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2005 GROUNDWATER MONITORING REPORT
NORTH BAY PROPERTY

PREPARED FOR
TESORO ALASKA COMPANY

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Acronyms and Abbreviations

µg/L	micrograms per liter
AS	air sparge
BTEX	benzene, toluene, ethylbenzene, and xylenes
DRO	diesel-range organics
EDC	1,2-dichloroethane
GRO	gasoline-range organics
KSI	Kent & Sullivan, Inc.
MCL	maximum contaminant level
NCA	North Creek Analytical, Inc.
RPD	relative percent difference
SVE	soil vapor extraction
Tesoro	Tesoro Alaska Company

1.0 INTRODUCTION

This report documents the field activities and results of the groundwater monitoring performed during May and October 2005 at the North Bay property located at mile 15.4 on the Kenai Spur Highway north of Kenai, Alaska (Figure 1). The site includes a former Tesoro Alaska Company (Tesoro) service station located along the highway and a commercial office property situated between the service station site and the Cook Inlet bluff.

A narrow plume of dissolved-phase hydrocarbon was delineated in the upper part of the unconfined aquifer underlying the North Bay site. Benzene and 1,2-dichloroethane (EDC) are the primary contaminants of concern in the plume. The plume is no more than 60 feet wide and extended approximately 950 feet downgradient from the service station prior to beginning remediation activities in July 2000.

2.0 FIELD ACTIVITIES

2.1 GROUNDWATER MONITORING

The 2005 groundwater monitoring program was conducted in accordance with the 2005 workplan. Monitoring events were conducted in May 2005 and October 2005.

Site monitoring wells were gauged on May 4, 2005 and October 18, 2005. An electronic water level meter was used to measure the depth to water in the wells. Table 1 provides the gauging data and calculated potentiometric surface elevations for these gauging event.

Monitoring wells B-12, B-21, B-22, B-31, and B-39 were sampled on May 4, 2005 and October 18, 2005, and wells B-014, B-030, B-036, B-037, and B-050 were also sampled in May. No purge sampling was performed using disposable bailers.

The groundwater samples were analyzed for BTEX (benzene, toluene, ethylbenzene, and xylenes), GRO (gasoline range organics) and EDC (1,2-dichloroethane). North Creek Analytical (NCA) in Anchorage, Alaska performed the analyses. Table 2 summarizes the analytical results, Table 3 is a cumulative summary of historical hydrocarbon data, and Appendix A contains the laboratory reports.

One field duplicate was collected for each of the sampling events (May and October) and labeled "Dup". One trip blank was included for each sampling event.

2.2 AIR SPARGE SYSTEM EXPANSION

Three new air sparge (AS) wells (B-51, B-52, and B-53) were installed in November 2005 as the third phase of the site AS system. The wells are located near the eastern edge of the former service station property (Figure 2) and near the presumed upgradient edge of the groundwater plume. The wells are intended to

address source area contamination by stripping volatile compounds in the sparge treatment zone and supplying oxygen to support aerobic biodegradation downgradient of the treatment zone.

The wells were drilled and installed using conventional hollow-stem auger methods. The boreholes were logged nearly continuously below the water table to characterize soil within the sparge treatment zone. Borehole logs and well as-built drawings are provided in Appendix B.

The AS wells are constructed with 2-inch diameter polyvinyl chloride riser pipe and two feet long, 0.010-inch slotted screens. The top of the screens were set seven to eight feet below the water table, and the sand packs extend 0.75 to 2 feet above the screens. The well design was dictated by the presence of a 0.1- to 1-foot thick silt and sandy silt bed present 6.5 to 8 feet below the water table at the three well locations. The well screens are set below the silt layer and the sand packs extend to just above the silt layer to allow air flow into the overlying sandy soil.

Hydrocarbon contamination was encountered in the lower part of the vadose zone at well B-52. A soil vapor extraction (SVE) well was nested with the AS well to address the contamination. The SVE well is constructed with 1-inch diameter polyvinyl chloride riser pipe and a 15-foot long, 0.020-inch slotted screen.

The new AS wells were developed by surging and sand bailing followed by air surging and further sand bailing. Air flow was established to wells B-51 and B-53 and these wells operate at 8 to 12 standard cubic feet per minute flow. The breakout pressure of well B-52, however, exceeds the maximum pressure of the AS blower, and the well cannot currently be operated. The new AS and SVE wells were connected to the existing AS and SVE systems in January 2006. The SVE well operates continuously and wells B-51 and B-53 operate on 20-minute cycles as air flow is switched between the Phase 2 and Phase 3 AS wells.

2.3 REMEDIATION SYSTEM OPERATION

The groundwater remediation air sparge (AS) and soil vapor extraction (SVE) systems operated in 2005 as follows:

System	Wells	Operation
Phase 1 AS system	B-41, B-42, B-43	Not operated
Phase 2 AS system	B-47, B-48, B-49	Operated continuously
Phase 3 AS system	B-51, B-53	Installed and began operating wells B-51 and B-53 in November 2005
VE system	VEB-002	Operated discontinuously.

3.0 DISCUSSION

Figures 2 and 3 are potentiometric surface elevation contour maps based on the May 2005 and October 2005 gauging data respectively. The data show that groundwater flow patterns and gradients were similar to those observed during previous gauging events. Water levels have varied by one to two feet throughout the site in the past five years after rising from a low water period in 1999 (Figure 4). Wells B-8 and B-34 have anomalous water levels and are not used in either of the water contour maps.

All analytical data meet the data quality objectives (DQOs) for this project (Table 4) with one exception. Duplicate toluene analysis from sample B-022 has a relative percent difference (RPD) of 107%. The result was J-flagged to indicate that the reported concentration is an estimated value.

Figure 5 is a map showing May 2005 and October 2005 benzene and EDC concentrations, and Figure 6 shows the benzene and EDC concentration trends for the wells. The principal results of the sampling are discussed in the following paragraphs.

- Benzene concentrations are below the reporting limit in groundwater downgradient of the phase 2 AS wells showing that the AS system has cut off plume migration. Benzene concentrations remain above the maximum contaminant level (MCL) immediately upgradient of the phase 2 sparge wells in well B-22 (194 µg/L), B-36 (39.5 µg/L), and B-50 (118 µg/L) in October 2005.
- The AS system has also reduced EDC concentrations to below the MCL downgradient of the phase 2 AS wells. EDC concentrations remain above the MCL immediately upgradient of the phase 2 sparge wells in well B-22 (11.2 µg/L) and B-50 (9.9 µg/L) in October 2005.

4.0 2006 OPERATING AND MONITORING PLAN

The North Bay AS and SVE systems will be operated continuously in 2006. Only the phase 2 and 3 AS wells will be operated as long as contaminant concentrations remain at or below groundwater criteria in the down-gradient part of the plume. Wells B-51 and B-53 in the phase 3 AS system are working normally. Well B-52 will be further developed in an attempt to lower the break-out pressure to a level where the well can be operated with the existing AS blower. If the well can not be operated, a decision to install a replacement well will be made based on one or two years monitoring data from wells B-50 and B-36 located downgradient of the phase 3 AS wells.

Groundwater monitoring will be performed semi-annually at the site with monitoring events in May and October of 2006 to evaluate remediation progress at the site. All of the site monitoring wells will be gauged during both events. Wells B-12, B-22, B-36, and B-50 will be sampled for BTEX/GRO and EDC during both events and well B-31 will be sampled for EDC in October.

Table 1
Groundwater Level Measurements
 North Bay Property
 May and October 2005

Well No	Gauge Date	Elevation TOC (ft MLLW)	DTW (feet)	Potentiometric Surface Elevation (ft MLLW)
B-008	04-May-05	85.81	59.32	26.49
	18-Oct-05	85.81	58.81	27.00
B-012	04-May-05	85.47	58.40	27.07
	18-Oct-05	85.47	58.02	27.45
B-013	04-May-05	84.74	56.17	28.57
	18-Oct-05	84.74	55.81	28.93
B-014	04-May-05	84.91	52.24	32.67
	18-Oct-05	84.91	51.68	33.23
B-021	04-May-05	85.07	59.82	25.25
	18-Oct-05	85.07	59.31	25.76
B-022	04-May-05	85.11	56.28	28.83
	18-Oct-05	85.11	55.84	29.27
B-023	04-May-05	85.6	61.36	24.24
	18-Oct-05	85.6	60.83	24.77
B-024	04-May-05	85.89	61.93	23.96
	18-Oct-05	85.89	61.40	24.49
B-025	04-May-05	84.17	67.07	17.10
	18-Oct-05	84.17	66.28	17.89
B-028	04-May-05	85.52	63.09	22.43
	18-Oct-05	85.52	62.58	22.94
B-029	04-May-05	84.85	63.07	21.78
	18-Oct-05	84.85	62.51	22.34
B-030	04-May-05	85.73	52.89	32.84
	18-Oct-05	85.73	52.30	33.43
B-031	04-May-05	85.21	60.72	24.49
	18-Oct-05	85.21	60.19	25.02
B-032	04-May-05	86.12	61.28	24.84
	18-Oct-05	86.12	60.76	25.36
B-033	04-May-05	85.51		
	18-Oct-05	85.51	62.00	23.51
B-034	04-May-05	85.48	5.82	79.66
	18-Oct-05	85.48	23.82	61.66

Table 1
Groundwater Level Measurements
 North Bay Property
 May and October 2005

Well No	Gauge Date	Elevation TOC (ft MLLW)	DTW (feet)	Potentiometric Surface Elevation (ft MLLW)
B-035	04-May-05	84.2	65.50	18.70
	18-Oct-05	84.2	65.14	19.06
B-036	04-May-05	84.93	54.22	30.71
	18-Oct-05	84.93	53.67	31.26
B-037	04-May-05	85.3	62.58	22.72
	18-Oct-05	85.3	62.05	23.25
B-038	04-May-05	84.99	62.15	22.84
	18-Oct-05	84.99	61.64	23.35
B-039	04-May-05	84.97	64.13	20.84
	18-Oct-05	84.97	63.58	21.39
B-040	04-May-05	84.14	65.86	18.28
	18-Oct-05	84.14	65.43	18.71
B-050	04-May-05	88.76	57.96	30.80
	18-Oct-05	88.76	56.75	32.01

Notes:

- DTW Depth to water
- ft. MLLW Elevation relative to mean lower low water (ft.)
- TOC Top of casing

Table 2

Summary of BTEX Data (µg/L)
 May and October 2005
 North Bay Project

Well ID	Sample Date	Lab ID	Benzene [5]	Ethylbenzene [700]	Toluene [1000]	Xylenes [10,000]	GRO [1300]	EDC [5]
B-012	5/4/2005	A5E0007-01	0.5 U	0.5 U	0.5 U	1.5 U	50 U	1.81
	10/18/2005	A5J0067-01	0.5 U	0.5 U	0.5 U	1.5 U	50 U	1.12
B-014	5/4/2005	A5E0007-02	0.5 U	0.5 U	0.5 U	1.5 U	50 U	0.5 U
B-021	5/4/2005	A5E0007-03	0.5 U	23.3	0.5 U	1.5 U	70.9	1.45
	10/18/2005	A5J0067-02	0.5 U	21.7	0.5 U	1.5 U	67.7	1.22
B-022	5/4/2005	A5E0007-04	983	1120	3420	4200	24700	39.5
	10/18/2005	A5J0067-03	194	459	28.2 J	856	5760	11.2
B-030	5/4/2005	A5E0007-05	0.5 U	0.5 U	0.5 U	1.5 U	50 U	0.5 U
B-031	5/4/2005	A5E0007-06	0.5 U	3.11	0.5 U	1.5 U	50 U	5.54
	10/18/2005	A5J0067-04	0.5 U	18.3	0.5 U	1.5 U	58.2	3.67
B-036	5/4/2005	A5E0007-07	39.5	21.8	0.5 U	1.5 U	200	1.29
B-037	5/4/2005	A5E0007-08	0.725	0.5 U	0.5 U	1.5 U	50 U	1
B-039	5/4/2005	A5E0007-09	0.5 U	0.5 U	0.5 U	1.5 U	50 U	1.81
	10/18/2005	A5J0067-05	0.5 U	0.5 U	0.5 U	1.5 U	50 U	0.7
B-050	5/4/2005	A5E0007-10	118	59.9	0.5 U	52.6	739	9.9

Bold Analyte was detected.

[5] Analyte exceeds 18AAC75 groundwater criterion.

GRO 18AAC75 groundwater criterion

EDC Gasoline Range Organics.

J Not analyzed.

U Estimated concentration.

EDC Analyte was not present in a concentration above the detection level shown on the table.
 1,2-Dichloroethane.

Table 3
Cumulative Summary of Hydrocarbon Data (ug/L)
 North Bay Project

Well No.	Project Phase	Sample Date (Criteria):	Benzene (5)	Toluene (1,000)	Ethylbenzene (700)	Xylenes (10,000)	GRO (1,300)	EDC (5)
B-012	OASIS	10/10/1997	1700	840	330	1150	9000	0.5 U
	OASIS	5/7/1998	1130	418	218	727	--	0.2 U
	OASIS	8/7/1998	835	356	203	679	--	17.8
	OASIS	10/5/1999	190	56	97	214	--	14
	KSI, 2000	5/24/2000	480	100	170	404	--	20 Y
	KSI, 2000	8/23/2000	913	161	100 U	590	--	--
	KSI, 2000	11/29/2000	520	98	150	330	--	--
	KSI, 2001	4/30/2001	560	13	160	280	--	10 U
	KSI, 2001	8/15/2001	4.2	1 U	8.4	3.2	--	--
	KSI, 2001	10/31/2001	52	1 U	10	2.3	--	--
	KSI, 2002	5/2/2002	1.1	1 U	1.9	1 U	--	--
	KSI, 2002	10/16/2002	23	1 U	1 U	1 U	--	--
	03R1	5/14/2003	1 U	1 U	1 U	1 U	--	--
	03R2	10/2/2003	0.5 U	0.5 U	0.5 U	1 U	80 U	4.55
	04R1	6/2/2004	0.5 U	0.5 U	0.5 U	1.5 U	50 U	5.15
04R2	11/2/2004	0.5 U	0.5 U	0.5 U	1.5 U	50 U	2.14	
05R1	5/4/2005	0.5 U	0.5 U	0.5 U	1.5 U	50 U	1.81	
05R2	10/18/2005	0.5 U	0.5 U	0.5 U	1.5 U	50 U	1.12	
B-014	OASIS	10/10/1997	26	0.5 U	0.5 U	4.6 J	520	0.5 U
	OASIS	5/7/1998	86.8	0.2 U	0.2 U	0.4 U	--	0.2 U
	OASIS	8/7/1998	112	0.2 U	0.65	0.41	--	0.62
	OASIS	10/5/1999	25	0.5 U	0.5 U	0.5 U	--	0.5 U
	05R1	5/4/2005	0.5 U	0.5 U	0.5 U	1.5 U	50 U	0.5 U
B-021	OASIS	5/7/1998	739	0.51	137	246	--	0.2 U
	OASIS	8/8/1998	410	0.38	78.4	173	--	17.6
	OASIS	10/6/1999	410	0.5 U	120	124	--	34
	KSI, 2000	5/24/2000	330	1 U	150	160	--	22 J
	KSI, 2000	8/23/2000	295	100 U	100 U	158	--	--
	KSI, 2002	10/16/2002	1 U	1 U	42	1.1	--	--
	03R1	5/14/2003	1 U	1 U	38	1 U	--	--
	03R2	10/2/2003	0.5 U	0.5 U	11.8	1 U	80 U	2.55
	04R1	6/2/2004	0.5 U	0.5 U	27.9	1.5 U	74.7	1.41
	04R2	11/2/2004	0.5 U	0.5 U	16.1	1.5 U	50 U	1.29
	05R1	5/4/2005	0.5 U	0.5 U	23.3	1.5 U	70.9	1.45
	05R2	10/18/2005	0.5 U	0.5 U	21.7	1.5 U	67.7	1.22
B-022	OASIS	8/7/1998	240	98.7	34	54.6	--	4.07
	OASIS	10/6/1999	950	950	350	1150	--	66

Table 3
Cumulative Summary of Hydrocarbon Data (ug/L)
 North Bay Project

Well No.	Project Phase	Sample Date (Criteria):	Benzene (5)	Toluene (1,000)	Ethylbenzene (700)	Xylenes (10,000)	GRO (1,300)	EDC (5)
B-022	KSI, 2000	5/24/2000	1600	1900	580	2160	--	69 Y
	KSI, 2000	8/23/2000	1520	999	100 U	1603	--	--
	KSI, 2000	11/30/2000	2900	1200	600	1970	--	83
	KSI, 2001	4/30/2001	2600	680	390	1340	--	50 U
	KSI, 2001	8/15/2001	2800	820	540	1920	--	--
	KSI, 2001	10/31/2001	3500	1200	680	2400	--	--
	KSI, 2002	5/2/2002	3400	2100	800	2970	--	--
	03R2	10/2/2003	1160	579	715	1800	10800	35
	04R1	6/2/2004	1450	2770	1030	3560	17800	--
	04R2	11/2/2004	695	1340	727	2650	12800	30.7
	05R1	5/4/2005	983	3420	1120	4200	24700	39.5
	05R2	10/18/2005	194	28.2 J	459	856	5760	11.2
B-030	OASIS	4/1/1999	0.5 U	0.5 U	0.5 U	0.5 U	--	0.5 U
	OASIS	8/31/1999	18	34	24	112	--	0.5 U
	05R1	5/4/2005	0.5 U	0.5 U	0.5 U	1.5 U	50 U	0.5 U
B-031	OASIS	9/26/1999	820	2.5	230	162	--	72
	OASIS	10/5/1999	1100	79	280	452	--	110
	KSI, 2000	5/25/2000	740	78	320	510	--	40 J
	KSI, 2000	8/23/2000	294	100 U	100 U	181	--	--
	KSI, 2001	1/2/2001	820	100 U	420	380	--	--
	KSI, 2001	4/30/2001	20	1 U	1 U	1 U	--	17
	KSI, 2001	8/15/2001	320	1 U	95	95	--	--
	KSI, 2001	10/31/2001	140	1 U	79	78	--	--
	KSI, 2002	5/2/2002	70	1 U	41	19	--	--
	KSI, 2002	10/16/2002	12	1 U	30	1 U	--	--
	03R1	5/14/2003	9.7	1 U	60	1 U	--	--
	03R2	10/2/2003	0.5 U	0.5 U	0.5 U	1 U	80 U	7.05
	04R1	6/2/2004	0.629	0.605	21.2	1.5 U	75.1	4.72
	04R2	11/2/2004	0.5 U	0.5 U	20.2	1.5 U	63.5	6.89
	05R1	5/4/2005	0.5 U	0.5 U	3.11	1.5 U	50 U	5.54
05R2	10/18/2005	0.5 U	0.5 U	18.3	1.5 U	58.2	3.67	
B-036	OASIS	10/30/1999	240	76	86	215	--	12
	KSI, 2000	11/30/2000	790	13	54	130	--	--
	KSI, 2002	5/2/2002	350	1.2	11	6.5	--	--
	05R1	5/4/2005	39.5	0.5 U	21.8	1.5 U	200	1.29
B-037	OASIS	10/30/1999	630	3	33	29	--	47

Table 3
Cumulative Summary of Hydrocarbon Data (ug/L)
 North Bay Project

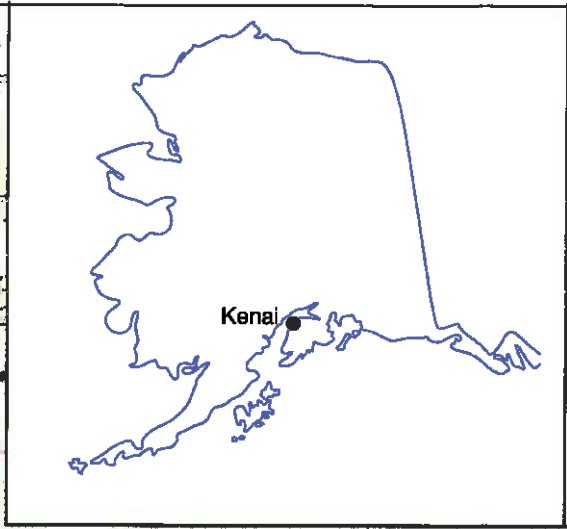
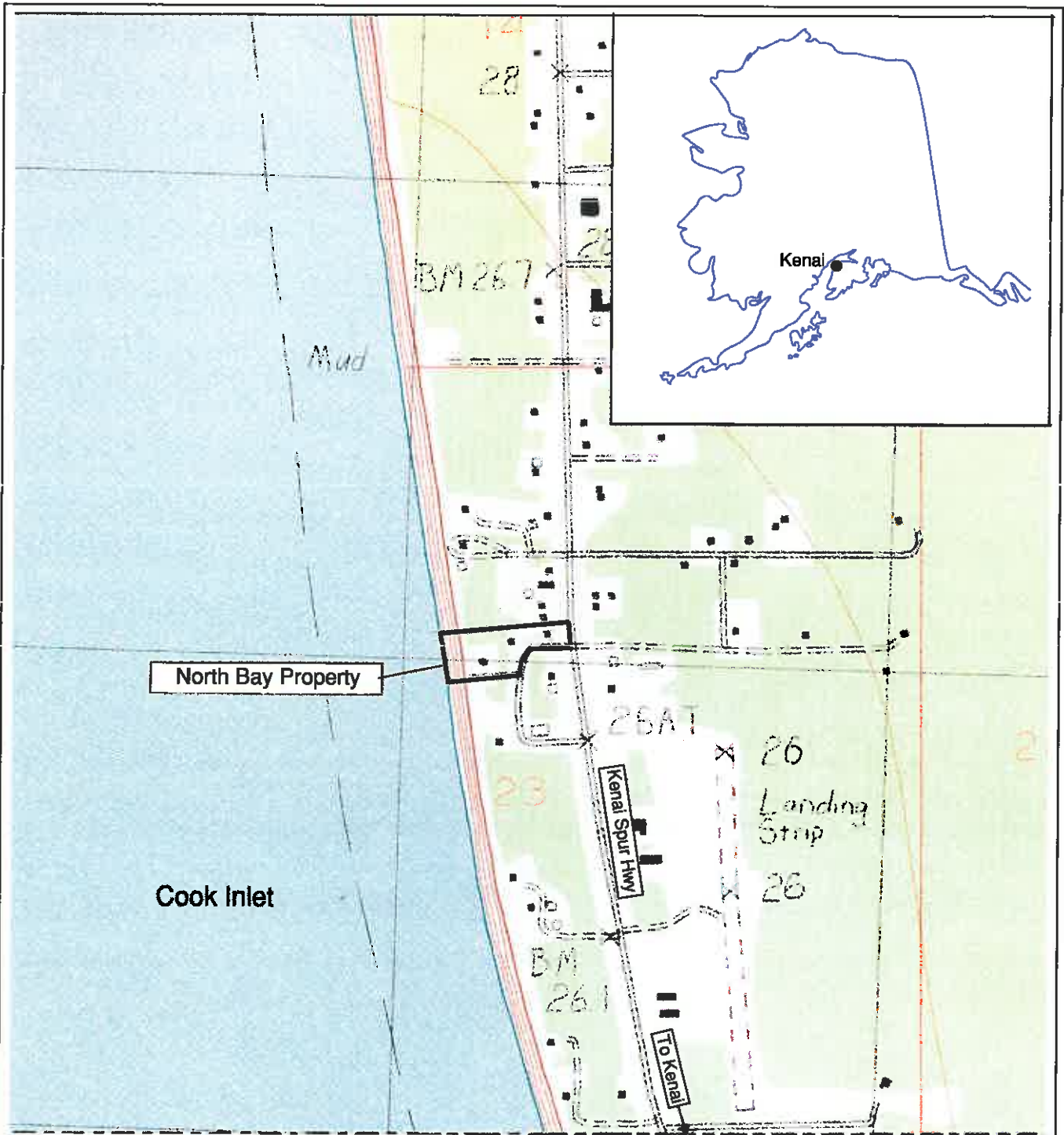
Well No.	Project Phase	Sample Date (Criteria):	Benzene (5)	Toluene (1,000)	Ethylbenzene (700)	Xylenes (10,000)	GRO (1,300)	EDC (5)
B-037	KSI, 2000	5/4/2000	460	1.5	32	34	--	19
	KSI, 2000	8/23/2000	5.8	1 U	1 U	7.9	--	--
	KSI, 2000	11/28/2000	1 U	1 U	1 U	1 U	--	2.3
	KSI, 2001	5/1/2001	1 U	1 U	1 U	1 U	--	--
	KSI, 2002	5/2/2002	1 U	1 U	1 U	1 U	--	--
	05R1	5/4/2005	0.725	0.5 U	0.5 U	1.5 U	50 U	1
B-039	OASIS	10/30/1999	1100	110	180	361	--	76
	KSI, 2000	5/25/2000	130	1 U	50	32	--	10 J
	KSI, 2000	8/3/2000	6.8	1 U	1 U	48.7	--	--
	KSI, 2000	8/23/2000	1 U	1 U	1 U	1 U	--	--
	KSI, 2000	11/28/2000	1 U	1 U	1 U	1 U	--	12
	KSI, 2001	4/30/2001	1 U	1 U	1 U	1 U	--	1 U
	KSI, 2001	8/15/2001	1 U	1 U	1 U	1 U	--	--
	KSI, 2001	10/31/2001	1 U	1 U	1 U	1 U	--	--
	KSI, 2002	5/2/2002	1 U	1 U	1 U	1 U	--	--
	KSI, 2002	10/16/2002	1.1	1 U	1 U	1 U	--	9.2
	03R1	5/14/2003	1 U	1 U	1 U	1 U	--	--
	03R2	10/2/2003	0.5 U	0.5 U	0.5 U	1 U	80 U	4.69
	04R1	6/2/2004	0.5 U	0.5 U	0.5 U	1.5 U	50 U	2.99
	04R2	11/2/2004	0.5 U	0.5 U	0.5 U	1.5 U	50 U	2.2
05R1	5/4/2005	0.5 U	0.5 U	0.5 U	1.5 U	50 U	1.81	
05R2	10/18/2005	0.5 U	0.5 U	0.5 U	1.5 U	50 U	0.7	
B-050	05R1	5/4/2005	118	0.5 U	59.9	62.6	739	9.9

Criterion Groundwater cleanup criteria contained in 18 AAC 75.
BOLD The analyte was detected.
 The concentration exceeds the criterion.
 -- Not analyzed.

EDC 1,2-Dichloroethane.
 GRO Gasoline range organics.
 J The concentration is estimated.
 U Undetected at the level shown.
 Y The concentration is estimated due to co-elution with benzene - possible high bias.

Table 4
Field Quality Control Summary
 North Bay Project

Quality Control Designation	Tolerance	Results for This Project
Holding time BTEX	14 days at 4° ± 2° C	All samples within tolerance
Holding time GRO.....	14 days at 4° ± 2° C	All samples within tolerance
Holding time EDC	14 days at 4° ± 2° C	All samples within tolerance
Completeness.....	85%	Within tolerance
Field duplicate RPD	<35%	All samples within tolerances except for toluene in sample B-22; the sample result was J flagged
Trip blank.....	Less than PQL.....	Within tolerance



North Bay Property

Cook Inlet

Site Location Map ~ North Bay Property ~

TESORO ALASKA COMPANY

Date: 9/21/00

Drawn by: BKJ

Proj. No.: 01-59

Checked by:

File: S:\01-59 North Bay\Site Location Map.dwg

FIGURE

1

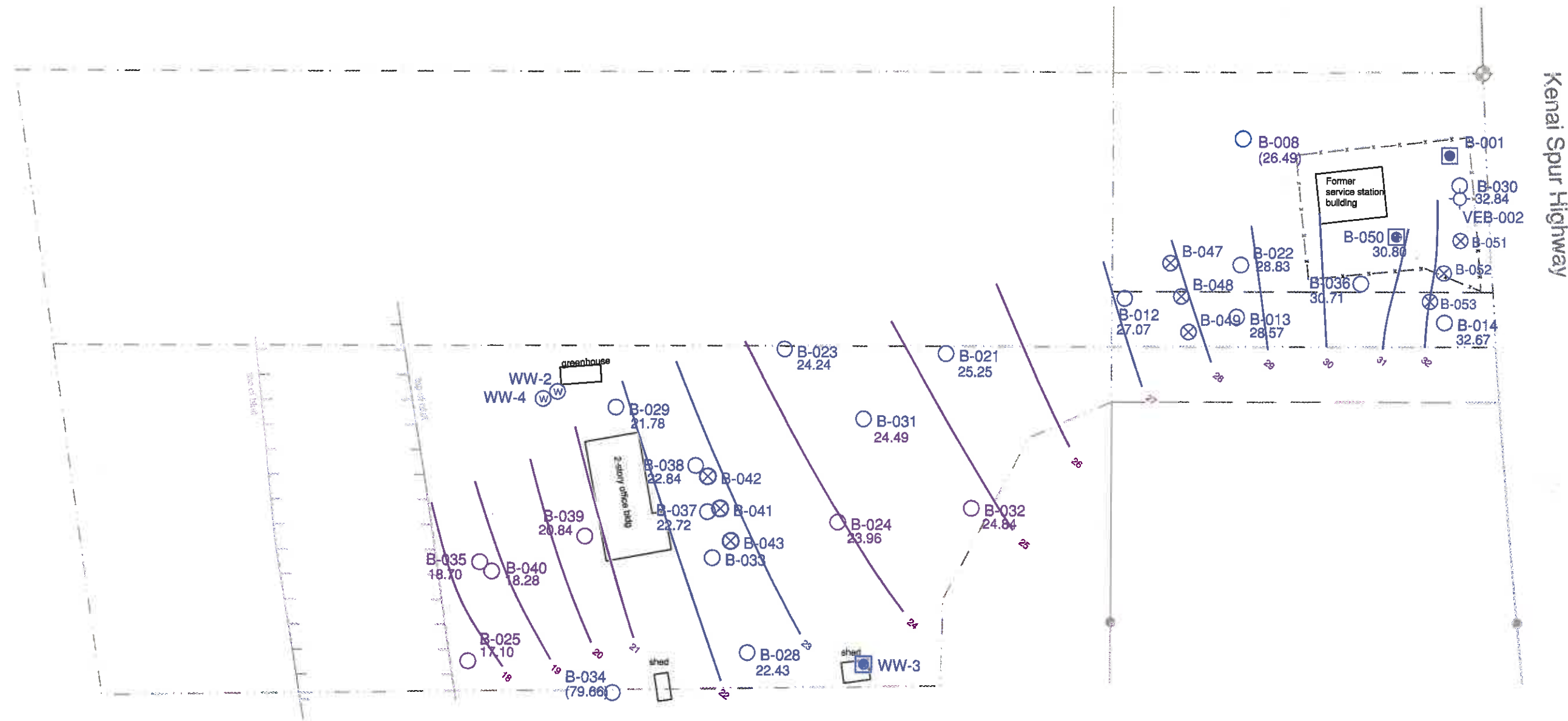
KENT & SULLIVAN, INC.



Scale

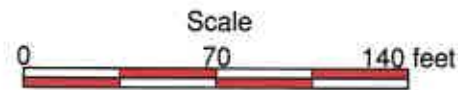


Base Map: USGS Quadrangle Map, Kenai C4 SW, Scale 1:24,000

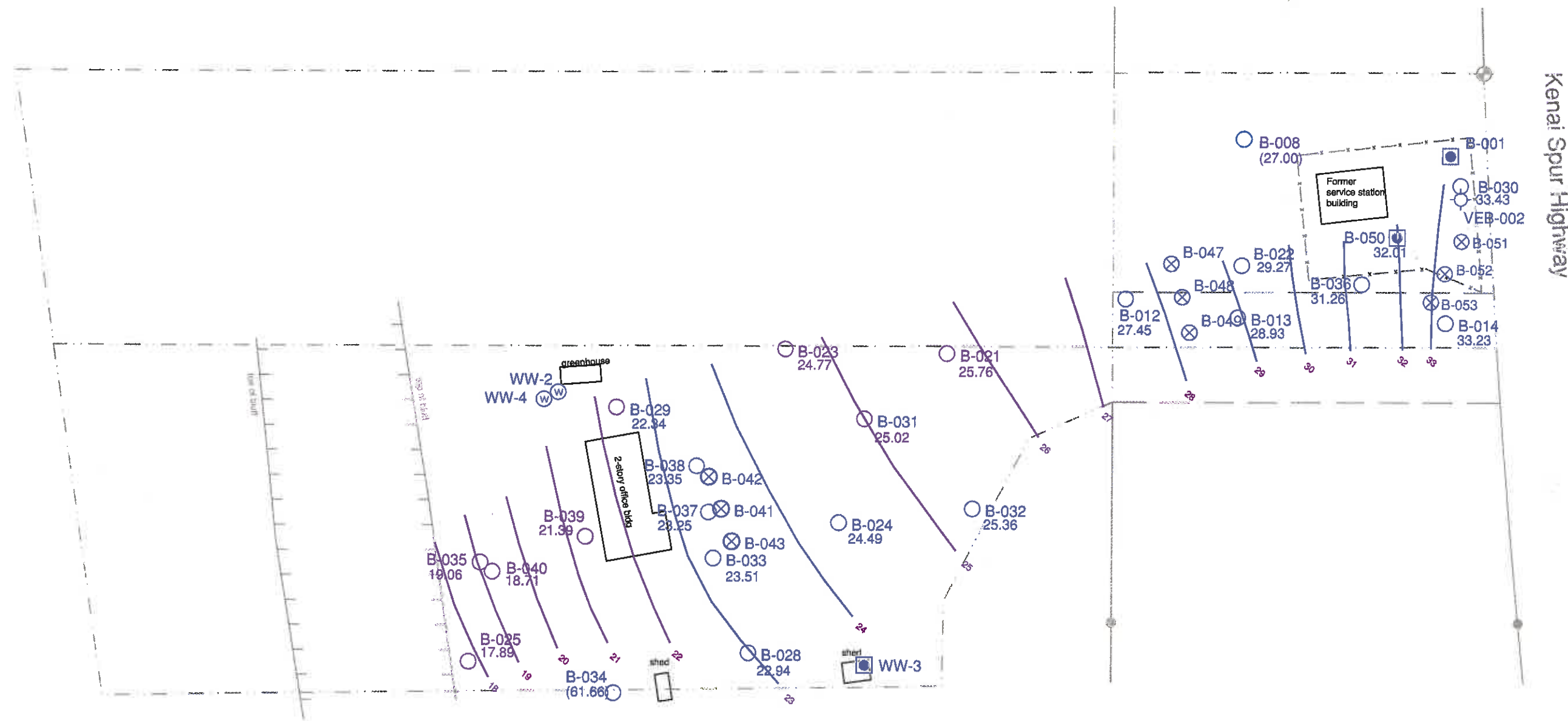


EXPLANATION

- B-035 ○ Monitoring well location
- B-001 ■ Monitoring well location - approximate
- B-048 ⊗ Air sparging well location
- VEB-002 ⊕ Vapor extraction well location
- WW-2 ⊙ Water well location
- 46.73 Water table elevation - May 4, 2004
(in parentheses if not used for contouring)
- Water table contour (1-foot interval)

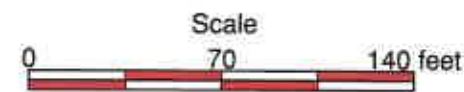


Water Level Contour Map May 4, 2005 ~North Bay Property~		FIGURE 2
TESORO ALASKA COMPANY		
Date: 1/5/2006 Proj. No.: 01-59 File: 01-59 North Bay/2006 May.dwg	Drawn by: BKJ Checked by:	
KENT & SULLIVAN, INC.		



EXPLANATION

- B-035 ○ Monitoring well location
- B-001 ■ Monitoring well location - approximate
- B-048 ⊗ Air sparging well location
- VEB-002 ⊕ Vapor extraction well location
- WW-2 ⊗ Water well location
- 46.73 Water table elevation - October 18, 2005
(in parentheses if not used for contouring)
- Water table contour (1-foot interval)



Water Level Contour Map
October 18, 2005
 ~North Bay Property~

TESORO ALASKA COMPANY

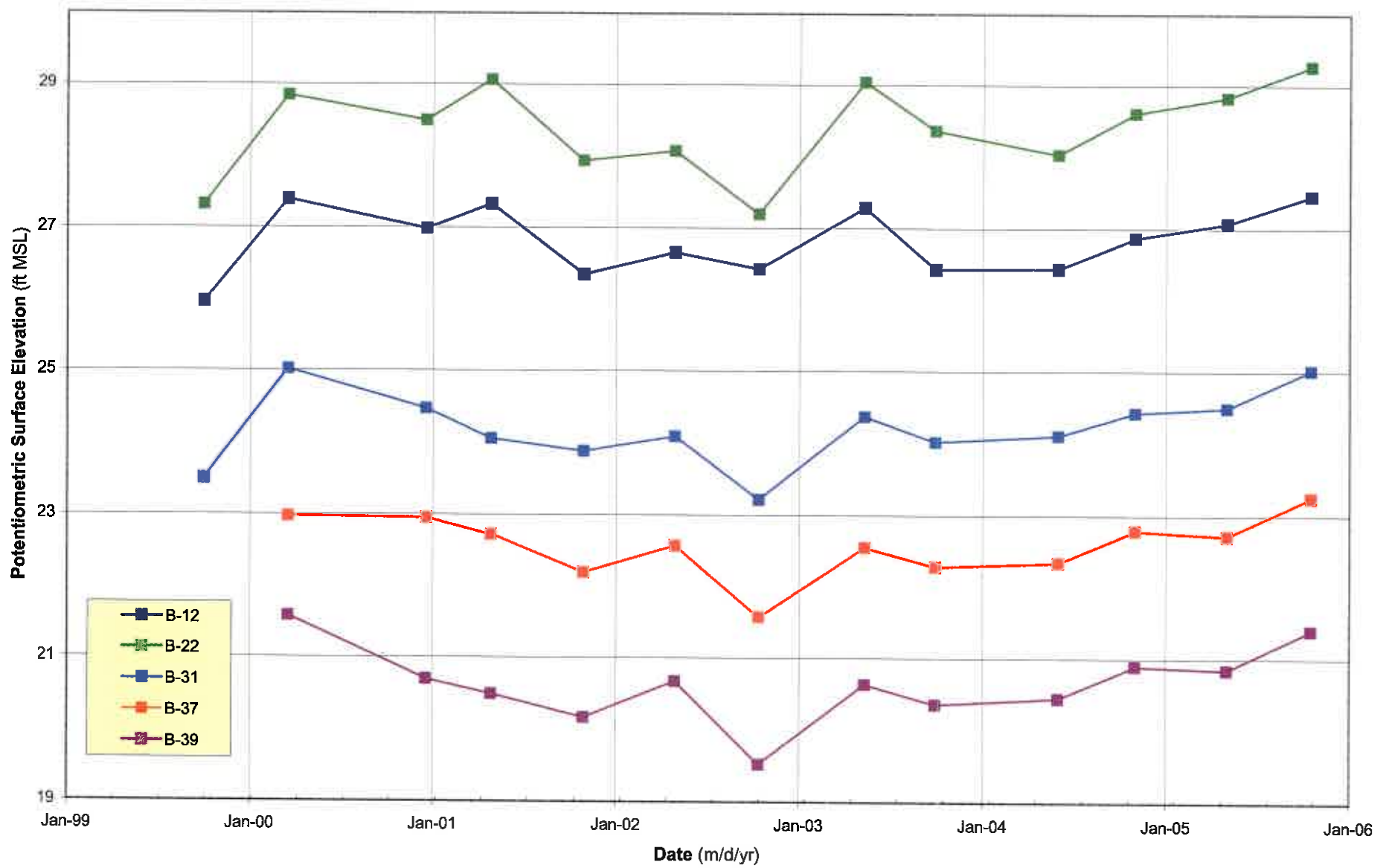
Date: 1/5/2006 Drawn by: BKJ
 Proj. No.: 01-59 Checked by:
 File: 01-59 North Bay/Oct 2006 .dwg

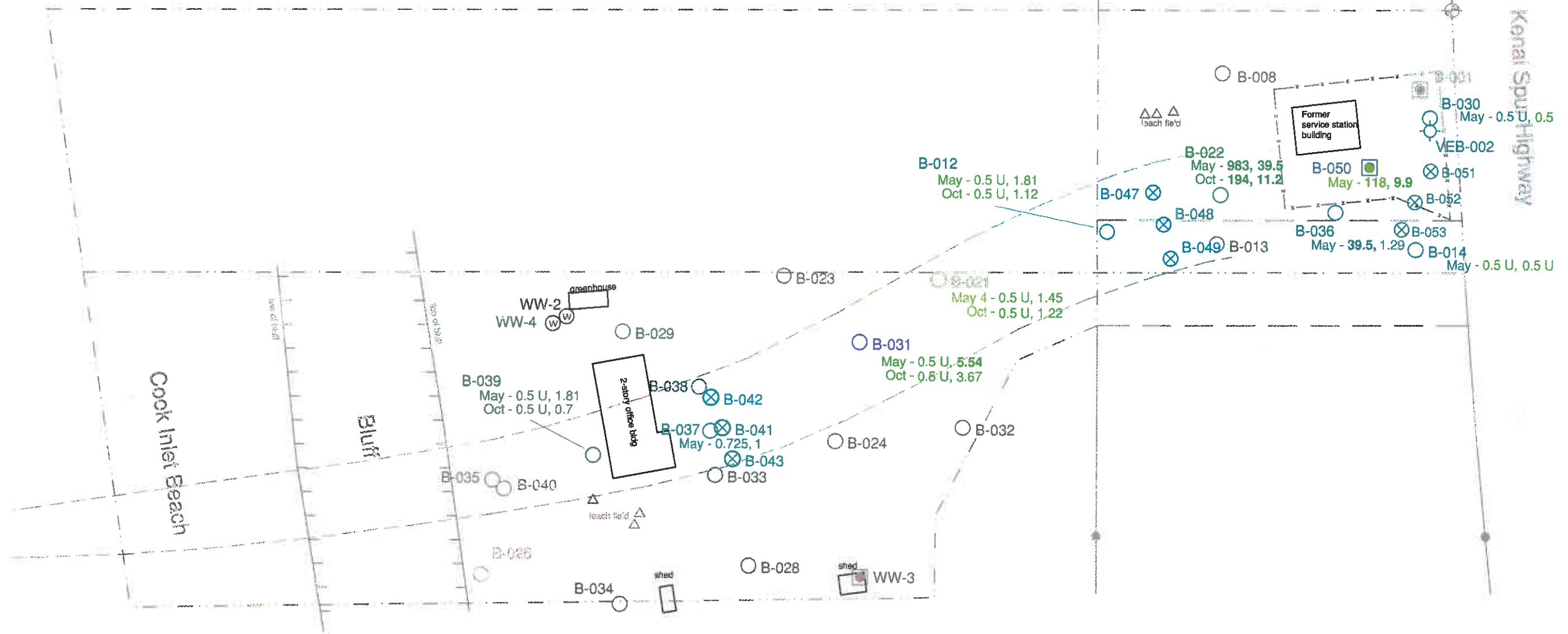
FIGURE

3

KENT & SULLIVAN, INC.

Hydrographs October 1999 to October 2005



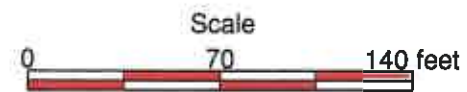


EXPLANATION

- B-035 ○ Monitoring well sampled in 2005
- B-001 ■ Monitoring well location - approximate
- B-025 ○ Monitoring well location
- B-048 ⊗ Air sparging well location
- VEB-002 ⊕ Vapor extraction well location
- WW-2 ⊗ Water well location
- Oct 4 - 1U, 2.55** Sample month - Benzene, EDC concentrations (µg/L). Bold text indicates the concentration is above ADEC groundwater criteria.
- Approximate extent of groundwater plume before remediation March 2000

Note:

- B-041, 42, 43 Phase - 1 Air Sparge System
- B-047, 48, 49 Phase - 2 Air Sparge System
- B-051, 52, 53 Phase - 3 Air Sparge System



2005 Benzene Concentrations and EDC Map

~North Bay Property~

TESORO ALASKA COMPANY

Date: 1/5/2006

Drawn by: BKJ

Proj. No.: 01-59

Checked by:

File: 01-59 North Bay/2004 rpt fig7.dwg

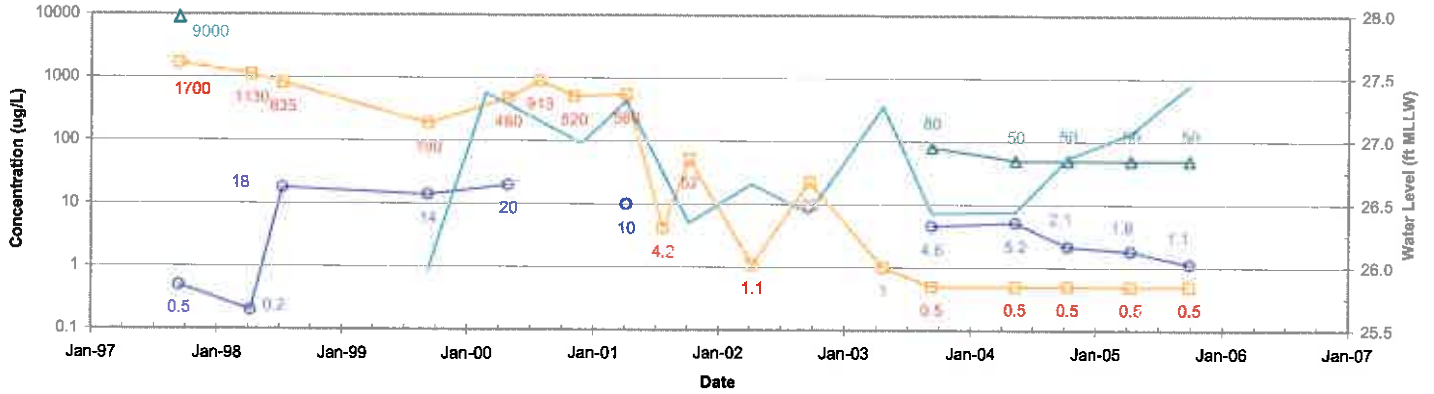
FIGURE

5

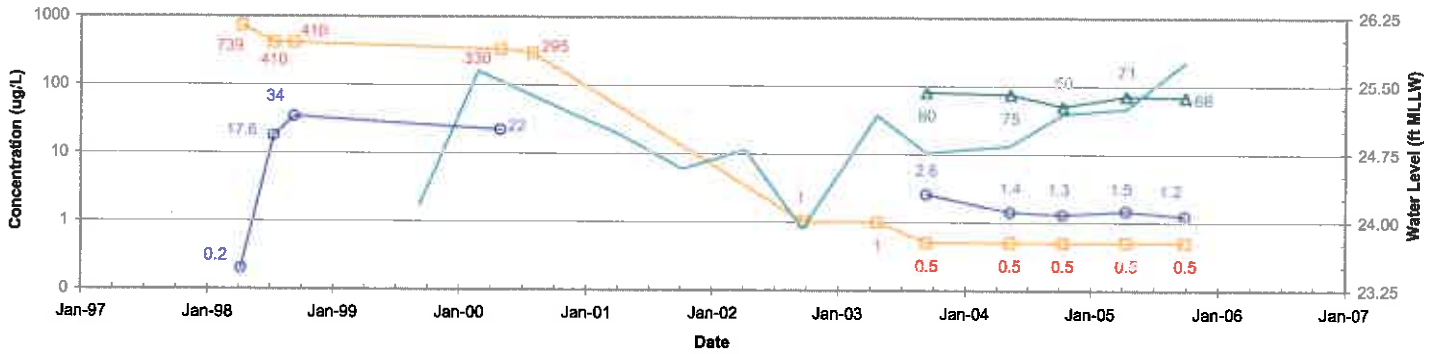
KENT & SULLIVAN, INC.

Figure 6
Time-Series Charts
 North Bay Project

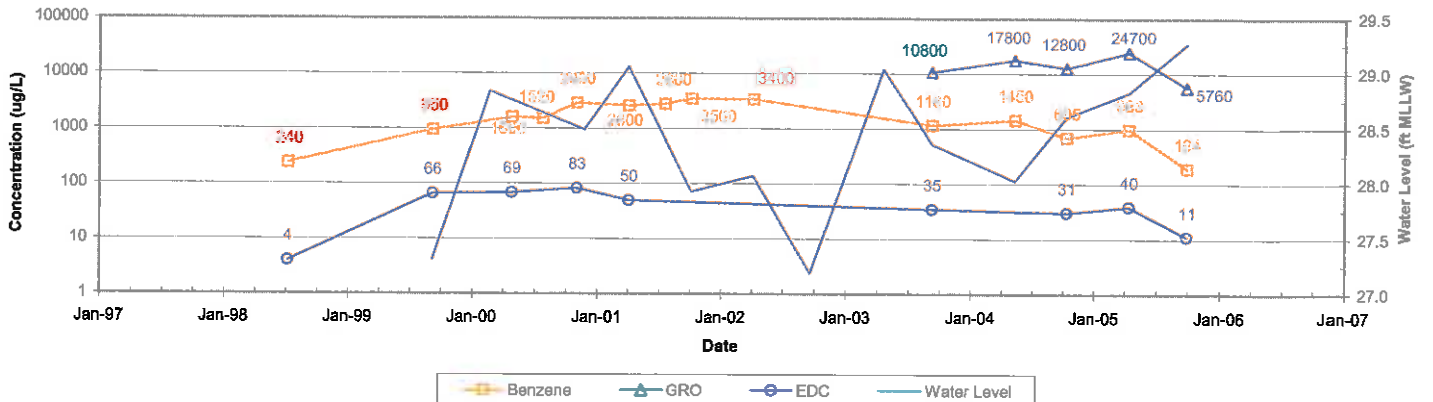
Time-Series Plot for B-012



Time-Series Plot for B-021



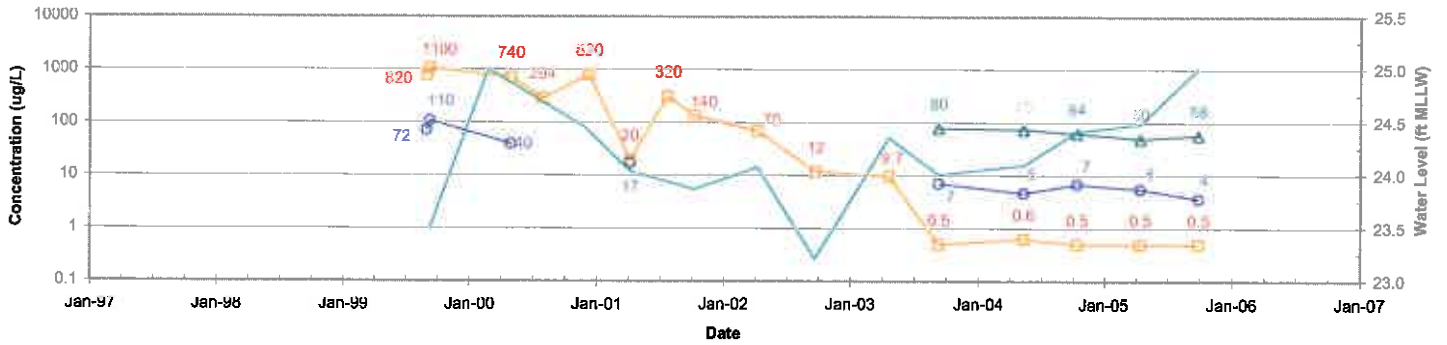
Time-Series Plot for B-022



Legend: Benzene (orange square), GRO (green triangle), EDC (blue circle), Water Level (teal line)

Figure 6
Time-Series Charts
 North Bay Project

Time-Series Plot for B-031



Time-Series Plot for B-039

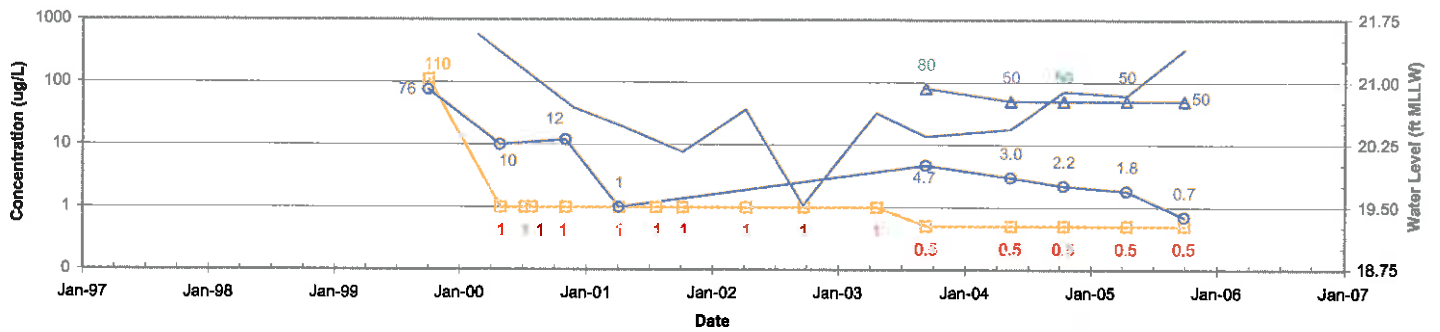


Table B1
New Well Survey Data
 Tesoro North Bay Property

Well No.	Survey Date	Easting	Northing	Elevation TOC <i>(ft MLLW)</i>	Elevation Gnd. <i>(ft MLLW)</i>
B-051	15-Feb-06	5008.1	5091.7	88.92	87.0
B-052	15-Feb-06	5072.2	4998.3	88.53	87.0
B-053	15-Feb-06	5055.2	4990.1	87.49	85.8

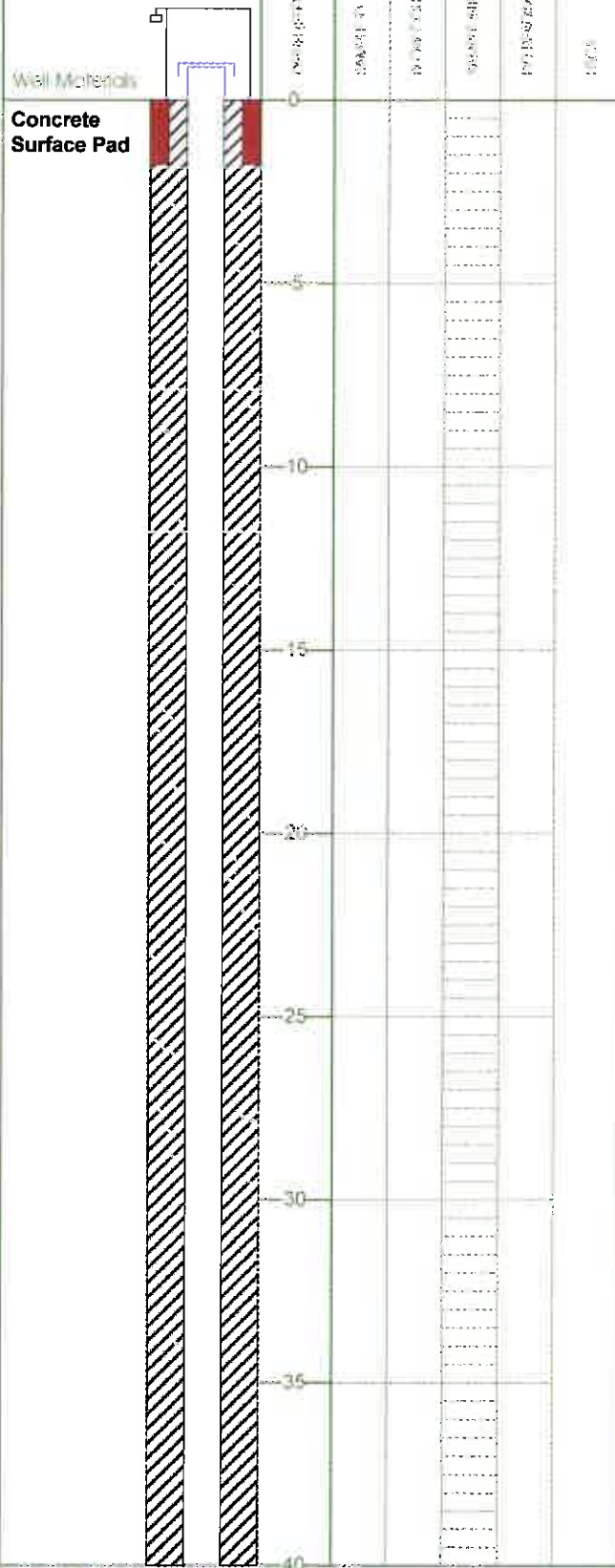
Note: Nearby wells used as local benchmarks.
 Locations surveyed by tape and compass and elevations by level.
 TOC - top of well casing

BORING AND WELL CONSTRUCTION LOG

WELL B-51

Elevation Ground: 86.9
 Elevation TOC: 88.92
 Total BH Depth: 65 feet
 Total Well Depth: 63.5 feet

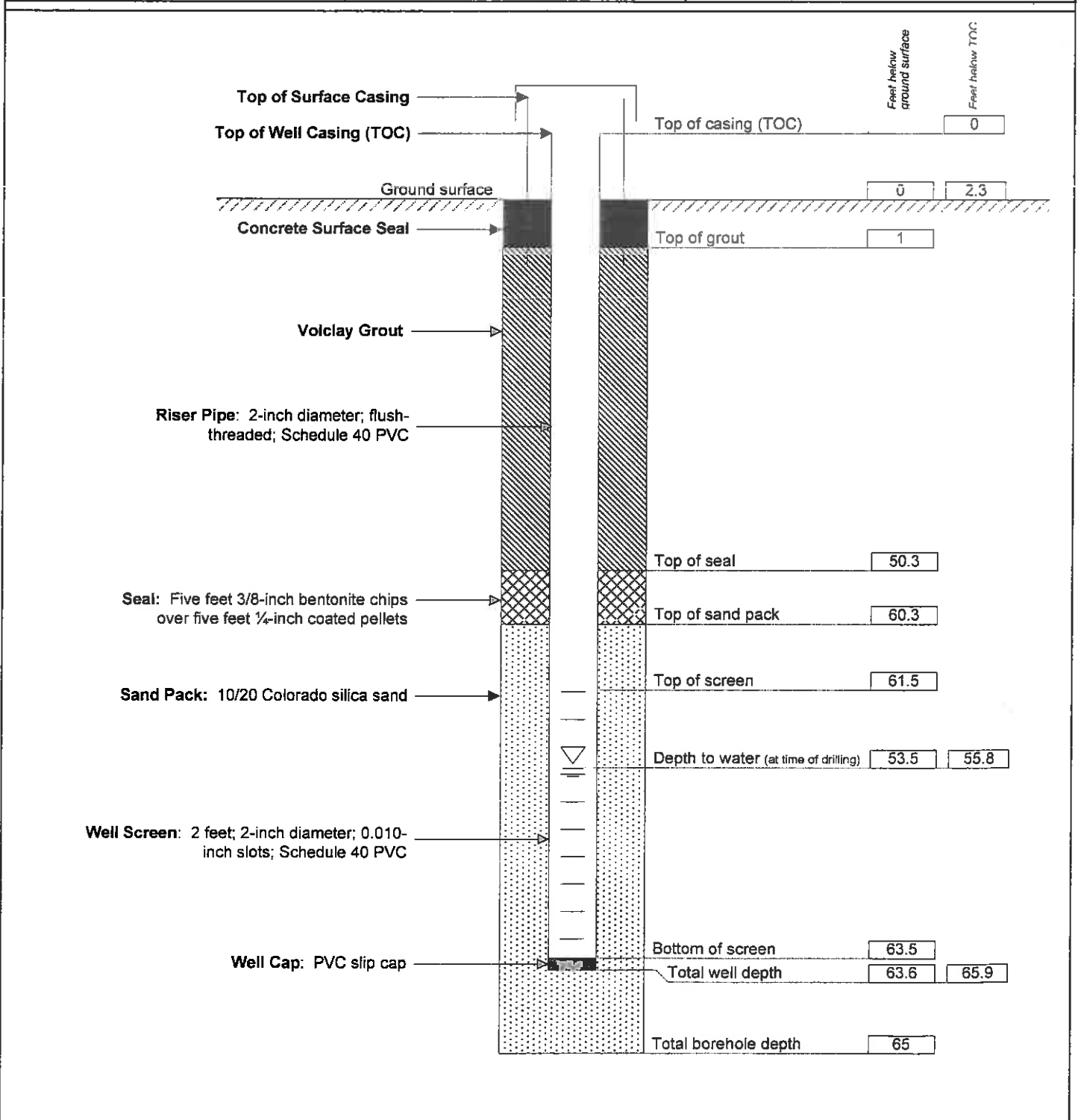
CUSTOMER: Tesoro Alaska Co. DRILLER: Hughes Drilling
 PROJECT SITE: North Bay DRILLING METHOD: Hollow-stem auger
 PROJECT NO.: 01-59 SAMPLING METHOD: 2-in split spoon
 AREA: Phase-3 AS system START DATE: 11/2/2005
 GEOLOGIST: Clay Sullivan END DATE: 11/4/2005



As-Built Diagram

Well B-51

Well Location: Phase 3 AS	Ground Elevation: 86.9	Drilling Company: Hughes Drilling
Date Installed: 11/4/05	TOC Elevation: 88.92	Driller: P. Smith
Date Developed: 12/23/2005	Northing: 5091.7	Drilling Rig: CME-75
Project Number: 01-59	Easting: 5008.1	Drilling Method: HSA
Geologist: C. Sullivan	Elevation Datum: feet MLLW	

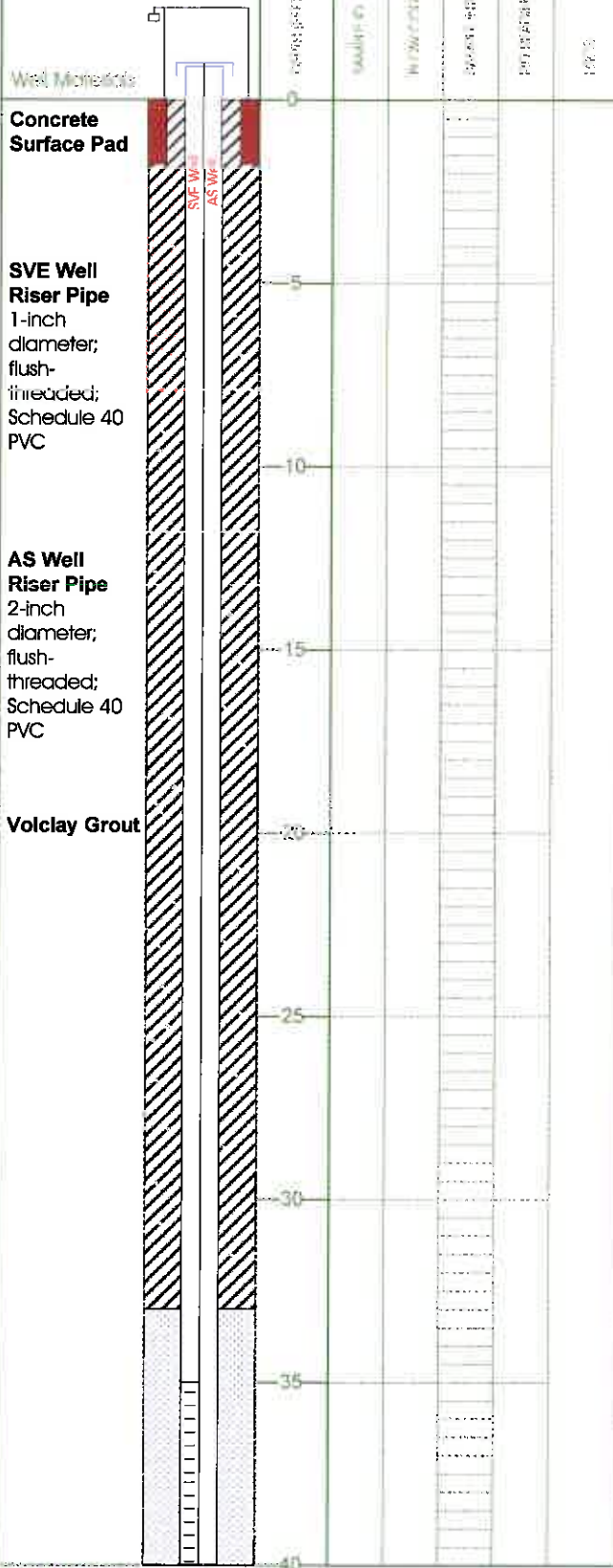


BORING AND WELL CONSTRUCTION LOG

WELL B-52

Elevation Ground: 87.0
 Elevation TOC: 88.53
 Total BH Depth: 65 feet
 Total Well Depth: 64.3 feet

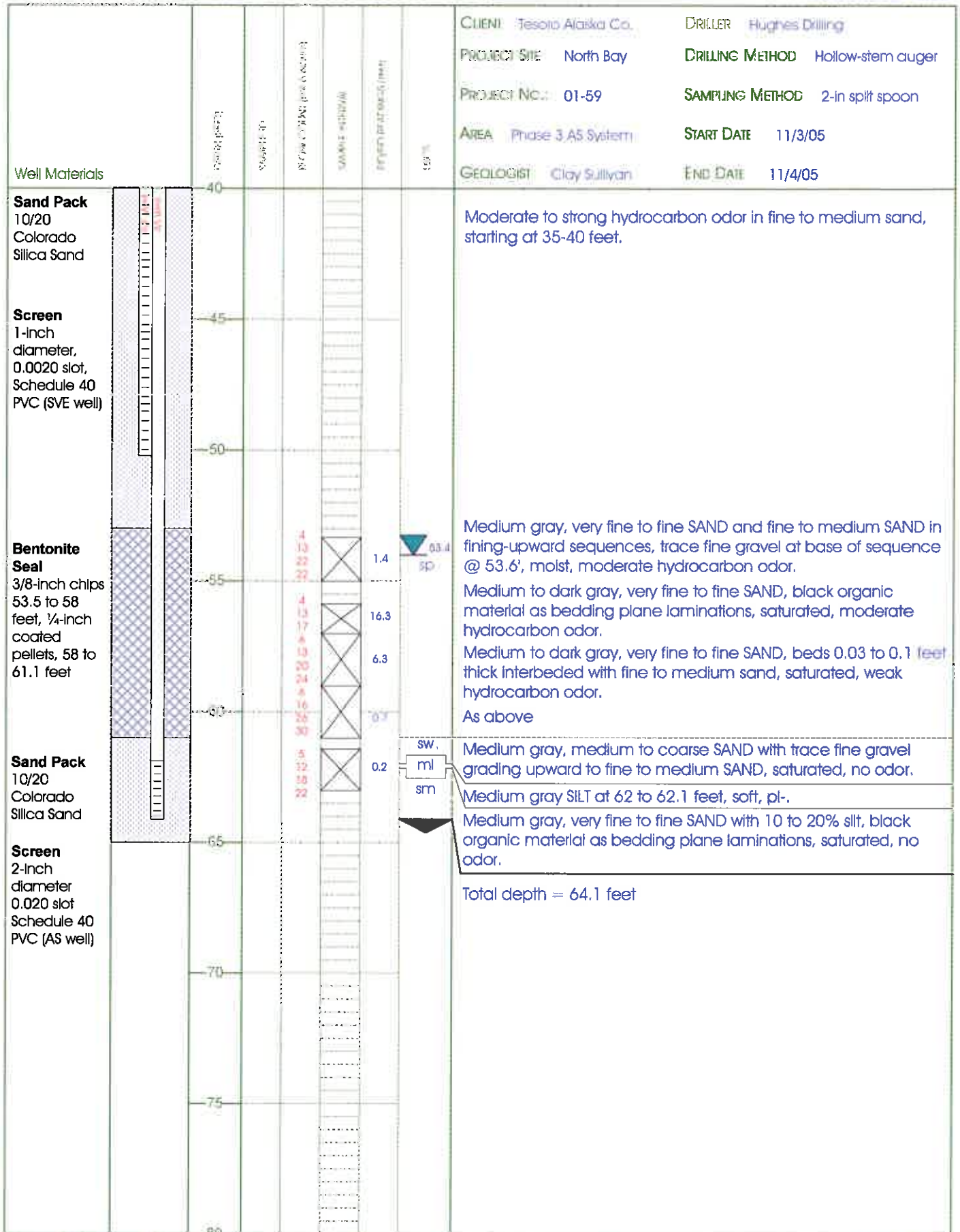
CLIENT: Tesoro Alaska Co. DRILLER: Hughes Drilling
 PROJECT SITE: North Bay DRILLING METHOD: Hollow-stem auger
 PROJECT NO.: 01-59 SAMPLING METHOD: 2-in split spoon
 AREA: Phase 3 AS System START DATE: 11/3/2005
 GEOLOGIST: Clay Sullivan END DATE: 11/4/2005



Borehole not logged above the water table.

BORING AND WELL CONSTRUCTION LOG

WELL B-52



As-Built Diagram

Well B-52

Well Location: Phase 3 AS

Ground Elevation: 87.0

Drilling Company: Hughes Drilling

Date Installed: 11/4/05

TOC Elevation: 88.53

Driller: P. Smith

Date Developed: 12/23/2005

Northing: not surveyed

Drilling Rig: CME-75

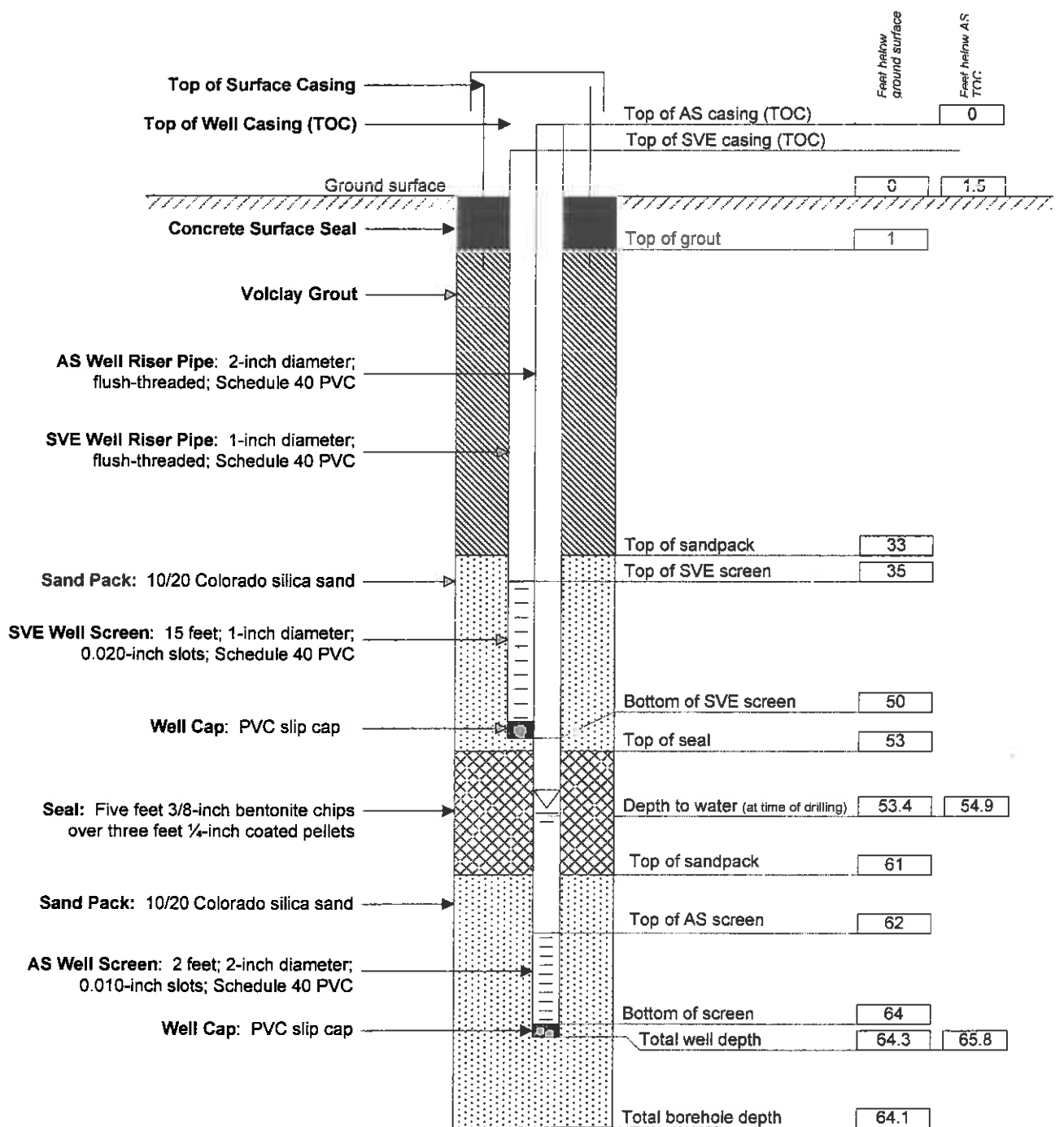
Project Number: 01-59

Easting: not surveyed

Drilling Method: HSA

Geologist: C. Sullivan

Elevation Datum: feet MLLW

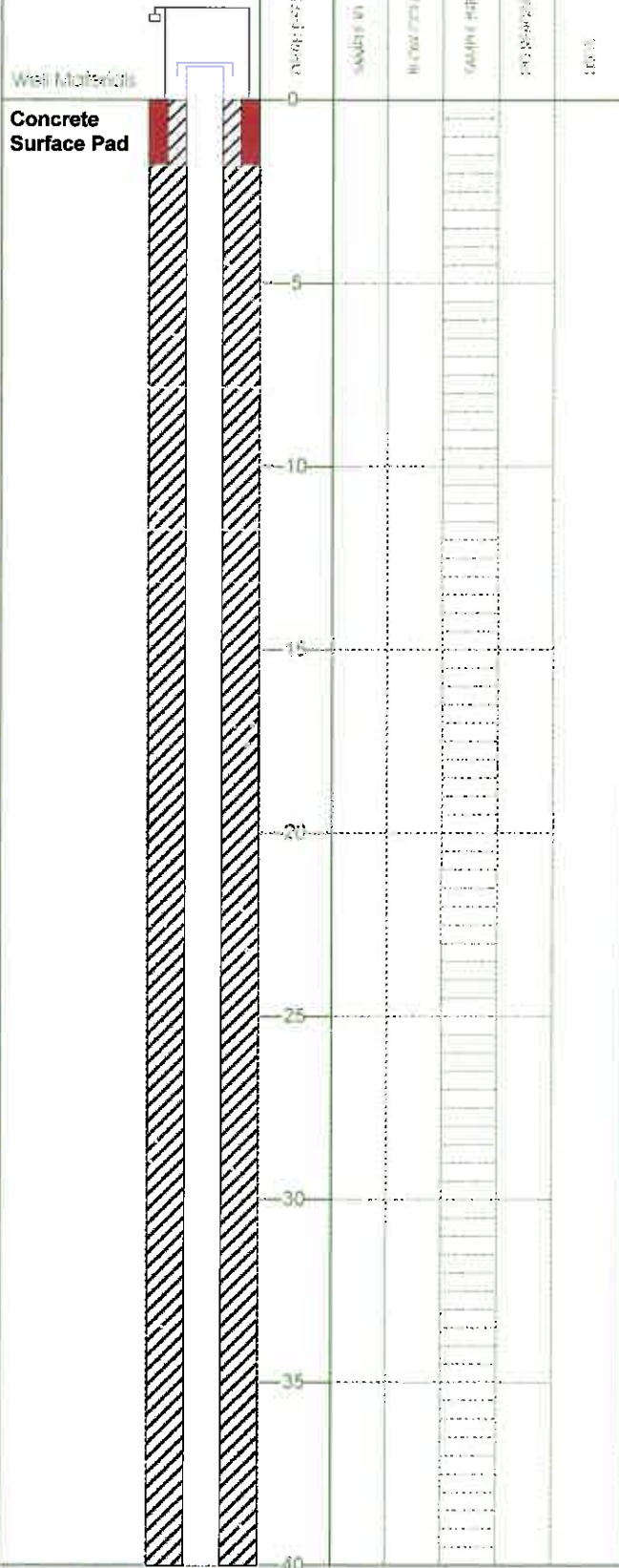


BORING AND WELL CONSTRUCTION LOG

WELL B-53

Elevation Ground: 85.8
 Elevation TOC: 87.49
 Total BH Depth: 65 feet
 Total Well Depth: 63.5 feet

CLIENT: Tesoro Alaska Co. DRILLER: Hughes Drilling
 PROJECT SITE: North Bay DRILLING METHOD: Hollow-stem auger
 PROJECT NO.: 01-59 SAMPLING METHOD: 2-in split spoon
 AREA: Phase 3 AS System START DATE: 11/3/2005
 GEOLOGIST: Clay Sullivan END DATE: 11/4/2005



Borehole not logged above the water table.

BORING AND WELL CONSTRUCTION LOG

WELL B-53

Well Materials		DEPTH (FEET)	SAMPLE ID	PICTURE COLUMN (Per A. 10/05)	SAMPLE INTERVAL	PICTURE INTERVALS (FEET)	USCS	CLIENT	DRILLER
								Tesoro Alaska Co.	Hughes Drilling
								PROJECT SITE	DRILLING METHOD
								North Bay	Hollow-stem auger
								PROJECT NO.:	SAMPLING METHOD
								01-59	2-in split spoon
								AREA	START DATE
								Phase 3 AS System	11/3/05
								GEOLOGIST	END DATE
								Clay Sullivan	11/4/05
Riser Pipe 2-inch diameter; flush-threaded; Schedule 40 PVC		40							
Volclay Grout Above 52 feet		45							
Bentonite Seal 3/8-inch chips, 52.2 to 57.2 feet; 1/4-inch coated pellets 57.2 to 60.3		50							
		55							
		58.5						63.5	
		60	6	X	0.2	sp			Medium to dark gray, fine to medium SAND with zones containing some very fine sand, saturated, no odor.
			10	X					
			14	X					
			16	X	0.0				As above, layer of coal chips at 58.1 feet.
			7	X					
			14	X					
			16	X					
			18	X					
			3	X	0.0	ml			Dark gray, medium to coarse SAND with trace fine gravel at base of bed, saturated, no odor.
			6	X					
			14	X					
			2	X	0.0	sw			Medium gray SILT with 10 to 20% very fine sand, soft to firm, pl-.
			6	X					
			9	X					Medium to dark gray, very fine to medium SAND, black organic material in lamination, saturated, no odor.
			11	X					
			2	X	0.0	ml			Medium gray SILT with 20 to 30% very fine sand, soft, pl-.
			8	X					
			10	X					
			16	X					
Screen 2-inch diameter, 0.020 slot; Schedule 40 PVC		65							
Sand Pack 10/20 Colorado Silica Sand		70							
		75							
		80							
								Total depth = 65 feet	

As-Built Diagram

Well B-53

Well Location: Phase 3 AS

Ground Elevation: 85.8

Drilling Company: Hughes Drilling

Date Installed: 11/3/05

TOC Elevation: 87.49

Driller: P. Smith

Date Developed: 12/23/2005

Northing: not surveyed

Drilling Rig: CME-75

Project Number: 01-59

Easting: not surveyed

Drilling Method: HSA

Geologist: C. Sullivan

Elevation Datum: feet MLLW

