

LETTER WORK PLAN

Well Removal Activities

**Former Underground Storage Tank Site 957/970
Former Department of Defense Housing Facility Novato
Novato, California**

**Contract No. N62583-11-D-0515
Task Order No. 021
DCN BATL-0515-0021-0005**

Prepared for



**Base Realignment and Closure, Program Management Office West
Naval Facilities Engineering Command**

Prepared by

Battelle
The Business of Innovation

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Introduction

Through previous evaluations of the monitoring well network at the Former Underground Storage Tank (UST) Site 957/970 at the Former Department of Defense Housing Facility Novato (herein referred to as the Site) it was determined that 24 monitoring wells are no longer necessary to meet data quality objectives. The Navy discussed the list of unnecessary wells with the San Francisco Regional Water Quality Control Board (Water Board) and California Department of Toxic Substances Control (DTSC), and ultimately presented it in the Annual Site Status Report for 2012,¹ both of which were approved by the regulatory agencies. In addition, performance monitoring data from the leading edge treatment area indicate that the primary remedial goal has been met. Therefore, the Navy plans to proceed with abandoning the approved list of monitoring wells and all of air sparge wells associated with the leading edge treatment system (see Table 1) starting in October 2013 such that the process can be completed before the start of the rainy season. Battelle will execute the work by following the procedures described herein; the work will be done under Contract No. N62473-08-D-8824, Task Order 09 and Contract No. N62583-11-D-0515, Task Order No. 021.

Monitoring Wells for Removal

The 24 wells to be removed are shown in Figure 1 and include: IT-2MW-1, IT-2MW-2, IT-MW-81S, IT-PZ-5, MW-2D, MW-2E, MW-3B, MW-4B, MW-6B, MW-9A, MW-M10, MW-M16, MW-M17, MW-M2, MW-M22, MW-M25S, MW-M25D, MW-M26S, MW-M26D, MW-M3, NA-1, PZ-1, 957-MW1, and 957-MW3. Well construction details are provided in Table 1.

Air Sparge Wells for Removal

The 50 air sparge wells to be removed are shown in Figure 2 and include: AS-Z1-01, AS-Z1-02, AS-Z1-03, AS-Z1-04, AS-Z1-05, AS-Z1-06, AS-Z1-07, AS-Z1-08, AS-Z1-09, AS-Z1-10, AS-Z2-01, AS-Z2-02, AS-Z2-03, AS-Z2-04, AS-Z2-05, AS-Z2-06, AS-Z2-07, AS-Z2-08, AS-Z2-09, AS-Z2-10, AS-Z3-01, AS-Z3-02, AS-Z3-03, AS-Z3-04, AS-Z3-05, AS-Z3-06, AS-Z3-07, AS-Z3-08, AS-Z3-09, AS-Z3-10, AS-Z4-01, AS-Z4-02, AS-Z4-03, AS-Z4-04, AS-Z4-05, AS-Z4-06, AS-Z4-07, AS-Z4-08, AS-Z4-09, AS-Z4-10, AS-Z5-01, AS-Z5-02, AS-Z5-03, AS-Z5-04, AS-Z5-05, AS-Z5-06, AS-Z5-07, AS-Z5-08, AS-Z5-09, and AS-Z5-10. Prior to air sparge well removal activities, the former treatment area will be cleared of all obstructions including aboveground piping and other components associated with the treatment system. The main air delivery trunk and five corresponding sparge zone air flow manifolds will be disconnected and removed. Additionally, all adjacent piping associated with the air sparge wells will be removed. Removal of all air sparge system piping prior to air sparge well removal will allow the drillers to maneuver safely within the former treatment area to properly abandon the air sparge wells. As with the monitoring wells planned for removal, the air sparge well construction details are provided in Table 1.

Well Removal and Site Restoration Procedures

Wells will be removed by Gregg Drilling through a subcontract to Battelle with oversight by a Battelle employee to ensure all required procedures are followed. Gregg's current C-57 drilling license will be documented prior to the completion of the work. In addition, a well destruction permit will be filed with the Marin County Department of Environmental Health Services prior to the event.

¹ Battelle. 2013. *Final Annual Site Status Report for the Year 2012, Former UST Site 957/970, Former Department of Defense Housing Facility Novato, Novato, California*. February.

Well destruction activities will be completed by following the California Department of Water Resources Well Standard Bulletins 74-90 (Supplement to Bulletin 74-81), Part III² and County of Marin Environmental Health Services well destruction permit application requirements³. Well removal activities include:

1. The concrete surface completions will be destroyed using a jackhammer. Concrete will be removed and stored in 55-gallon drums or approved roll-off bins (separate from any soil derived from well removal) for disposal at a non-hazardous waste disposal facility after work is completed.
2. The well will then be drilled with a hollow stem auger to remove all related construction debris (e.g., sand, bentonite). Each borehole will be drilled 1 foot deeper than the total depth listed in Table 1 to ensure total removal of all material. Polyvinyl chloride (PVC) completion pipes will then be pulled from the well and properly disposed of. All soil derived during this process will be stored in 55-gallon drums or approved roll-off bins (separate from surface completion concrete).
3. After well construction material is removed, the borehole will be tremie pressure grouted and completed with neat cement up to approximately 1ft below ground surface (bgs),
4. The remaining borehole volume will be backfilled and the surface will be restored to match the existing surface using soil in open areas and either concrete with dye or cold-patch in areas of asphalt.

In addition to the well removal procedures described above, PVC casing from each well will be photographed next to the borehole. The photograph will be included in a final Well Completion Report Form which meets the standards set forth in the California Department of Water Resources (DWR) Form 188⁴ and submitted to the County of Marin Environmental Health Services.

Waste Disposal Procedures

All soil will be characterized prior to disposal. All derived wastes will be disposed of at an approved waste disposal facility. PVC pipe length and estimated soil waste quantities are presented in Table 2. Approximately two 20-cubic yard roll-off bins will be required to hold waste soil. Sizes of concrete monitoring well completions are variable, but may have an average volume of approximately 20 gallons of concrete each, which would require nine 55-gallon drums for disposal.

² California Department of Water Resources. 1991. California Well Standards, Bulletin 74-90. June.

³ County of Marin Environmental Health Services.

http://www.co.marin.ca.us/depts/CD/main/pdf/EHS/water_program/WellDestructionApplicationandInstructions.pdf.

⁴ http://www.water.ca.gov/pubs/groundwater/well_completion_report_dwr_188/dwr188_prd.pdf

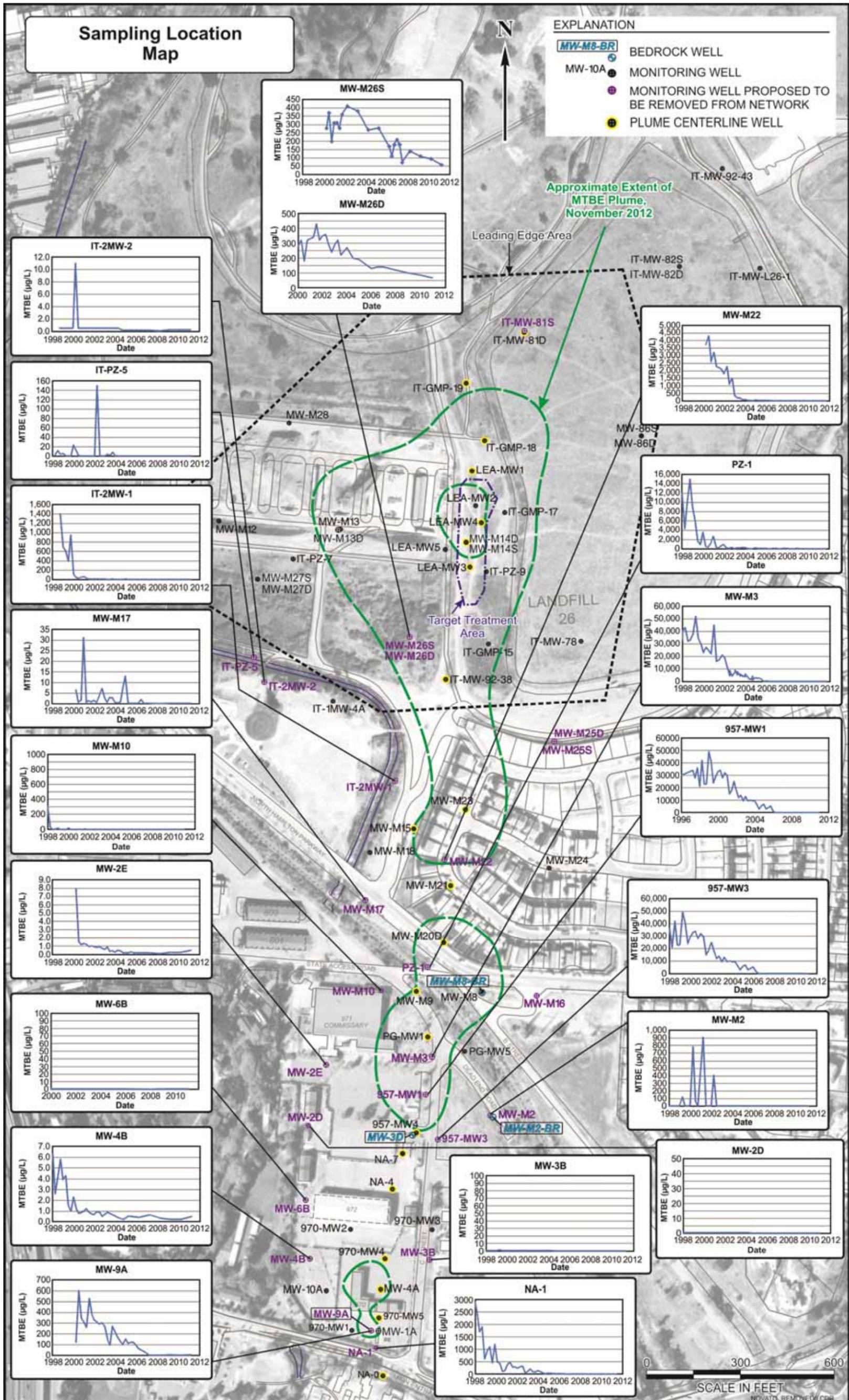


Figure 1. Monitoring Wells Scheduled for Removal

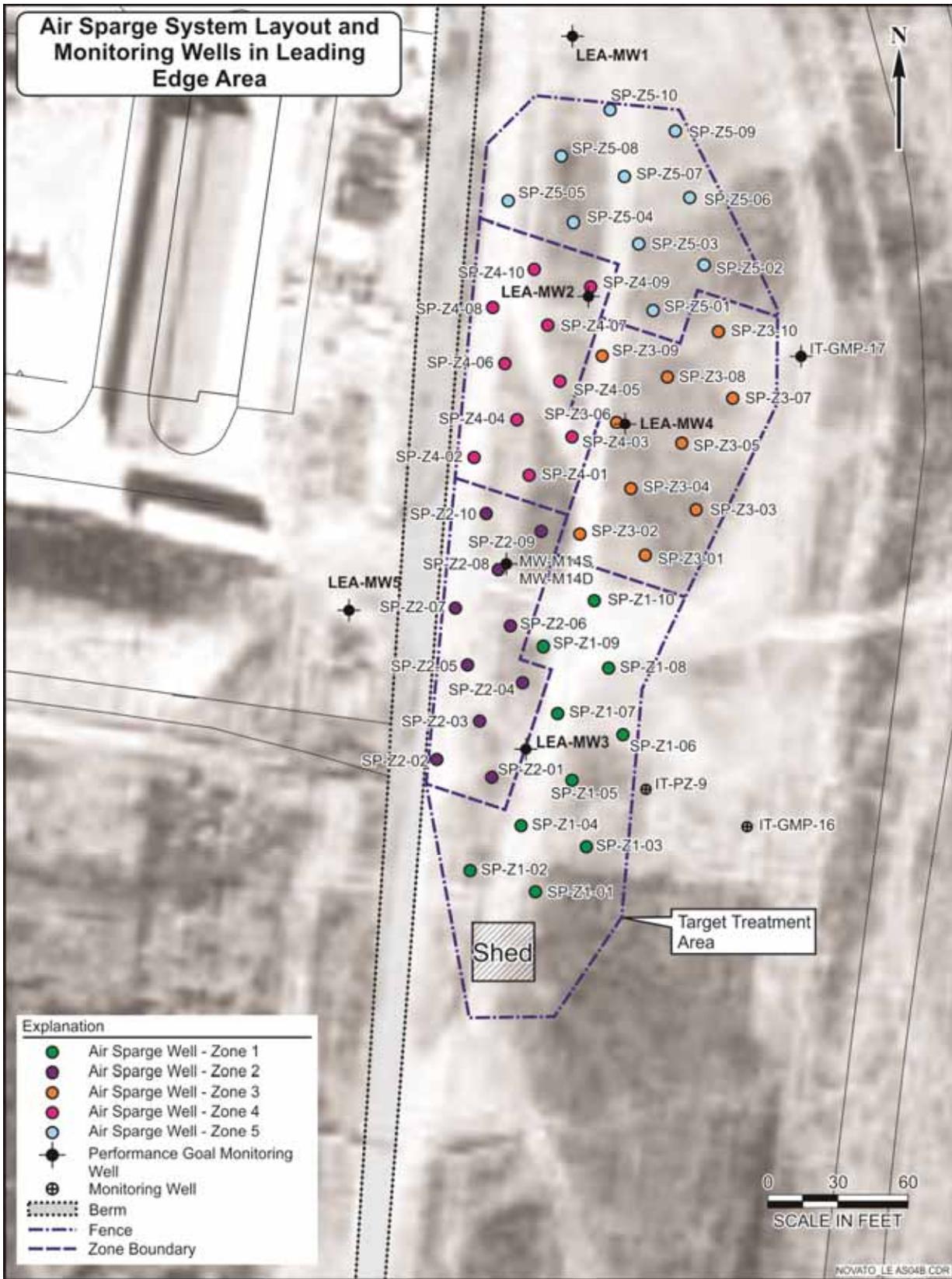


Figure 2. Air Sparge Wells Scheduled for Removal

Table 1. Well Construction Details for Wells to be Removed

Well	Date Drilled	Diameter (in.)	Screen Top (ft bgs)	Screen Bottom (ft bgs)	Total Depth (ft bgs)
<i>Monitoring Wells</i>					
IT-2MW-1	1/28/99	2	5	15	17
IT-2MW-2	1/28/99	2	10	25	26
IT-MW-81S	Unknown	4	4	12	12
IT-PZ-5	4/17/97	2	3.4	13.4	14.5
MW-2D	5/5/98	1	5	15	15
MW-2E	9/21/00	1	5.5	17.5	17.5
MW-3B	5/2/98	1	6	11	11.5
MW-4B	5/1/98	1	5	15	15
MW-6B	9/25/00	1	5	15	15
MW-9A	8/17/01	1	27	32	32
MW-M10	12/7/98	2	6	16	16.5
MW-M16	9/23/00	1	9	14	14
MW-M17	9/21/00	1	5	15	15
MW-M2	5/5/98	1	9	14	15
MW-M22	9/22/00	1	9	14	14
MW-M25S	9/23/00	1	6.5	9.5	18.5
MW-M25D	9/23/00	1	13.5	18.5	18.5
MW-M26S	9/24/00	1	7	12	22
MW-M26D	9/24/00	1	17	22	22
MW-M3	5/5/98	1	10.5	15.5	15.5
NA-1	4/29/98	1	9	14	14
PZ-1	5/15/02	3/4	9.77	14.27	14.27
957-MW1	12/15/94	4	7.9	17.9	18.25
957-MW3	12/16/94	4	8.11	18.11	18.5
<i>Air Sparge Wells</i>					
AS-Z1-01	11/1/2010	1	18.15	20.15	20.15
AS-Z1-02	11/1/2010	1	18.9	20.9	20.9
AS-Z1-03	11/1/2010	1	21.25	23.25	23.25
AS-Z1-04	11/1/2010	1	14.7	16.7	16.7
AS-Z1-05	10/29/2010	1	10.42	12.42	12.42
AS-Z1-06	10/29/2010	1	19.13	21.13	21.13
AS-Z1-07	10/29/2010	1	19.26	21.26	21.26
AS-Z1-08	10/29/2010	1	18.72	20.72	20.72
AS-Z1-09	10/27/2010	1	19.1	21.1	21.1
AS-Z1-10	10/27/2010	1	22.55	24.55	24.55
AS-Z2-01	11/1/2010	1	17.8	19.8	19.8
AS-Z2-02	10/29/2010	1	19.83	21.83	21.83
AS-Z2-03	10/28/2010	1	20.63	22.63	22.63
AS-Z2-04	10/28/2010	1	22.15	24.15	24.15
AS-Z2-05	10/28/2010	1	18.75	20.75	20.75
AS-Z2-06	10/28/2010	1	22.58	24.58	24.58
AS-Z2-07	10/28/2010	1	22.37	24.37	24.37
AS-Z2-08	10/27/2010	1	13.1	15.1	15.1
AS-Z2-09	10/27/2010	1	15.21	17.21	17.21
AS-Z2-10	10/27/2010	1	14.1	16.1	16.1
AS-Z3-01	10/22/2010	1	17.56	19.56	19.56
AS-Z3-02	10/27/2010	1	14	16	16
AS-Z3-03	10/20/2010	1	16.58	18.58	18.58

Table 1. Well Construction Details for Wells to be Removed (Continued)

Well	Date Drilled	Diameter (in.)	Screen Top (ft bgs)	Screen Bottom (ft bgs)	Total Depth (ft bgs)
AS-Z3-04	10/22/2010	1	17.2	19.2	19.2
AS-Z3-05	10/22/2010	1	18.1	20.1	20.1
AS-Z3-06	10/22/2010	1	17.67	19.67	19.67
AS-Z3-07	10/19/2010	1	17.2	19.2	19.2
AS-Z3-08	10/21/2010	1	17.8	19.8	19.8
AS-Z3-09	10/22/2010	1	17.9	19.9	19.9
AS-Z3-10	10/19/2010	1	17.25	19.25	19.25
AS-Z4-01	10/27/2010	1	15.75	17.75	17.75
AS-Z4-02	10/26/2010	1	15	17	17
AS-Z4-03	10/26/2010	1	18.18	20.18	20.18
AS-Z4-04	10/26/2010	1	17.71	19.71	19.71
AS-Z4-05	10/26/2010	1	21.39	23.39	23.39
AS-Z4-06	10/26/2010	1	18.1	20.1	20.1
AS-Z4-07	10/25/2010	1	19.55	21.55	21.55
AS-Z4-08	10/26/2010	1	19.4	21.4	21.4
AS-Z4-09	10/22/2010	1	18.15	20.15	20.15
AS-Z4-10	10/25/2010	1	21.19	23.19	23.19
AS-Z5-01	10/21/2010	1	22.9	24.9	24.9
AS-Z5-02	10/20/2010	1	21.5	23.5	23.5
AS-Z5-03	10/21/2010	1	19.1	21.1	21.1
AS-Z5-04	10/25/2010	1	18.2	20.2	20.2
AS-Z5-05	10/25/2010	1	19.37	21.37	21.37
AS-Z5-06	10/20/2010	1	18.3	20.3	20.3
AS-Z5-07	10/21/2010	1	17.91	19.91	19.91
AS-Z5-08	10/25/2010	1	17.41	19.41	19.41
AS-Z5-09	10/20/2010	1	19.12	21.12	21.12
AS-Z5-10	10/21/2010	1	19.85	21.85	21.85

Table 2. Estimated Amount of Non-Hazardous Waste

Well	Proposed Drilling Depth (ft bgs)	Length of PVC* (ft)	Estimated Amount of Soil Waste (gal)
<i>Monitoring Wells**</i>			
IT-2MW-1	18	19.03	97
IT-2MW-2	27	28.37	149
IT-MW-81S	13	11.52	63
IT-PZ-5	15.5	16.91	83
MW-2D	16	14.76	88
MW-2E	18.5	16.84	102
MW-3B	12.5	11.07	67
MW-4B	16	14.52	88
MW-6B	16	14.45	88
MW-9A	33	31.79	187
MW-M10	17.5	15.98	95
MW-M16	15	13.47	82
MW-M17	16	14.44	88
MW-M2	16	14.42	88
MW-M22	15	13.38	82
MW-M25S	19.5	21.04	108
MW-M25D	19.5	21.04	108
MW-M26S	23	24.92	129
MW-M26D	23	24.9	129
MW-M3	16.5	14.87	91
NA-1	15	13.78	82
PZ-1	15.27	13.89	83
957-MW1	19.25	17.97	96
957-MW3	19.5	18.28	97
<i>Air Sparge Wells***</i>			
AS-Z1-01	21.15	20.15	54
AS-Z1-02	21.9	20.9	56
AS-Z1-03	24.25	23.25	62
AS-Z1-04	17.7	16.7	46
AS-Z1-05	13.42	12.42	35
AS-Z1-06	22.13	21.13	57
AS-Z1-07	22.26	21.26	57
AS-Z1-08	21.72	20.72	56
AS-Z1-09	22.1	21.1	57
AS-Z1-10	25.55	24.55	66
AS-Z2-01	20.8	19.8	54
AS-Z2-02	22.83	21.83	59
AS-Z2-03	23.63	22.63	61
AS-Z2-04	25.15	24.15	65
AS-Z2-05	21.75	20.75	56
AS-Z2-06	25.58	24.58	66
AS-Z2-07	25.37	24.37	65
AS-Z2-08	16.1	15.1	41
AS-Z2-09	18.21	17.21	47
AS-Z2-10	17.1	16.1	44

Well	Proposed Drilling Depth (ft bgs)	Length of PVC* (ft)	Estimated Amount of Soil Waste (gal)
AS-Z3-01	20.56	19.56	53
AS-Z3-02	17	16	44
AS-Z3-03	19.58	18.58	50
AS-Z3-04	20.2	19.2	52
AS-Z3-05	21.1	20.1	54
AS-Z3-06	20.67	19.67	53
AS-Z3-07	20.2	19.2	52
AS-Z3-08	20.8	19.8	54
AS-Z3-09	20.9	19.9	54
AS-Z3-10	20.25	19.25	52
AS-Z4-01	18.75	17.75	48
AS-Z4-02	18	17	46
AS-Z4-03	21.18	20.18	54
AS-Z4-04	20.71	19.71	53
AS-Z4-05	24.39	23.39	63
AS-Z4-06	21.1	20.1	54
AS-Z4-07	22.55	21.55	58
AS-Z4-08	22.4	21.4	58
AS-Z4-09	21.15	20.15	54
AS-Z4-10	24.19	23.19	62
AS-Z5-01	25.9	24.9	67
AS-Z5-02	24.5	23.5	63
AS-Z5-03	22.1	21.1	57
AS-Z5-04	21.2	20.2	55
AS-Z5-05	22.37	21.37	58
AS-Z5-06	21.3	20.3	55
AS-Z5-07	20.91	19.91	54
AS-Z5-08	20.41	19.41	53
AS-Z5-09	22.12	21.12	57
AS-Z5-10	22.85	21.85	59
TOTAL			5,117

*PVC pipe length includes pipe stick-up.

**Assumes wells removed with 12-inch hollow-stem auger to total depth plus 1ft. Casing volume has been subtracted from the estimates.

***Assumes wells removed with 8-inch hollow-stem auger to total depth plus 1ft. Casing volume has been subtracted from estimates