 FEET		
30							

ALTA
Geosciences, Inc.
Bothell, Washington

PROJECT NAME: Norgetown Laundry
BORING NO: MW-110
BORING LOGGER: Quine

SOIL BORING LOG

PROJECT PHASE: March Investigation
ELEVATION: Approx. EL
DRILLING METHOD: 8" Hollow-Stem Auger; SPT Sampler
WATER LEVEL & DATE: Approx. 8.5'

LOCATION: E. 30th Avenue
CONTRACTOR: Denali Drilling
START: 7/12/99, 1600 Hrs.
FINISH: 2000 Hrs.

SAMPLE					SOIL DESCRIPTION		COMMENTS
DEPTH BELOW	INTERVAL	TYPE AND NUMBER	RECOVERY	PENETRATION TEST RESULTS 6"-6"-6" (N)	Soil Name, Overall Color, Moisture Condition, Relative Density or Consistency, Soil Structure, Odors, Discoloration	USCS SYMBOL	Drilling Progress, Groundwater Encountered, Tests Performed, Notes Regarding Samples
1					AC- Road Base at surface		W. side of roadway
2							
3	2.5-4.0		Good	High	Sandy Gravel, gray-brown, moist, dense	GW	6" Aluminum well box at surface,
4							cold mix asphalt patch at surface
5							Bentonite chips 0-7'
6	5-6.5		Good	Very High	Same, layer of cobbles, hard drilling	GW	Sand, 7'-19'
7							Unslotted 2" pipe, 0-9'
8	7.5-9.0		Good	High	Gravelly Sand, gray-brown, moist, dense	SW	0.020" Slotted 2" pipe, 9'-19'
9							All pipe flush jointed, threaded,
10							with end caps top and bottom
11	10-11.5		Good	Moderate	Fine-Coarse sand, dark gray, wet, mod. dense	SW	
12							
13	12.5-14		Good	Very High	Sandy gravel & gravelly sand, gray, wet, dense		
14					13.5'-14', silty gravelly sand		
15							
16	15-16.5		Good	High	Same	SW	
17							
18	17.5-19		Good	High	Same	SW	
19							
20	20-21		Good	High	Same	SW	
21							
22							Note: Well 108 feet W. of west
23							side Rose Street, 2 feet south of
24							N. side pavement on E. 30th Ave.
25							
26							
27							
28							
29					**END BORING AT APPROXIMATELY 21 FEET**		
30							

APPENDIX C

CLEANUP LEVEL CALCULATION SUPPORTING DATA

ALTA Geosciences, Inc.

NORGETOWN HYDRAULIC GRADIENT CALCULATIONS

			3Q99				4Q99				1Q2000			
WELL	TOC	DIST	DTW	GWEL	DIFF	GRAD	DTW	GWEL	DIFF	GRAD	DTW	GWEL	DIFF	GRAD
MW107	195.435	440	13.44	181.995	0.385	0.000875	13.56	181.875	0.545	0.001239	14.81	180.625	0.225	0.000511
MW13	193.2		11.59	181.61			11.87	181.33			12.8	180.4		
MW107	195.435	200	13.44	181.995	0.07	0.00035	13.56	181.875	0.1	0.0005	14.81	180.625	0.56	0.0028
MW44B	193.025		11.1	181.925			11.25	181.775			12.96	180.065		
MW107	195.435	120	13.44	181.995	0.055	0.000458	13.56	181.875	0.185	0.001542	14.81	180.625	0.045	0.000375
MW108	195.04		13.1	181.94			13.35	181.69			14.46	180.58		

RESULTS SUMMARY

QUARTER	RESULTS
3Q99	0.000875
	0.00035
	0.000458
4Q99	0.001239
	0.0005
	0.001542
1Q2000	0.000511
	0.0028
	0.000375
MEAN	0.000961

ANCHORAGE RAINFALL RECORDS 1952-1998
Source: National Weather Service, Alaska Regional Office

YEAR(S)	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	TOTAL
1952	0	0.44	0.34	0.02	2.72	3.86	2.66	3.76	13.8
1953	0.36	0.08	0.89	0.12	0.94	4.99	2.69	1.27	11.34
1954	0.97	0.03	0.15	0.91	2.08	2.13	1.66	2.02	9.95
1955	0.51	1.32	0.02	1.18	1.72	3.26	1.27	1.82	11.1
1956	0.28	0.5	0.44	0.52	3.07	1.57	2	2.19	10.57
1957	0.2	0.01	0.02	0.56	1.64	2.02	3.21	0.93	8.59
1958	0.19	0.25	1.05	2.19	4.44	1.67	1.31	1.93	13.03
1959	0.85	1.32	0.49	0.26	4.43	3.11	1.42	1.12	13
1960	0.22	0.27	0.44	0.26	2.71	2.7	4.79	0.35	11.74
1961	0.34	1.38	0.47	1.12	2.22	1.94	5.43	2.81	15.71
1962	0.58	0.25	1.52	3.4	0.72	1.92	1.45	1.56	11.4
1963	1.48	1.78	0.44	1.82	2.75	2.8	0.98	1.01	13.06
1964	1.07	0.89	0.97	1.73	1.08	2.16	0.83	2.31	11.04
1965	0.83	0.3	0.51	0.96	1.74	1.58	4.6	1.44	11.96
1966	0.44	0.7	0.75	0.27	0.71	2.47	2.45	0.86	8.65
1967	0.98	0.49	1.07	1.44	2.47	2.96	2.86	0.51	12.78
1968	0.29	0.85	1.6	0.62	1.34	0.69	1.05	1.61	8.05
1969	0.1	0	0.86	0.18	2.14	0.33	0.78	0.9	5.29
1970	0.29	0.27	0.43	0.85	2.03	2.23	1.11	1.62	8.83
1971	0.7	0.63	0.52	0.37	2.86	2.58	1.79	2.16	11.61
1972	0.68	0.73	0.81	0.61	0.42	1.4	4.42	2.89	11.96
1973	0.65	0.33	0.14	1.07	0.6	3.4	0.76	1.74	8.69
1974	0.6	0.61	0.34	0.69	1.22	1.62	1.53	2.63	9.24
1975	0.54	1.71	0.4	0.47	1.33	1.19	4.52	0.69	10.85
1976	1.77	0.74	0.16	0.33	0.6	0.97	3.5	1.29	9.36
1977	0.84	1.91	0.46	0.49	1.37	1.35	4.08	1.92	12.42
1978	0.45	0.02	0.03	3.09	1.78	0.54	2.16	1.65	9.72
1979	2.76	0.94	0.15	1.79	3.84	1.56	2.73	2.54	16.31
1980	0.3	0.19	1.68	2.73	2.27	3.06	2.53	3.05	15.81
1981	0.41	0.19	0.81	0.83	4.39	4.96	2.15	3.49	17.23
1982	0.42	0.27	0.54	1.56	2.41	2.33	4.66	2.95	15.14
1983	0	1.36	0.59	0.66	0.55	2.89	2.29	2.67	11.01
1984	0.08	0.93	0.96	1.1	1.11	3.21	2.59	1.38	11.36
1985	0.86	0.5	1.45	1.01	0.99	3.54	3.17	1.07	12.59
1986	1.7	0.42	0.5	0.33	2.02	3.62	2.85	4.11	15.55
1987	0.17	0.24	0.67	1.09	1.89	0.43	1.91	2.6	9
1988	0.65	0.37	0.56	0.79	0.64	3.77	1.26	2.96	11
1989	0.22	0.98	1.93	1.14	2.89	9.77	3.92	3.63	24.48
1990	0.46	0.27	0.71	1.52	0.81	1.9	6.64	0.73	13.04
1991	0.65	0.23	0.12	0.18	2.82	3.54	3.41	1.93	12.88
1992	0.31	0.08	0.58	1.21	0.79	2.49	2.83	2.08	10.37
1993	0.29	0.09	1.17	0.17	0.57	4.02	4.27	1.9	12.48
1994	1.51	0.45	0.51	1.34	0.57	1.02	1.66	1.21	8.27
1995	0.88	0.08	1.11	0.91	3.01	2.19	2.93	0.95	12.06
1996	0.42	0.08	0.2	0.5	2.04	2.53	1.93	2.63	10.33
1997	0.01	0.25	1.12	0.6	1.36	8.37	2.53	1.93	16.17
1998	0.07	0.39	0.63	2.7	1.01	3.25	0.72	0.54	9.31

MEAN	**11.88**
STANDARD DEVIATION:	**3.13**
MEAN PLUS ONE STANDARD DEVIATION:	**15.01**

ANCHORAGE WSCMO AP, ALASKA

Monthly Total Precipitation (inches)

(500280)

File last updated on Oct 5, 1999
*** Note *** Provisional Data *** After Year/Month 199907
a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,
z = 26 or more days missing, A = Accumulations present
Long-term means based on columns; thus, the monthly row may not
sum (or average) to the long-term annual value.
MAXIMUM ALLOWABLE NUMBER OF MISSING DAYS : 5
Individual Months not used for annual or monthly statistics if more than 5 days are missing.
Individual Years not used for annual statistics if any month in that year has more than 5 days missing.

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1952	0.00 z	0.00 z	0.00 z	0.44	0.34	0.02	2.72	3.86	2.66	3.76 d	1.25 b	0.00 z	15.05
1953	0.00 z	0.68	0.36	0.08	0.89	0.12	0.94	4.99	2.69	1.27	0.11	1.11	13.24
1954	0.56	0.18	0.97	0.03 a	0.15	0.91	2.08	2.13	1.66	2.02	0.93	1.00	12.62
1955	1.12	3.07	0.51	1.32	0.02	1.18	1.72	3.26	1.27 a	1.82	0.59	2.67	18.55
1956	0.52	2.49	0.28	0.50	0.44	0.52	3.07	1.57 b	2.00	2.19	2.33	0.19	16.10
1957	1.36	0.67	0.20	0.01	0.02	0.56	1.64	2.02	3.21	0.93	1.51	0.36	12.49
1958	1.05	0.07	0.19	0.25	1.05	2.19	4.44	1.67	1.31	1.93	1.41	0.54	16.10
1959	0.27	0.95	0.85	1.32	0.49	0.26	4.43	3.11	1.42	1.12	0.67	1.34	16.23
1960	0.72	0.45	0.22	0.27	0.44	0.26	2.71	2.70	4.79	0.35	0.56	1.04	14.51
1961	1.51	0.46	0.34	1.38	0.47	1.12	2.22	1.94	5.43	2.81	0.64	0.95	19.27
1962	0.88	0.74	0.58	0.25	1.52	3.40	0.72	1.92	1.45	1.56	0.49	1.06	14.57
1963	2.09	1.35	1.48	1.78	0.44	1.82	2.75	2.80	0.98	1.01	0.12	1.49	18.11
1964	0.19 a	1.15	1.07	0.89	0.97	1.73	1.08	2.16	0.83	2.31	2.71	0.64	15.73
1965	0.57	0.67	0.83	0.30	0.51	0.96	1.74	1.58	4.60	1.44	1.86	1.44	16.50
1966	0.63	0.80	0.44	0.70	0.75	0.27	0.71	2.47	2.45	0.86	1.11	1.06	12.25
1967	1.25	1.01	0.98	0.49	1.07	1.44	2.47	2.96	2.86	0.51	1.72	2.40	19.16
1968	0.83	1.67	0.29	0.85	1.60	0.62	1.34	0.69	1.05	1.61	1.08	0.45	12.08
1969	0.28	0.73	0.10	0.00	0.86	0.18	2.14	0.33	0.78	0.90	0.84	0.94	8.08
1970	0.86	0.57	0.29	0.27	0.43	0.85	2.03	2.23	1.11	1.62	1.21	1.62	13.09
1971	0.24	1.49	0.70	0.63	0.52	0.37	2.86	2.58	1.79	2.16	0.67	0.88	14.89
1972	0.56	0.63	0.68	0.73	0.81	0.61	0.42	1.40	4.42	2.89	0.76	0.72	14.63
1973	0.72	0.11	0.65	0.33	0.14	1.07	0.60	3.40	0.76	1.74	0.78	0.38	10.68
1974	0.02	1.15	0.60	0.61	0.34	0.69	1.22	1.62	1.53	2.63	1.01	2.00	13.42
1975	0.43	0.77	0.54	1.71	0.40	0.47	1.33	1.19	4.52	0.69	0.10	0.89	13.04
1976	0.98	0.33	1.77	0.74	0.16	0.33	0.60	0.97	3.50	1.29	2.84	1.03	14.54
1977	1.35	0.52	0.84	1.91	0.46	0.49	1.37	1.35	4.08	1.92	0.53	0.69	15.51
1978	0.39	1.19	0.45	0.02	0.03	3.09	1.78	0.54	2.16	1.65	0.85	2.60	14.75
1979	0.23	0.69	2.76	0.94	0.15	1.79	3.84	1.56	2.73	2.54	2.77	1.15	21.15
1980	1.28	1.18	0.30	0.19	1.68	2.73	2.27	3.06	2.53	3.05	0.49	0.41	19.17
1981	0.93	0.97	0.41	0.19	0.81	0.83	4.39	4.96	2.15	3.49	1.85	0.36	21.34
1982	0.02 a	0.69	0.42	0.27	0.54	1.56	2.41	2.33	4.66	2.95	1.72	0.11	17.68
1983	0.21	0.23	0.00	1.36	0.59	0.66	0.55	2.89	2.29	2.67	0.23	0.48	12.16
1984	1.30	1.08	0.08	0.93	0.96	1.10	1.11	3.21	2.59	1.38	0.15	1.08	14.97
1985	0.70	0.67	0.86	0.50	1.45	1.01	0.99	3.54	3.17	1.07	0.08	1.47	15.51
1986	0.20	0.55	1.70	0.42	0.50	0.33	2.02	3.62	2.85	4.11	1.23	1.42	18.95
1987	2.71	0.20	0.17	0.24	0.67	1.09	1.89	0.43	1.91	2.60	1.90	1.12	14.93
1988	0.38	0.32	0.65	0.37	0.56	0.79	0.64	3.77	1.26	2.96	1.11	1.51	14.32
1989	0.26	0.17	0.22	0.98	1.93	1.14	2.89	9.77	3.92	3.63	1.01	1.63	27.55
1990	1.42	1.46	0.46	0.27	0.71	1.52	0.81	1.90	6.64	0.73	1.31	1.78	19.01
1991	0.62	0.42	0.65	0.23	0.12	0.18	2.82	3.54	3.41	1.93	1.57	1.82	17.31

1991	0.62	0.42	0.65	0.23	0.12	0.18	2.82	3.54	3.41	1.93	1.57	1.82	17.31
1992	1.17	1.04	0.31	0.08	0.58	1.21	0.79	2.49	2.83	2.08	1.17	0.69	14.44
1993	0.94	1.17	0.29	0.09	1.17	0.17	0.57	4.02	4.27	1.90	2.00	0.30	16.89
1994	0.59	0.28	1.51	0.45	0.51	1.34	0.57	1.02	1.66	1.21	2.47	1.51	13.12
1995	0.52	1.00	0.88	0.08	1.11	0.91	3.01	2.19	2.93	0.95	0.09	0.09	13.76
1996	0.11	2.40	0.42	0.08	0.20	0.50	2.04	2.53	1.93	2.63	1.38	0.24	14.46
1997	0.12	0.52	0.01	0.25	1.12	0.60	1.36	8.37	2.53	1.93	0.87	1.80	19.48
1998	0.45	0.24	0.07	0.39	0.63	2.70	1.01	3.25	0.72	0.54	0.18	1.47	11.65
1999	0.37	0.28	0.61	0.29	1.30	1.11	1.98	4.00	3.22	0.00 z	0.00 z	0.00 z	13.16
Period of Record Statistics													
MEAN	0.74	0.84	0.62	0.55	0.68	1.02	1.86	2.71	2.61	1.90	1.11	1.09	15.66
S.D.	0.55	0.63	0.53	0.50	0.46	0.79	1.08	1.75	1.37	0.92	0.75	0.64	3.36
SKEW	1.29	1.59	1.89	1.18	0.77	1.29	0.74	2.01	0.73	0.41	0.61	0.53	0.88
MAX	2.71	3.07	2.76	1.91	1.93	3.40	4.44	9.77	6.64	4.11	2.84	2.67	27.55
MIN	0.02	0.07	0.00	0.00	0.02	0.02	0.42	0.33	0.72	0.35	0.08	0.09	8.08
NO YRS	46	47	47	48	48	48	48	48	48	47	47	46	45

ANCHORAGE WSCMO AP, ALASKA

Monthly Average Maximum Temperature (Degrees Fahrenheit)

(500280)

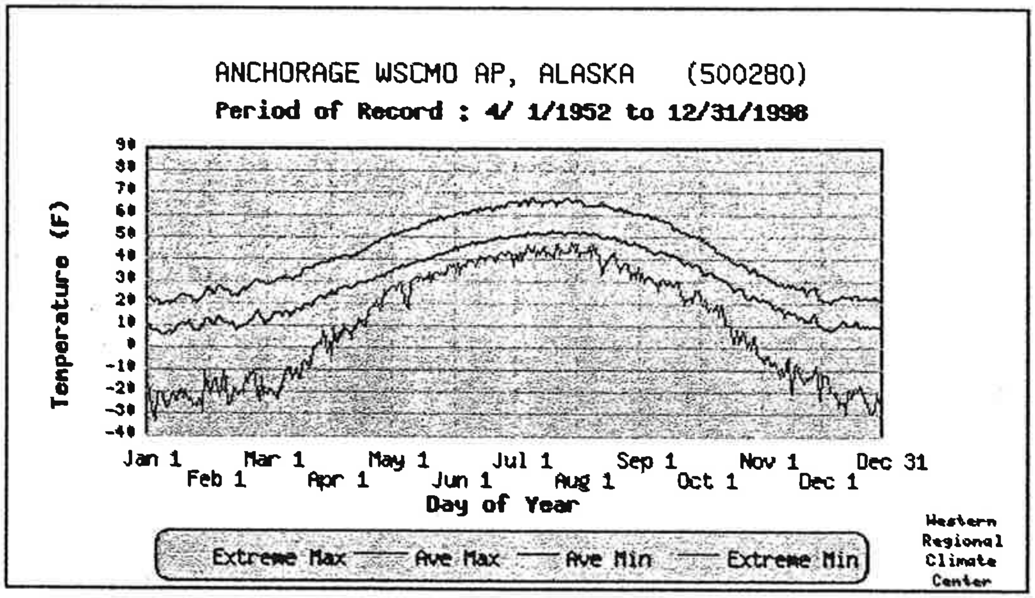
File last updated on Oct 6, 1999
*** Note *** Provisional Data *** After Year/Month 199907
a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,
z = 26 or more days missing, A = Accumulations present
Long-term means based on columns; thus, the monthly row may not
sum (or average) to the long-term annual value.
MAXIMUM ALLOWABLE NUMBER OF MISSING DAYS : 5
Individual Months not used for annual or monthly statistics if more than 5 days are missing.
Individual Years not used for annual statistics if any month in that year has more than 5 days missing.

YEAR(S)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1952	----- z	----- z	----- z	40.61g	52.43j	60.40	65.52	65.61c	54.48e	45.38g	37.57b	----- z	56.71
1953	----- z	32.63i	26.87	42.77	52.58	65.77	67.61	60.61	52.63	40.55	27.20	24.84	46.14
1954	18.55	17.86	32.94	43.07a	57.29	63.57	65.84	63.65	55.97	45.90	33.43	13.39	42.62
1955	25.97	23.57	32.06	39.27	51.87	58.33	66.23	61.90	54.30	38.16	17.03	16.13	40.40
1956	14.81	19.17	29.97	42.67	50.90	59.53	63.58	63.53a	54.23	35.97	24.90	12.68	39.33
1957	21.77	22.79	36.45	45.60	58.13	66.83	66.13	66.52	55.83	45.58	37.63	16.58	44.99
1958	25.35	27.64	37.10	48.60	55.52	62.77	63.23	62.39	53.93	36.19	25.40	21.52	43.30
1959	17.52	27.82	24.97	40.60	56.52	66.27	61.71	63.29	56.07	40.29	29.87	24.42	42.44
1960	23.65	30.28	30.26	41.43	57.39	63.17	64.42	62.26	52.57	42.55	28.27	30.65	43.91
1961	27.29	24.00	25.68	42.47	57.23	62.53	64.16	61.13	54.97	35.45	23.87	11.26	40.84
1962	21.35	26.29	28.58	44.50	52.06	60.73	65.74	63.77	53.07	44.00	28.20	23.16	42.62
1963	24.94	29.96	31.74	39.50	56.16	58.33	65.42	64.77	59.60	42.97	19.73	30.35	43.62
1964	21.23a	27.55	25.68	40.27	49.97	63.23	64.84	61.42	56.87	42.48	27.53	9.39	40.87
1965	17.39	18.75	41.61	47.17	53.84	59.03	65.87	63.84	59.07	38.42	28.10	20.55	42.80
1966	17.16	23.50	25.45	42.30	51.00	62.77	65.06	59.61	54.13	37.29	24.20	17.90	40.03
1967	15.13	22.86	32.23	41.93	56.61	62.03	66.29	63.77	54.07	43.84	35.80	22.42	43.08
1968	18.39	28.34	35.06	40.83	55.94	62.67	66.19	65.77	54.43	38.52	28.10	13.58	42.32
1969	11.77	25.64	34.84	46.23	55.10	65.13	65.32	62.16	56.73	47.77	29.17	33.65	44.46
1970	16.16	34.71	41.06	42.67	56.29	60.67	62.68	60.32	52.77	37.84	29.40	21.03	42.97
1971	10.06	27.00	23.52	39.43	47.32	58.27	61.81	61.13	52.40	37.68	24.57	22.97	38.85
1972	13.16	22.00	23.52	33.87	49.26	58.23	67.35	63.10	50.43	36.55	26.97	18.26	38.56
1973	10.48	21.46	30.87	41.33	50.19	58.40	64.58	59.61	52.67	37.87	21.60	25.00	39.51
1974	14.03	20.29	32.23	45.43	57.94	63.60	64.58	64.52	57.40	39.61	28.00	24.06	42.64
1975	19.48	20.71	30.29	38.40	53.77	59.97	65.00	62.61	54.53	40.52	20.73	18.35	40.36
1976	22.26	20.79	29.29	41.20	51.84	61.70	66.10	62.77	53.57	39.06	35.87	27.65	42.67
1977	36.39	38.43	31.61	41.70	54.32	65.67	70.42	67.10	58.03	43.94	22.30	17.94	45.65
1978	26.87	32.93	36.42	47.07	57.06	60.93	65.32	68.58	59.47	44.16	32.17	27.58	46.55
1979	28.42	20.46	37.45	44.97	58.13	63.97	66.58	65.42	58.87	46.32	39.20	16.68	45.54
1980	20.90	33.72	34.03	47.63	52.32	59.40	63.42	61.06	54.20	42.55	32.37	7.87	42.46
1981	37.06	30.11	41.35	45.07	59.52	61.27	62.58	60.42	55.13	40.97	28.17	21.68	45.28
1982	13.97	22.11	32.77	40.50	52.61	59.93	62.58	62.29	53.83	31.58	26.37	26.55	40.42

1983	20.58	27.79	36.74	43.87	55.97	64.33	65.35	62.84	51.93	40.06	30.53	22.35	43.53
1984	25.10	25.79	43.74	46.13	58.32	66.33	66.65	63.55	57.07	42.00	25.63	25.48	45.48
1985	36.06	20.68	34.26	36.27	52.90	58.97	64.77	61.81	54.37	36.74	21.00	32.10	42.49
1986	30.71	28.61	32.45	38.57	54.77	62.63	65.26	60.00	54.77	45.19	29.47	32.81	44.60
1987	28.84	32.07	34.94	45.83	54.19	58.00	63.06	65.23	54.27	44.65	31.10	24.13	44.69
1988	24.00	29.48	36.90	43.73	55.65	61.90	65.00	62.32	55.50	38.29	26.37	28.77	43.99
1989	11.06	25.18	32.55	46.97	53.87	63.37	66.90	65.00	56.33	38.90	22.63	30.13	42.74
1990	22.10	12.50	37.19	49.07	57.35	64.43	66.13	65.45	54.97	38.81	16.93	21.77	42.23
1991	21.71	26.68	31.61	45.50	54.87	63.83	63.81	63.39	56.67	39.10	29.70	24.97	43.49
1992	26.39	22.52	32.71	43.90	54.23	63.37	65.81	60.97	47.37	37.94	32.73	21.23	42.43
1993	22.03	27.32	36.35	48.97	59.42	64.23	68.90	65.23	54.93	44.52	30.80	29.77	46.04
1994	26.68	23.89	32.29	46.10	54.52	64.57	66.00	66.06	56.00	38.81	21.80	22.52	43.27
1995	21.65	27.21	28.35	48.07	56.52	63.47	65.55	64.84	58.90	43.39	27.67	23.84	44.12
1996	12.77	22.41	37.06	47.03	60.16	65.27	67.13	64.45	53.90	32.55	23.70	19.48	42.16
1997	22.55	35.18	31.97	46.27	57.32	65.50	67.58	64.90	57.43	36.13	32.67	23.52	45.08
1998	21.39	31.71	37.71	48.00	54.13	61.80	64.16	59.77	54.97	42.52	28.90	20.35	43.78
1999	18.45	14.14	31.19	41.33	54.10	62.90	65.00	62.52	55.03	47.00z	----- z	----- z	44.96
Period of Record Statistics													
MEAN	21.38	25.52	32.85	43.49	54.83	62.29	65.28	63.19	55.01	40.31	27.77	22.20	42.87
S.D.	6.60	5.43	4.75	3.48	2.88	2.50	1.72	2.12	2.35	3.66	5.15	6.12	1.97
SKEW	0.41	0.03	0.02	-0.44	-0.41	-0.16	0.25	0.21	-0.34	-0.08	0.07	-0.28	-0.36
MAX	37.06	38.43	43.74	49.07	60.16	66.83	70.42	68.58	59.60	47.77	39.20	33.65	46.55
MIN	10.06	12.50	23.52	33.87	47.32	58.00	61.71	59.61	47.37	31.58	16.93	7.87	38.56
NO YRS	46	46	47	47	47	48	48	48	48	46	47	46	45

ANCHORAGE WSCMO AP, ALASKA

POR - Daily Temperature Averages and Extremes



- ○ - Extreme Max. is the maximum of all daily maximum temperatures recorded for the day of the year.
- ● - Ave. Max. is the average of all daily maximum temperatures recorded for the day of the year.
- ● - Ave. Min. is the average of all daily minimum temperatures recorded for the day of the year.
- ● - Extreme Min. is the minimum of all daily minimum temperatures recorded for the day of the year.

ANCHORAGE MUNICIPAL CHARTER, CODE AND REGULATIONS Municipality of ANCHORAGE, ALASKA
TITLE 15 ENVIRONMENTAL PROTECTION*
Chapter 15.55 WATER WELLS*
15.55.055 Certificates of health authority approval.

F. All test procedures used to collect the information necessary to meet the requirements of this section shall be approved by the department.

(AO No. 86-21; AO No. 98-124, § 1, 8-18-98)

Editor's note--Ordinance No. 98-124, § 1, effective August 18, 1998, renumbered and amended § 15.05.160 as a new § 15.55.055.

15.55.060 General standards for domestic wells.

A. *Prohibited wells.* Well pits are prohibited. The department may, in its discretion, allow an existing well pit to remain in use if it is shown that the pit provides adequate protection against flooding.

B. *Well location and minimum setbacks.* The location of a well shall be at a site readily accessible year round for testing, repair or maintenance purposes. The minimum separation requirements between wells and other specified facilities or areas shall be:

SEPARATION OF WELL FROM	MINIMUM SEPARATION DISTANCE IN FEET
Private sewer line	25
Curtain drain	25
Hydrocarbon storage tank	25
Sewer trunk line	75
Any source of potential contamination	75
Solid waste holding tank	75
Septic absorption field	100
Sewer manhole or cleanout	100
Septic tank	100
Animal feed lots, shelters and containment areas	100

C. *Well drilling.* The commercial drilling of a well and subsequent recompletion/deepening operation shall be performed by a licensed well driller. Any drilling method used in the construction of a well shall meet the following requirements:

1. The ground surface surrounding the well for at least ten feet shall be sloped or contoured to allow surface water to drain away from the well.

2. **The** well driller shall exercise reasonable care during excavation or drilling operation to prevent contamination to any aquifer.

3. **Organic** drilling fluid may be used only if the fluid is approved for that use by the National Sanitation **Foundation** (NSF) or by an equivalent organization; these fluids are listed in NSF Standard 60 and NSF Standard 61 and in associated product listings described in these two standards.

4. **Water** used in the drilling process shall be obtained from a source providing potable water.

5. **Water** wells shall be drilled and cased with non-perforated pipe to a minimum depth of 40 feet in **unconsolidated** materials such as sand and gravel. In cases where bedrock is encountered before the minimum depth, the casing shall be driven and sealed at least three feet into bedrock or to casing refusal, except where the drilling contractor or property owner has obtained a written variance from this provision from the department. Such variance shall be granted only upon a finding by the department that the construction permitted under the variance will be sound and will not materially reduce the purity and safety of the water supply.

ALASKA TESTLAB
A Division of DOWL LLC

Client: Alta Geosciences, Inc.

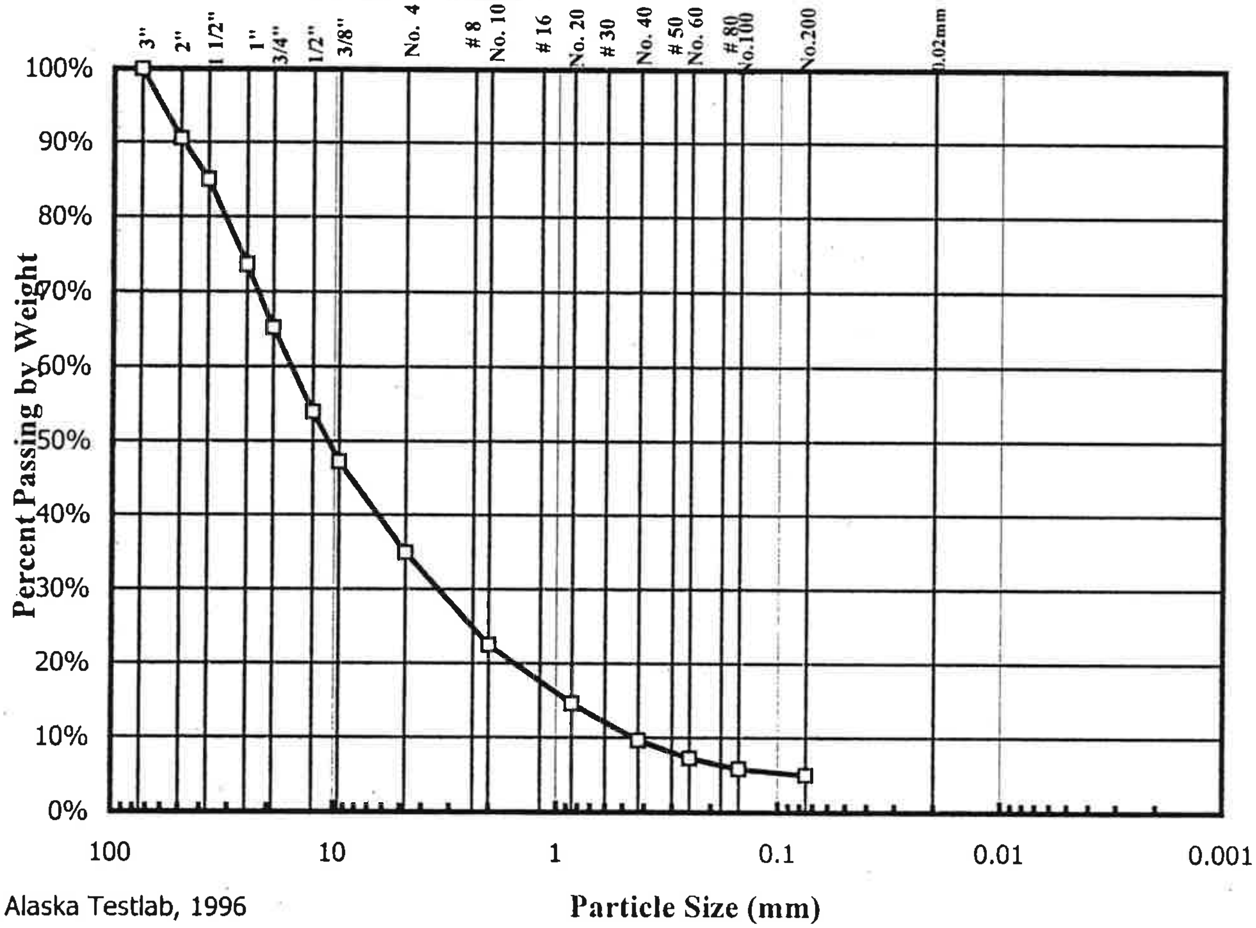
Project: Sewer Line

Location: Gravel Sample Taken From Site

PARTICLE-SIZE
DIST. ASTM D422/C136

W.O. A28425
Lab No. 1470
Received: July 7, 1999
Reported: 7/12/99

Engineering Classification: Well Graded GRAVEL with Silt and Sand, GW-GM
Frost Classification: Not Measured



SIZE	PASSING	SPECIFICATION
+3 in Not Included in Test = ~0%		
3"	100%	
2"	91%	
1 1/2"	85%	
1"	74%	
3/4"	65%	
1/2"	54%	
3/8"	47%	
No. 4	35%	
Total Wt. of Coarse Fraction = 58199g		
No. 8		
No. 10	22%	
No. 16		
No. 20	15%	
No. 30		
No. 40	10%	
No. 50		
No. 60	7%	
No. 80		
No. 100	6%	
No. 200	5%	
Total Wt. of Fine Fraction = 314g		
0.02 mm		

David L. Andersen, P.E., General Manager

MultiChem
ANALYTICAL SERVICES

FAX Cover Sheet

To:	Alex Tula	FAX Number:	(425) 486-7651
Company:	Alta Geosciences	Date:	11/12/98
From:	Elaine M. Walker	Pages (including cover page):	3
Phone:	425-228-8335	In re/accession:	821616
Fax:	425-228-8336		

Enclosed are TOC data for your Norgetown project, received for analysis on October 22, 1998.

Thanks,

Elaine

DATA SUMMARY
TOTAL ORGANIC CARBON
METHOD 9060M

ACCESSION NO.: 821616

UNIT: % CARBON

MATRIX: SOIL

SAMPLE ID	DATE PREPARED	DATE ANALYZED	TOC RESULT	DF
821616-1	11/9/98	11/11/98	0.23	2
821616-4	11/9/98	11/11/98	0.25	2
BLANK	NA	11/11/98	<0.010	

Analyst: SD

Reviewer: S 11/11/98

NORTH CREEK ANALYTICAL
Environmental Laboratory Services

Renton

18939 120th Avenue N.E., Suite 101, Bothell, WA 98011-9508 (206) 481-9200 FAX 485-2992
East 11115 Montgomery, Suite B, Spokane, WA 99206-4779 (509) 924-9200 FAX 924-9290
9405 S.W. Nimbus Avenue, Beaverton, OR 97008-7132 (503) 643-9200 FAX 644-2202

CHAIN OF CUSTODY REPORT

Work Order # 821616

REPORT TO:
ATTENTION: ALEX TULA
ADDRESS: 11711 NORTHCREEK PARKWAY S
BOTHELL, WA 98011
PHONE: 425-485-1053 FAX: 425 486-7651
PROJECT NAME: NOISE TOWN LAUNDRY
PROJECT NUMBER:
SAMPLED BY: OTTEN

INVOICE TO:
ATTENTION: SAME
ADDRESS:
P.O. NUMBER: NCA QUOTE #:
Analysis Request:

TURNAROUND REQUEST in Business Days *
Organic & Inorganic Analyses: ☒ 10 Standard ☐ 7 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ Same Day
Fuels & Hydrocarbon Analyses: ☒ Standard ☐ 3-4 ☐ 2 ☐ 1 ☐ Same Day
BMM 10/21/98
☐ OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NCA SAMPLE ID (Laboratory Use Only)	TOC	HOLD	MATRIX (W, S, A, O)	# OF CONTAINERS	COMMENTS
1.	C-1-105	10/21/98 1425	-1	X		S	1	
2.	C-2-105	1430	-2		X	S	1	DUPLICATE
3.	C-3-105	—	-3		X	S	1	bag
4.	C-1-107	1440	-4	X		S	1	
5.	C-2-107	1445	-5		X	S	1	DUPLICATE
6.	C-3-107	—	-6		X	S	1	bag
7.								
8.								
9.								
10.								

RELINQUISHED BY (Signature): Mark I Otten DATE: 10/21/98
PRINT NAME: MARK I. OTTEN FIRM: ALTA TIME:
RECEIVED BY (Signature): Sharon Anderson 7.1°C DATE: 10-21
PRINT NAME: Sharon Anderson FIRM: MultiChem TIME: 3:4
RELINQUISHED BY (Signature): DATE: 10/21/98
PRINT NAME: Brent Matheny FIRM: MASAK TIME: 1715
RECEIVED BY (Signature): DATE: 10/22
PRINT NAME: J. VAN DYCK FIRM: MAS-R TIME: 125
ADDITIONAL REMARKS: HOLD BAGS FOR POSSIBLE GRAIN SIZE TESTING

SW 10/22/98

PAGE 1 OF 1

CT&E Ref.# 993284026
Client Name ALTA Geosciences, INC
Project Name/# Norgetown
Client Sample ID STA 42, TOC
Matrix Soil/Solid
Ordered By
PWSID

Client PO#
Printed Date/Time 07/15/99 09:47
Collected Date/Time 07/07/99 11:05
Received Date/Time 07/08/99 15:15
Technical Director: Stephen C. Ede
Released By Heather S Hal

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
^								
Total Solids	97.6		%	SM18 2540G			07/13/99	SEC
Total Organic Carbon	7111	1130	mg/Kg	TOC CTE SOP		07/09/99	07/09/99	SCL

CT&E Environmental Services Inc.

CT&E Ref.#	993284027	**Client PO#**	
Client Name	ALTA Geosciences, INC	**Printed Date/Time**	07/15/99 09:47
Project Name/#	Norgetown	**Collected Date/Time**	07/07/99 11:10
Client Sample ID	STA 76, TOC	**Received Date/Time**	07/08/99 15:15
Matrix	Soil/Solid	**Technical Director:**	**Stephen C. Ede**
Ordered By			
PWSID		**Released By**	Heather S Hal

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Total Solids	95.6		%	SM18 2540G			07/13/99	SEC
Total Organic Carbon	2468	1080	mg/Kg	TOC CTE SOP		07/09/99	07/09/99	SCL

Client ALTA Geosciences, INC
Workorder Norgetown

QC Batch WXX 2015 (62572)
Original
Matrix Soil/Solid

Prep Date 07/09/99 13:26
Analysis Method TOC CTE SOP

QC results affect the following production samples:

993284026 993284027

QC results for Method Blank [244527]

Run Instrument:

Parameter	Analyzed	Result	PQL	Units
Total Organic Carbon	07/09/99	1000 U	1000	mg/Kg

Client ALTA Geosciences, INC
Workorder Norgetown

QC Batch WXX 2015 (62572)
Original
Matrix Soil/Solid

Prep Date 07/09/99 13:27
Analysis Method TOC CTE SOP

QC results affect the following production samples:

993284026 993284027

QC results for Lab Check Standard [244528]

Parameter		QC Result	Pct Recov	LCS/LCSD Limits	RPD	RPD Limits	Spiked Amount	Analyzed	Instru ID
Total Organic Carbon	LCS	9300	106	75-125			8800mg/Kg	07/09/99	