1.0 INTRODUCTION

This report presents an evaluation of options for remedial activities related to the Main Seep located north of the North Country Environmental Services, Inc. (NCES) landfill facility on the south bank of the Ammonoosuc River in Bethlehem, New Hampshire. Sanborn, Head & Associates, Inc. (SHA) prepared this report on behalf of NCES in accordance with Condition 15 of the Groundwater Management and Release Detection Permit (No. GWP-198704033-B-004) issued to NCES on November 10, 2002 by the New Hampshire Department of Environmental Services (NHDES).

2.0 BACKGROUND SUMMARY

Four springs located along the southerly bank of the Ammonoosuc River and several surface water monitoring stations in and near the river are included in the monitoring program for the landfill facility. The Main Seep (the Seep), or sampling location S-1 shown on Figure 1, is the most prominent of the springs. The three other monitored springs are designated S-101, S-108, and S-109. Sampling point SF-1 is a surface water sampling location along the course of the Seep just prior to its discharge to the River. In addition, there are three surface water sampling locations in the River, designated AR-1 through AR-3. AR-1 is located where the easterly limit of the Groundwater Management Zone (GMZ) for the facility crosses the river; AR-2 is located just downstream of SF-1, where the Seep discharges to the river; and AR-3 is located at the westerly, downstream limit of the GMZ.

2.1 Hydrogeologic Setting of the Seep

The Seep is located off the landfill property, about 250 feet northeast of NCES's property line. The Seep emerges from the south bank of the Ammonoosuc River at an elevation approximately 80 feet above the River and approximately 60 feet below the elevation of Muchmore Road. The bank seepage comprising the head end of the Seep spans a lateral distance of about 25 feet. The slope of the south bank of the River in the vicinity of the Seep is estimated to be on the order of 1.5H:1V, and in some areas steeper. The slope is covered with dense brush, trees, and boulders and, in areas of bank seepage along the slope, occasional wetland-type vegetation.

The presence of the Seep along the south bank of the river is a direct reflection of the geology and hydrology of the area. Three prominent soil units have been observed to comprise the stratigraphy at the NCES Landfill site. From the ground surface down, these soils include an upper glacial till unit consisting mainly of fine to medium sand and silt with moderate amounts of coarse-grained material and lesser amounts of clay; a heterogeneous sequence of stratified drift deposits comprised of silt and fine sands commonly interfingered with coarser-grained "till-like" submembers; and a very dense lower glacial till unit comprised mainly of sand and gravel with lesser amounts of silt. In the northeast portion of the landfill site, the stratigraphy consists primarily of stratified drift overlying the lower glacial till unit. The texture and distribution of soils in the vicinity of the Seep and landfill imply a complicated depositional environment associated with glaciation of the area, and include ice-contact deposits and moving and/or stagnant water deposits interfingered among the prominent soil units.

In the vicinity of the Seep, groundwater moves from higher elevations in the south to the north toward the river. While groundwater moves through the entire saturated soil column (up to 250 feet in thickness in the vicinity), flow is locally more prominent in zones of coarser-grained materials. The Seep is a surficial expression of such a zone of coarser-grained materials. It is likely that either a former glacial meltwater channel or stringer of gravelly soils provides for a zone of convergent groundwater flow from south to north, discharging at the Seep. As can be seen on the cross-section provided on Figure 2, the Seep emerges at the contact between stratified drift and less permeable lower glacial till soils, discharging to the bank above the River. The Seep contains considerably higher flow than other areas of bank seepage in the vicinity. While the flow is expected to vary seasonally, on the basis of visual observations, flow rates at the head end of the Seep are estimated to be on the order of 50 to 100 gallons per minute.

On the basis of groundwater quality conditions (discussed below) it is known that the Seep discharges groundwater migrating from beneath the former unlined landfill at the NCES facility. The exact flow pathway from the former unlined landfill vicinity to the Seep is not known; this condition is made even more evident by the fact that there are smaller seeps adjacent to the Main Seep where there is no evidence of current or historical water quality impact.

2.2 Seep Water Quality

When first investigated in 1984, water quality conditions downgradient of the former unlined landfill at the NCES facility, including water quality at the Seep, were found to be degraded by a number of constituents present in landfill leachate. As part of subsequent development of the lined NCES landfill facility, all landfilled materials and visibly stained soils in the former unlined landfill were removed and placed in Stage I of the lined landfill. This relocation project began in December 1991 and was completed in October 1993. The presence and concentration of leachate constituents in the Seep increased as a result of exposing landfill materials during the waste relocation project, reaching maximum concentrations in 1994. Leachate constituent concentrations have decreased markedly since that time with many constituents, notably volatile organic compounds (VOCs), no longer being detected. A plot of total VOC concentrations vs. time for the Seep is provided as Figure 3. Though considerably lower than previously detected concentrations, iron and manganese continue to persist in groundwater discharging at the Seep at average concentrations of approximately 8.8 mg/l and 1.2 mg/l, respectively, during the most recent 12-month period (three monitoring events).

1995

2.3 Seep Appearance

The discoloration observed at the Seep is due to precipitation of iron and manganese from groundwater when the groundwater emerges at the ground surface and is oxidized. The current appearance of the Seep is the result of over twenty years of iron and manganese deposition on associated with glaciation of the area, and include ice-contact deposits and moving and/or stagnant water deposits interfingered among the prominent soil units.

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The discoloration observed at the Seep is due to precipitation of iron and manganese from groundwater when the groundwater emerges at the ground surface and is oxidized. The current appearance of the Seep is the result of over twenty years of iron and manganese deposition on the slope above the river. Since removal of the source of contamination (the former unlined landfill) in 1993, water quality conditions have improved significantly, with the remaining impact being the presence of iron and manganese and the discoloration associated with iron and manganese precipitation. Decomposition of waste materials and the production of leachate in the former unlined landfill consumed oxygen present in groundwater beneath the landfill, creating anaerobic (i.e., lack of oxygen) conditions beneath and downgradient of the landfill. These conditions altered the geochemical balance in groundwater, specifically, the oxidation-reduction potential. As a result, iron and manganese, which are naturally present in soils, are dissolved under the reducing conditions beneath and downgradient of the former unlined landfill and are transported to the north in groundwater. When the groundwater discharges at the Seep, the dissolved iron and manganese are oxidized and precipitate out of solution, resulting in the iron and manganese oxide deposition along the bank at and below the Seep. Natural attenuation processes will eventually restore the dissolved oxygen concentration in groundwater moving beneath the former unlined landfill which will, in turn, stabilize dissolution of iron and manganese from this vicinity and its eventual deposition at the Seep. Indeed, as the record of water quality data for the Seep indicates, water quality conditions at the Seep continue to improve with time, as a result of removal of the former unlined landfill and natural attenuation.

3.0 EVALUATION OF REMEDIAL ALTERNATIVES

This section presents an evaluation of remedial alternatives to address iron and manganese oxide deposition at the Seep resulting from oxidation of iron and manganese present in groundwater discharging from the Seep. We identified and reviewed a range of technologies and options potentially applicable to addressing the conditions at the Seep, including chemical treatment of groundwater and physical approaches to intercept/capture the Seep. In developing and evaluating the remedial options discussed below, the following key issues affecting all potential activities were considered:

- The Seep is located on a densely wooded, long, steep slope presumably existing at about the angle of repose for the soil. The elevation of the head of the Seep is approximately 60 feet below the nearest access area (Muchmore Road) and approximately 80 feet above the river. As a result, the Seep is not accessible to typical construction equipment, such as trucks, excavators, or support vehicles. Construction of a road to the Seep from Muchmore Road beginning proximate to the Seep would not be feasible due to the very steep natural slope angle of the bank. A road to the Seep would have to begin approximately 1,200 feet or more to the northwest where the elevation of Muchmore Road is closer to the river. Because this approach would require major disturbance of the slope, including wetlands crossings and potential stability and erosion concerns, remedial activities that require heavy equipment access to the Seep are judged to be unsuitable.

- The water quality of the Seep continues to improve. No VOCs have been detected in the Seep in over four years, and iron and manganese concentrations continue to decrease. Although turbid in the past, the Seep water is currently clear. The degraded appearance of

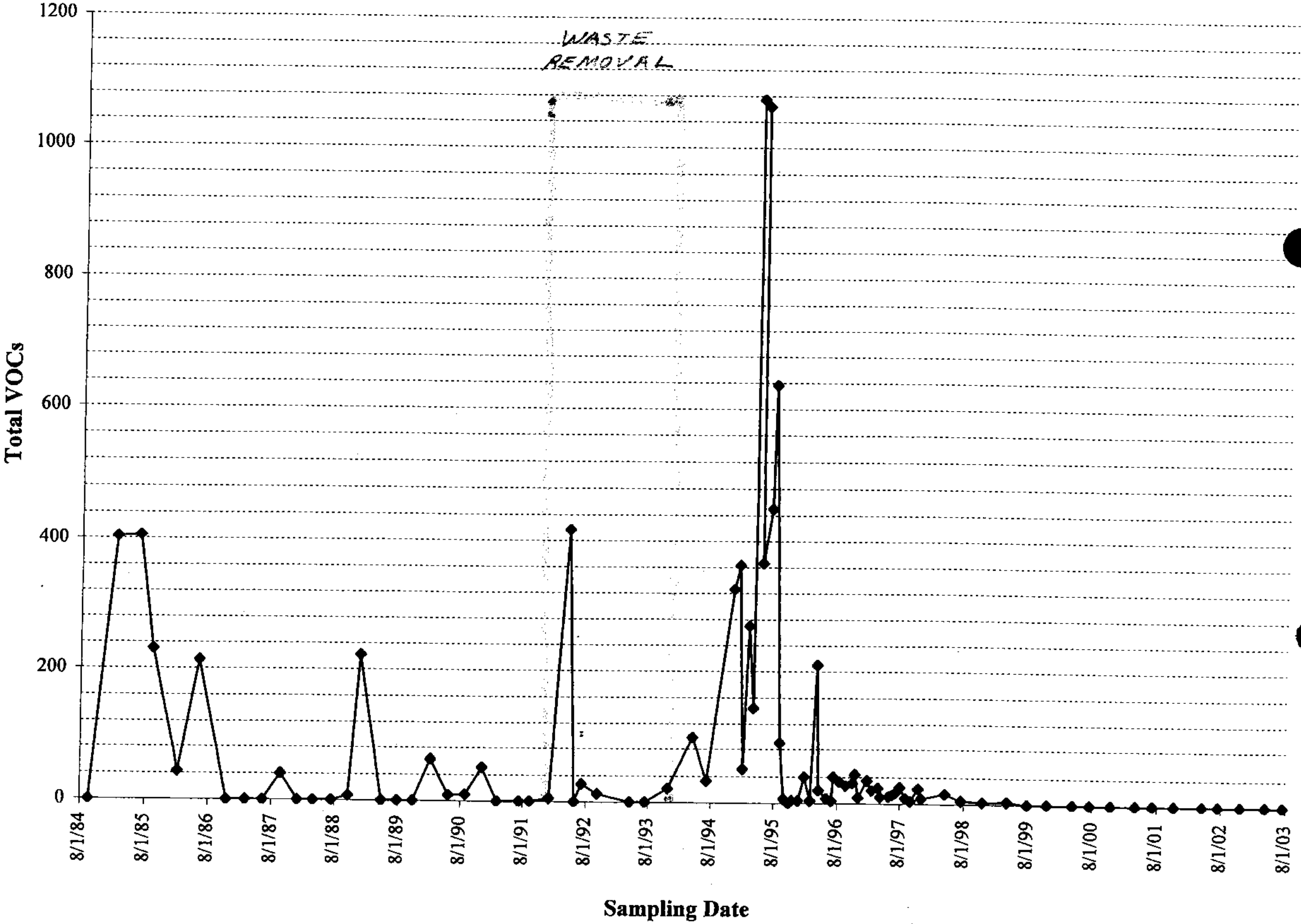
TOTAL VOCs

Round	Sampling	Groundwater																								
No.	Date	B-101	B-102	B-102S	B-103	B-103D	B-104	B-401	B-402U	B-402L	B-403U	B-403L	B-40	MW-913U	MW-913M	MW-913L	MW-914U	MW-914L	Seep	AR-1	AR-2	AR-3	SF-1	S-101	S-108	S-109
1	09-18-84	>10	>2790	-	>26	-	>0	-	-	-	-	-	-	-	-	-	-	-	>0	-	-	-	-	-	-	-
2	09-27-84	>31	>590	-	>337	-	BDL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	02-15-85	>6	>920	-	>934	-	>0	-	-	-	-	-	-	-	-	-	-	-	>395	-	-	-	-	-	-	-
4	06-24-85	>0	>260	-	>644	-	>0	-	-	-	-	-	-	-	-	-	-	-	>405	-	-	-	-	-	-	-
5	09-13-85	>9	>310	-	>506	-	BDL	-	-	-	-	-	-	-	-	-	-	-	>230	-	-	-	-	-	-	-
6	02-06-86	BDL	>87	-	>79	-	BDL	-	-	-	-	-	-	-	-	-	-	-	>43	-	-	-	-	-	-	-
7	06-05-86	>0	>240	-	>74	-	BDL	-	-	-	-	-	-	-	-	-	-	-	>213	-	-	-	-	-	-	-
8	11-15-86	>0	>1105	-	>120	-	BDL	-	-	-	-	-	-	-	-	-	-	-	BDL	-	-	-	-	-	-	-
9	03-03-87	>0	>262	BDL	>20	>30	BDL	-	-	-	-	-	-	-	-	-	-	-	BDL	-	-	-	-	-	-	-
10	06-11-87	BDL	>721	26	>53	>252	BDL	-	-	-	-	-	-	-	-	-	-	-	BDL	-	-	-	-	-	-	-
11	09-21-87	20	>929	42	>474	>450	-	BDL	BDL	BDL	BDL	BDL	BD	-	-	-	-	-	>40	-	-	-	-	-	-	-
12	12-29-87	7	647	BDL	>505	>255	-	BDL	BDL	BDL	BDL	BDL	BD	-	-	-	-	-	BDL	-	-	-	-	-	-	-
13	03-29-88	>0	682	BDL	>214	>19	-	BDL	BDL	BDL	BDL	BDL	BD	-	-	-	-	-	BDL	-	-	-	-	-	-	-
14	07-13-88	>56	>441	>0	>1016	>524	-	BDL	BDL	BDL	BDL	BDL	BD	-	-	-	-	-	BDL	-	-	-	-	-	-	-
15	10-17-88	>5	-	BDL	>516	>42	-	BDL	BDL	BDL	BDL	BDL	BD	-	-	-	-	-	>7	-	-	-	-	-	-	-
16	12-20-88	>82	-	>0	>467	>165	-	BDL	BDL	BDL	BDL	BDL	BD	-	-	-	-	-	>222	-	-	-	-	-	-	-
17	04-26-89	>331	-	>0	>458	>86	-	BDL	BDL	BDL	BDL	BDL	BD	-	-	-	-	-	>0	-	-	-	-	-	-	-
18	07-27-89	106	-	BDL	>48	>49	-	BDL	BDL	BDL	BDL	BDL	BC	-	-	-	-	-	BDL	-	-	-	-	-	-	-
19	10-26-89	94	>107	BDL	>9	50	-	BDL	BDL	BDL	BDL	BDL	BC	-	-	-	-	-	BDL	-	-	-	-	-	-	-
20	02-06-90	347	102	BDL	95	61	-	BDL	13	BDL	BDL	13	BC	-	-	-	-	-	63	-	-	-	-	-	-	-
21	05-23-90	102	68	BDL	40	49	-	BDL	BDL	BDL	BDL	BDL	7	-	-	-	-	-	9	-	-	-	-	-	-	-
22	08-29-90	195	142	-	27	58	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	10	-	-	-	-	-	-	-
23	12-03-90	211	227	BDL	55	51	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	51	-	-	-	-	-	-	-
24	02-28-91	>292	147	BDL	>40	44	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	BDL	-	-	-	-	-	-	-
25	07-08-91	>468	>313	96	>60	>54	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	BDL	-	-	-	-	-	-	-
26	09-09-91	916	1165	477	302	106	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	BDL	-	-	-	-	-	-	-
27	01-02-92	661	1563	234	1219	275	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	5	-	-	-	-	-	-	-
28	04-10-92	669	1376	178	624	279	-	120	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	417	-	-	-	-	-	-	-
29	05-26-92	-	-	-	-	-	-	BDL	-	-	-	-	-	-	-	-	-	-	BDL	-	-	-	-	-	-	-
30	07-08-92	889	938	507	787	298	-	50	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	27	-	-	-	-	-	-	-
31	10-07-92	846	1573	487	849	364	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	12	-	-	-	-	-	-	-
32	04-15-93	792	4006	161	723	660	-	BDL	80	BDL	BDL	BDL	BI	-	-	-	-	-	BDL	-	-	-	-	-	-	-
33	07-15-93	1033	2870	244	1078	1239	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	BDL	-	-	-	-	-	-	-
34	11-24-93	1028	2375	435	1476	1029	-	-	-	-	-	-	-	-	-	-	-	-	21	-	-	-	-	-	-	-
35	04-13-94	1820	6250	3	9020	1326	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	98	-	-	-	-	-	-	-
36	07-07-94	9700	13450	1466	3370	2880	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	33	-	-	-	-	-	-	-
37	11-28-94	5130	8330	1961	3570	3000	-		-	-	-	-	-	-	-	-	-	-	326	-	-	-	-	-	-	-
38	04-03-95	6120	3680	782	2120	2460	-		-	-	-	-		-	-	-	-	-	[illegible]	-	-	-	-	-	-	-
39	07-13-95	4940	1630	1014	1703	2520	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	636	-	BDL	-	-	-	-	-
40	11-95	3320	700	350	1190	1330	-		-	-	-	-	-	-	-	-	-	-	4	-	BDL	-	-	-	-	-
41	04-15,16-96	1680	447	964	191	650	-		BDL	BDL	BDL	BDL	BI	-	-	-	-	-	20	BDL	BDL	BDL	-	-	-	-
42	07-9, 10-96	1420	513	280	421	620	-	BDL	BDL	10	BDL	BDL	BI	-	-	-	-	-	40	BDL	BDL	BDL	140	-	-	-
43	11-11,12-96	2510	325	35	66	500	-	-	-	-	-	-	-	-	-	-	-	-	44	BDL	BDL	BDL	BDL	-	-	-
	12-11-96	-	-	-	-	-	-	-	-	BDL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	04-7,8,9-97	1198	67	109	52	413	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	10	BDL	BDL	BDL	BDL	-	-	-
45	07-7-16-97	672	55	12	6	265	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	16	BDL	BDL	BDL	BDL	BDL	1.3	1.2
46	11-11-13-97	531.8	27.2	16.4	16.3	165.9	-		-	-	-	-	-	-	-	-	-	-	23	BDL	BDL	BDL	BDL	-	-	-
47	04-13-15-98	102.4	224.2	4.9	109	69.8	-	BDL	BDL	BDL	BDL	BDL	14	-	-	-	-	-	15.1	-	-	-	BDL	-	-	-
48	07-13-15-98	46.5	278.3	16.8	6.5	67.6	-		-	-	-	-	-	-	-	-	-	-	5	BDL	BDL	BDL	BDL	BDL	2.6	3.8
49	11-16-18-98	17.4	50.2	6.4	3.2	121.7	-	1.0	BDL	BDL	BDL	BDL	1	-	-	-	-	-	2.9	-	-	-	BDL	-	-	-
50	04-05-08-99	43.5	48.3	9.5	30.7	77.5	-	2.5	BDL	BDL	BDL	0.8	1						4.1	-	-	-	BDL	-	-	-
51	07-27-29-99	50	33.8	9.8	12.9	44.1	-	-	-	-	-	-	-	-	-	-	-	-	BDL	BDL	BDL	BDL	BDL	BDL	2.2	2.6
52	11-17-18-99	50.4	23.8	BDL	3.7	27.6	-	BDL	BDL	BDL	BDL	BDL	1	-	-	-	-	-	BDL	-	-	-	BDL			
53	04-10-12-00	5.9	20.5	1.2	3.5	9.9	-	BDL	BDL	BDL	BDL	BDL	BI	-	-	-	-	-	BDL	-	-	-	BDL	-	-	-
54	07-17-19-00	3.9	12.3	1.3	6.2	12.4	-	-	-	-	-	-	-	-	-	-	-	-	BDL	BDL	BDL	BDL	BDL	BDL	1.4	4.5
55	11-13-15-00	3	16.4	1.7	8.4	16.3	-	BDL	5.6	BDL	BDL	1.4	BI	BDL	BDL	BDL	1.2	45.6	BDL	-	-	-	BDL	-		
56	04-02-04-01	4.3	14.2	BDL	6.4	11.2	-	BDL	5.9	BDL	BDL	2.3	BI	BDL	BDL	-	BDL	29.6	BDL	-	-	-	BDL	-	-	-
57	07-09-12-01	3.6	7.5	BDL	9.9	8.4	-	BDL	9.5	BDL	-	-		-	-	-	-	36.6	BDL	BDL	BDL	BDL	BDL	BDL	2	1.4
58	11-05-07-01	17.2	3.5	BDL	7.0	6.9	-	BDL	39.5	BDL	BDL	1.8	BI	BDL	BDL	-	BDL	-	BDL	-	-	-	BDL	-	-	-
59	04-15-17-02	5.3	1.3	BDL	4.5	4.7	-	BDL	46.7	BDL	BDL	2.0	BI	BDL	BDL	-	BDL	-	BDL	-	-	-	BDL	-	-	-
60	07-15-18-02	1.5	BDL	BDL	5	1.9	-	-	-	-	-	-		-	-	BDL	-	16.3	BDL	BDL	BDL	BDL	BDL	BDL	1.3	BDL
61	11-18-25-02	10.2	BDL	BDL	4	2.1	-	BDL	24.5	-	BDL	3.2	BI	BDL	BDL	-	BDL	-	BDL	-	-	-	BDL	-	-	-
62	04-07-10-03	2.2	BDL	BDL	1.7	1.1	-	BDL	46.7	BDL	BDL	1.7	BI	BDL	BDL	-	BDL	-	BDL	-	-	-	BDL	-	-	-
63	07-14-17-03	10.4	BDL	BDL	1.2	1.1	-		-	-	-	-	-	-	-	BDL	-	15.7	BDL	BDL	BDL	BDL	BDL	BDL	1.1	1.4

Unlined Landfill Waste Removal

LEGEND
- Indicates no testing performed.
Indicates an upgradient sampling location.
BDL - Indicates the result is below detection limits for parameters tested.
> - Indicates that the sum of the VOC's is greater than the value shown due to the presence of one or more parameters identified but in concentrations less than the detection limit.

FIGURE 7
Total VOCs (ppb)
MAIN SEEP (S-1)



Fe

Round No.	Sampling Date	B-101	B-102	B-102S	B-103	B-103D	B-104	B-401	B-402U	B-402L	04L	MW-913U	MW-913M	MW-913L	MW-914U	MW-914L	Seep	AR-1	AR-2	AR-3	SF-1	S-101	S-108	S-109
		Groundwater																						
1	09-18-84	170	280	-	230	-	380	-	-	-		-	-	-	-	-	3.9	-	-	-	-	-	-	-
2	09-27-84	490	230	-	73	-	1000	-	-	-		-	-	-	-	-	12	-	-	-	-	-	-	-
3	02-15-85	0.28	7.2	-	3.2	-	0.52	-	-	-		-	-	-	-	-	4.1	-	-	-	-	-	-	-
4	06-24-85	1.3	6.8	-	670	-	0.055	-	-	-		-	-	-	-	-	50	-	-	-	-	-	-	-
5	09-13-85	0.14	100	-	114	-	<0.01	-	-	-		-	-	-	-	-	29	-	-	-	-	-	-	-
6	02-06-86	0.11	30	-	92	-	<0.05	-	-	-		-	-	-	-	-	24	-	-	-	-	-	-	-
7	06-05-86	0.11	82	-	59	-	0.06	-	-	-		-	-	-	-	-	66	-	-	-	-	-	-	-
8	11-15-86	0.56	150	-	54	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-
9	03-03-87	0.03	110	14	57	2.6	0.06	-	-	-		-	-	-	-	-	1.4	-	-	-	-	-	-	-
10	06-11-87	0.04	96	6.3	69	22	0.03	-	-	-		-	-	-	-	-	2.6	-	-	-	-	-	-	-
11	09-21-87	<0.03	130	8.5	94	25	-	<0.05	0.8	<0.05		-	-	-	-	-	2.2	-	-	-	-	-	-	-
12	12-29-87	0.54	130	43	90	23	-	0.05	0.27	<0.03		-	-	-	-	-	2.7	-	-	-	-	-	-	-
13	03-29-88	2.4	140	20	94	13	-	0.07	0.06	0.04		-	-	-	-	-	1.5	-	-	-	-	-	-	-
14	07-13-88	0.33	120	110	78	18	-	0.22	0.38	<0.02		-	-	-	-	-	0.1	-	-	-	-	-	-	-
15	10-17-88	14	-	20	120	31	-	0.45	0.14	<0.03		-	-	-	-	-	2	-	-	-	-	-	-	-
16	12-20-88	17	-	14	140	35	-	0.2	0.8	<0.1		-	-	-	-	-	82	-	-	-	-	-	-	-
17	04-26-89	17	-	1.9	120	33	-	0.07	0.16	0.06		-	-	-	-	-	13	-	-	-	-	-	-	-
18	07-27-89	32	-	2.3	150	38	-	0.03	0.11	0.03		-	-	-	-	-	11	-	-	-	-	-	-	-
19	10-26-89	30	230	0.95	180	44	-	0.99	1.8	<0.03		-	-	-	-	-	17	-	-	-	-	-	-	-
20	02-06-90	39	200	0.65	180	56	-	<03	0.21	0.03		-	-	-	-	-	110	-	-	-	-	-	-	-
21	05-23-90	69	200	0.68	190	57	-	0.05	0.38	0.16		-	-	-	-	-	36	-	-	-	-	-	-	-
22	08-29-90	45	250	-	210	66	-	<0.03	0.08	0.03		-	-	-	-	-	30	-	-	-	-	-	-	-
23	12-03-90	34	240	11	170	50	-	0.072	0.39	0.04		-	-	-	-	-	28	-	-	-	-	-	-	-
24	02-28-91	49	230	37	200	67	-	0.074	1.5	0.16		-	-	-	-	-	0.48	-	-	-	-	-	-	-
25	07-08-91	85	230	61	250	83	-	0.23	1.2	0.03		-	-	-	-	-	0.78	-	-	-	-	-	-	-
26	09-09-91	110	310	160	210	63	-	0.14	0.32	<0.01		-	-	-	-	-	<0.01	-	-	-	-	-	-	-
27	01-02-92	100	310	82	250	88	-	<0.03	0.14	<0.03		-	-	-	-	-	30	-	-	-	-	-	-	-
28	04-10-92	98	150	48	150	73	-	0.04	2.3	<0.01		-	-	-	-	-	56	-	-	-	-	-	-	-
29	05-26-92	-	-	-	-	-	-	-	-	-		-	-	-	-	-	0.67	-	-	-	-	-	-	-
30	07-08-92	940	240	150	150	97	-	<0.01	0.03	<0.01		-	-	-	-	-	29	-	-	-	-	-	-	-
31	10-07-92	210	360	170	250	100	-	0.17	0.17	<0.01		-	-	-	-	-	0.04	-	-	-	-	-	-	-
32	04-15-93	140	330	81	170	140	-	0.44	0.12	0.48		-	-	-	-	-	0.09	-	-	-	-	-	-	-
33	07-15-93	140	280	98	160	110	-	0.22	0.03	<0.01		-	-	-	-	-	0.65	-	-	-	-	-	-	-
34	11-24-93	210	320	40	260	180	-	<0.001	0.45	<0.01		-	-	-	-	-	36	-	-	-	-	-	-	-
35	04-13-94	180	460	40	320	180	-	<0.01	0.29	<0.01		-	-	-	-	-	120	-	-	-	-	-	-	-
36	07-07-94	420	420	140	240	180	-	0.28	<0.01	<0.01		-	-	-	-	-	14	-	-	-	-	-	-	-
37	11-28-94	440	500	100	380	230	-	0.04	0.28	<0.01		-	-	-	-	-	60	-	-	-	-	-	-	-
38	04-03-95	-	-	-	-	-	-	<0.01	<0.01	<0.01		-	-	-	-	-	140	-	-	-	-	-	-	-
39	07-13-95	350	200	110	290	200	-	0.02	<0.01	0.02		-	-	-	-	-	57	-	0.78	-	-	-	-	-
40	11-95	21	170	130	260	170	-	5.4	0.05	<0.01		-	-	-	-	-	1.4	-	0.22	-	-	-	-	-
41	04-15,16-96	160	180	130	120	100	-	0.03	0.03	<0.01		-	-	-	-	-	19	-	1.5	-	-	-	-	-
42	07-09,10-96	120	130	79	230	120	-	<0.01	0.23	<0.01		-	-	-	-	-	30	0.08	0.16	0.10	9.4	-	-	-
43	11-11,12-96	240	160	53	100	100	-	0.06	0.08	<0.01		-	-	-	-	-	29	0.07	0.08	0.080	4.1	-	-	-
44	04-7,8,9-97	244	162	117	78	117	-	0.04	<0.03	<0.03		-	-	-	-	-	31.4	0.80	1.15	0.83	9.5	-	-	-
45	07-7-16-97	250	135	64	59	121		<0.03	<0.03	<0.03		-	-	-	-	-	22.3	0.22	0.29	0.26	16	-	-	-
46	11-11-13-97	140	58	60	61	82	-	0.06	<0.03	<0.03		-	-	-	-	-	31	0.11	0.51	0.1	0.05	-	-	-
47	04-13-15-98	120	140	21	28	80	-	<0.05	<0.05	<0.05		-	-	-	-	-	27	-	-	-	2.8	-	-	-
48	07-13-15-98	99	170	72	45	52	-	<0.05	<0.05	<0.05		-	-	-	-	-	13	0.12	0.46	0.18	2.3	-	-	-
49	11-16-18-98	110	140	43	62	69	-	0.09	<0.03	<0.03		-	-	-	-	-	18	-	-	-	2.2	-	-	-
50	04-05-08-99	85	150	37	68	63	-	0.11	0.22	<0.03		-	-	-	-	-	22	-	-	-	6.1	-	-	-
51	07-27-29-99	42	120	36	72	81	-	0.03	0.05	<0.03		-	-	-	-	-	22	0.15	0.92	0.14	2.3	<0.03	170	3
52	11-17-18-99	56.8	84.6	29.2	63.0	103	-	0.053	0.027	<0.010		-	-	-	-	-	19.5	-	-	-	3.05	-	-	-
53	04-10-12-00	38.7	85.2	21.4	67.6	65.4	-	0.160	<0.010	<0.010		-	-	-	-	-	4.80	-	-	-	1.93	-	-	-
54	07-17-19-00	<0.010	47.0	13.4	0.402	53.8	-	0.089	0.240	<0.010		-	-	-	-	-	13.5	0.126	1.11	0.250	1.79	0.057	66.5	9.68
55	11-13-15-00	40	103	9.88	89.6	50.7	-	0.025	<0.010	<0.010		<0.010	<0.010	<0.010	52.9	0.017	8.49	-	-	-	47.4	-	-	-
56	04-02-04-01	48.1	21.1	15.5	97.0	52.0	-	0.84	0.221	<0.010		0.011	<0.010	-	48.3	-	11.1	-	-	-	4.42	-	-	-
57	07-09-12-01	48.6	69.0	22.1	103.0	67.0	-	0.03	0.067	<0.010		0.201	<0.010	-	30.1	-	13.1	0.157	1.46	0.296	286	0.149	469	110
58	11-05-07-01	16.2	12.5	3.08	15.5	13.7	-	0.052	0.085	0.010		0.918	0.026	-	19.6	-	10.8	-	-	-	1.44	-	-	-
59	04-15-17-02	57.5	33.4	6.91	60.5	43.9	-	0.033	0.071	<0.010		0.023	<0.010	-	19.9	-	11.0	-	-	-	1.46	-	-	-
60	07-15-18-02	51.5	37.0	10.0	79.0	48.0	-	0.399	<0.010	<0.010	25	0.015	<0.010	<0.010	16.3	3.10	7.57	0.245	1.39	0.405	8.56	0.044	20.6	16.4
61	11-18-25-02	42.9	20.9	1.03	78.1	35.4	-	0.050	0.761	-		0.080	< 0.010	-	19.7	-	9.37	-	-	-	3.31	-	-	-
62	04-07-10-03	59.8	19.0	5.60	56.5	25.6	-	0.011	0.057	< 0.010		0.017	< 0.010	-	13.5	-	9.62	-	-	-	2.81	-	-	-
63	07-14-17-03	27.5	15.8	3.83	46.7	15.3	-	0.721	< 0.010	0.045	310	< 0.010	< 0.010	< 0.010	1.87	0.065	9.45	0.124	0.364	0.142	4.84	0.095	54.0	4.99

Spreadsheet master prepared by and data for rounds 1 through 32 entered by G.
Sampling rounds 1 through 33 were completed by GZA. Subsequent rounds w
- Indicates no testing performed.
< Indicates result is less than the detection limit shown.
Indicates an upgradient sampling location.
Results > Secondary Maximum Contaminant Level (MCL) for iron are

Mn

AGQS = 0.840 mg/L

Round No.	Sampling Date	Groundwater B-101	B-102	B-102S	B-103	B-103D	B-104	B-401	B-402U	B-402L	B-403U	B-403L	MW-913U	MW-913M	MW-913L	MW-914U	MW-914L	Seep	AR-1	AR-2	AR-3	SF-1	S-101	S-108	S-109
1	09-18-84	5.8	24	-	16	-	8.1	-	-	-	-	-	-	-	-	-	-	0.62	-	-	-	-	-	-	-
2	09-27-84	7	22	-	12	-	31	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-
3	02-15-85	3.1	16	-	17	-	0.077	-	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-
4	06-24-85	3.5	1.6	-	180	-	<0.02	-	-	-	-	-	-	-	-	-	-	8.7	-	-	-	-	-	-	-
5	09-13-85	4.9	15	-	26	-	<0.005	-	-	-	-	-	-	-	-	-	-	4.8	-	-	-	-	-	-	-
6	02-06-86	5	11	-	15	-	<0.03	-	-	-	-	-	-	-	-	-	-	5.9	-	-	-	-	-	-	-
7	06-05-86	6.1	11	-	11	-	<0.005	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-
8	11-15-86	9	19	-	11	-	0.094	-	-	-	-	-	-	-	-	-	-	1.4	-	-	-	-	-	-	-
9	03-03-87	8.2	16	17	14	1.4	0.051	-	-	-	-	-	-	-	-	-	-	0.39	-	-	-	-	-	-	-
10	06-11-87	7	16	16	17	9.8	0.03	-	-	-	-	-	-	-	-	-	-	0.58	-	-	-	-	-	-	-
11	09-21-87	7.9	15	12	24	9.6	-	0.19	0.084	0.053	0.12	0.09	-	-	-	-	-	0.49	-	-	-	-	-	-	-
12	12-29-87	7.4	16	21	24	8.3	-	0.23	0.014	<0.005	0.011	0.033	-	-	-	-	-	0.61	-	-	-	-	-	-	-
13	03-29-88	6.5	15	20	22	4.6	-	0.08	<0.01	<0.01	<0.01	0.02	-	-	-	-	-	0.36	-	-	-	-	-	-	-
14	07-13-88	7.2	14	21	25	11	-	0.014	0.005	<0.005	<0.005	<0.005	-	-	-	-	-	0.028	-	-	-	-	-	-	-
15	10-17-88	8.8	-	20	28	11	-	0.057	0.014	0.006	0.024	0.01	-	-	-	-	-	0.43	-	-	-	-	-	-	-
16	12-20-88	13	-	31	28	12	-	0.012	0.012	<0.005	0.016	<0.005	-	-	-	-	-	8.1	-	-	-	-	-	-	-
17	04-26-89	15	-	36	22	12	-	0.01	<0.005	<0.005	0.005	<0.005	-	-	-	-	-	1.6	-	-	-	-	-	-	-
18	07-27-89	28	-	23	25	12	-	0.01	<0.005	<0.005	0.01	<0.005	-	-	-	-	-	1.2	-	-	-	-	-	-	-
19	10-26-89	24	18	20	27	14	-	0.022	0.025	<0.005	0.007	<0.005	-	-	-	-	-	1.6	-	-	-	-	-	-	-
20	02-06-90	23	17	17	23	15	-	0.006	<.005	<.005	<.005	<.005	-	-	-	-	-	7.4	-	-	-	-	-	-	-
21	05-23-90	36	28	16	23	14	-	<.005	0.025	<.005	0.012	<.005	-	-	-	-	-	2.9	-	-	-	-	-	-	-
22	08-29-90	20	14	-	20	14	-	<.005	<.005	<.005	0.007	<.005	-	-	-	-	-	2.6	-	-	-	-	-	-	-
23	12-03-90	16	13	25	19	12	-	<.005	0.009	<.005	<.005	<.005	-	-	-	-	-	2.7	-	-	-	-	-	-	-
24	02-28-91	19	12	19	19	13	-	0.009	0.03	<.005	<.005	<.005	-	-	-	-	-	0.009	-	-	-	-	-	-	-
25	07-08-91	25	11	11	19	13	-	0.006	0.017	<.005	0.01	<.005	-	-	-	-	-	0.44	-	-	-	-	-	-	-
26	09-09-91	27	15	11	22	12	-	0.009	0.011	<0.005	<0.005	<0.005	-	-	-	-	-	0.006	-	-	-	-	-	-	-
27	01-02-92	20	13	5.8	18	14	-	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	2.3	-	-	-	-	-	-	-
28	04-10-92	18	12	2.3	19	14	-	0.01	0.091	<0.005	<0.005	<0.005	-	-	-	-	-	3.5	-	-	-	-	-	-	-
29	05-29-92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.14	-	-	-	-	-	-	-
30	07-08-92	96	11	7.3	19	16	-	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	-	-	1.8	-	-	-	-	-	-	-
31	10-07-92	24	14	8.4	22	15	-	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	-	-	<0.005	-	-	-	-	-	-	-
32	04-15-93	15	12	4.1	14	16	-	0.007	<0.005	<0.005	<0.005	<0.005	-	-	-	-	-	<0.005	-	-	-	-	-	-	-
33	07-15-93	17	12	14	15	16	-	0.026	<0.005	<0.005	<0.005	<0.005	-	-	-	-	-	0.13	-	-	-	-	-	-	-
34	11-24-93	21	14	28	18	19	-	<0.005	0.017	<0.005	0.009	<0.005	-	-	-	-	-	2.2	-	-	-	-	-	-	-
35	04-13-94	21	23	6.5	(44)	18	-	<0.005	0.009	<0.005	<0.005	<0.005	-	-	-	-	-	7.6	-	-	-	-	-	-	-
36	07-07-94	48	30	11	26	19	-	0.026	<0.005	<0.005	<0.005	<0.005	-	-	-	-	-	1	-	-	-	-	-	-	-
37	11-28-94	34	24	12	26	22	-	0.007	0.008	<0.005	<0.005	<0.005	-	-	-	-	-	4.0	-	-	-	-	-	-	-
38	04-03-95	-	-	-	-	-	-	<0.005	<0.005	<0.005	0.01	<0.005	-	-	-	-	-	9.4	-	-	-	-	-	-	-
39	07-13-95	41	9.8	9.4	20	20	-	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	-	-	5.6	-	0.12	-	-	-	-	-
40	11-95	2.2	7.2	7.8	15	19	-	0.56	0.005	<0.005	0.005	<0.005	-	-	-	-	-	0.24	-	0.048	-	-	-	-	-
41	04-15,16-96	16	7.9	10	12	16	-	0.006	<0.005	<0.005	0.005	<0.005	-	-	-	-	-	2.5	-	0.15	-	-	-	-	-
42	07-09,10-96	11	7.2	7	17	15	-	0.009	0.031	<0.005	0.007	<0.005	-	-	-	-	-	2.5	0.030	0.055	0.034	1.7	-	-	-
43	11-11,12-96	22	3.6	7.3	15	12	-	0.047	0.006	<0.005	<0.005	<0.005	-	-	-	-	-	3.5	0.020	0.025	0.021	1.3	-	-	-
44	04-7,8,9-97	15.4	7.1	6.5	9.3	12.1	-	0.10	<0.02	<0.02	<0.02	<0.02	-	-	-	-	-	3.3	0.05	0.09	0.07	1.18	-	-	-
45	07-7-16-97	17.9	4.66	4.0	7.1	13	-	0.04	<0.02	<0.02	<0.02	<0.02	-	-	-	-	-	2.42	0.03	0.04	0.03	1.21	-	-	-
46	11-11-13-97	14	2.2	3.6	6.6	9.7	-	0.03	<0.02	<0.02	<0.02	<0.02	-	-	-	-	-	2.9	<0.02	0.03	<0.02	<0.02	-	-	-
47	04-13-15-98	12	6.3	1.7	3.0	8.8	-	0.04	<0.02	<0.02	<0.02	<0.02	-	-	-	-	-	2.7	-	-	-	0.72	-	-	-
48	07-13-15-98	11	7.8	6.4	5.2	6.2	-	0.05	<0.02	<0.02	0.04	<0.02	-	-	-	-	-	1.8	<0.02	0.04	0.02	0.78	-	-	-
49	11-16-18-98	8.3	5.4	3.7	6.1	6.3	-	0.07	<0.02	<0.02	<0.02	<0.02	-	-	-	-	-	1.8	-	-	-	0.65	-	-	-
50	04-05-08-99	9.7	7.0	4.1	8.5	6.3	-	0.05	0.02	<0.02	0.02	<0.02	-	-	-	-	-	2.1	-	-	-	0.66	-	-	-
51	07-27-29-99	6.2	5.6	4.7	8.7	8	-	0.03	<0.02	<0.02	0.02	<0.02	-	-	-	-	-	2.3	<0.02	0.08	<0.02	0.60	<0.02	13	7.3
52	11-17-18-99	6.36	4.64	3.70	6.70	8.35	-	0.031	0.008	<0.005	<0.005	<0.005	-	-	-	-	-	1.93	-	-	-	0.508	-	-	-
53	04-10-12-00	5.18	5.70	3.87	5.65	5.23	-	0.055	0.007	<0.005	<0.005	<0.005	-	-	-	-	-	1.05	-	-	-	0.620	-	-	-
54	07-17-19-00	0.098	4.49	3.03	6.40	6.93	-	0.049	0.011	<0.005	<0.005	<0.005	-	-	-	-	-	1.62	0.013	0.072	0.022	0.661	<0.005	3.53	10.5
55	11-13-15-00	6.49	6.18	4.26	8.26	6.13	-	0.052	0.01	<0.005	0.036	<0.005	0.018	<0.005	<0.005	2.88	0.117	1.45	-	-	-	1.810	-	-	-
56	04-02-04-01	5.9	5.72	3.54	8	6.4	-	0.044	0.018	<0.005	<0.005	<0.005	<0.005	<0.005	-	1.59	-	1.58	-	-	-	0.616	-	-	-
57	07-09-12-01	6.6	5.05	8.2	8.21	6.2	-	<0.005	0.019	<0.005	<0.005	<0.005	0.008	<0.005	-	0.989	-	1.64	0.018	0.059	0.024	3.600	0.005	18.3	40.6
58	11-05-07-01	1.96	0.690	1.85	1.48	1.17	-	0.008	0.020	<0.005	<0.005	<0.005	0.044	<0.005	-	0.583	-	1.62	-	-	-	0.603	-	-	-
59	04-15-17-02	6.35	2.76	8.87	4.83	4.15	-	0.006	0.016	<0.005	<0.005	<0.005	<0.005	<0.005	-	1.31	-	1.49	-	-	-	0.462	-	-	-
60	07-15-18-02	7.55	2.40	10.0	6.10	4.26	-	0.013	0.017	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	1.25	0.205	1.14	0.029	0.054	0.03	0.939	<0.005	4.2	32.6
61	11-18-25-02	7.37	1.72	1.03	5.78	3.05	-	0.006	0.040	-	0.006	< 0.005	< 0.005	< 0.005	-	0.998	-	1.21	-	-	-	0.658	-	-	-
62	04-07-10-03	6.69	1.28	5.56	4.36	2.34	-	< 0.005	0.023	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	-	0.683	-	1.17	-	-	-	0.579	-	-	-
63	07-14-17-03	7.35	1.17	5.67	4.16	2.09	-	0.027	0.018	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.73	0.51	0.975	0.014	0.031	0.02	0.515	0.007	21.7	11.5

Spreadsheet master prepared by and data for rounds 1 through 32 entered by GZA GeoEnvironmenta
Sampling rounds 1 through 33 were completed by GZA. Subsequent rounds were completed by SH/
- Indicates no testing performed
<Indicates result is less than the detection limit shown
Indicates an upgradient sampling location.
Results > GW-1 for manganese (effective October 26, 2000) are shown in **boldface** type. Resu

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Round No.	Sampling Date	Groundwater B-101	B-102	B-102S	B-103	B-103D	B-104	B-401	B-402U	B-402L	B	MW-913U	MW-913M	MW-913L	MW-914U	MW-914L	Seep	AR-1	AR-2	AR-3	SF-1	S-101	S-108	S-109
1	09-18-84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	09-27-84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	02-15-85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	06-24-85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	09-13-85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	02-06-86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	06-05-86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	11-15-86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	03-03-87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	06-11-87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	09-21-87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	12-29-87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	03-29-88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	07-13-88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	10-17-88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	12-20-88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	04-26-89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	07-27-89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	10-26-89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	02-06-90	<0.04	0.04	<0.01	0.04	0.04	-	0.02	<0.01	<0.01	<	-	-	-	-	-	0.02	-	-	-	-	-	-	-
21	05-23-90	0.04	0.04	<0.01	0.03	0.03	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
22	08-29-90	0.05	0.05	-	0.03	0.03	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
23	12-03-90	0.023	0.04	<0.01	<0.01	0.018	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
24	02-28-91	0.035	0.04	<0.01	0.04	0.04	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
25	07-08-91	0.054	0.06	<0.01	0.04	0.04	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
26	09-09-91	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
27	01-02-92	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
28	04-10-92	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
29	05-26-92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
30	07-08-92	<0.01	0.03	0.03	<0.01	0.03	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
31	10-07-92	0.08	0.07	0.05	0.05	0.04	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
32	04-15-93	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	07-15-93	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	-	-	-	-	-	-	-	-
34	11-24-93	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	04-13-94	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	07-07-94	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<	-	-	-	-	-	<0.01	-	-	-	-	-	-	-
37	11-28-94	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	04-03-95	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	07-13-95	<0.01	<0.01	<0.01	<0.01	0.03	-	<0.01	<0.01	<0.01	<0	-	-	-	-	-	-	-	-	-	-	-	-	-
40	11-95	0.05	0.08	0.04	0.03	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	04-15,16-96	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	07-09,10-96	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	11-11,12-96	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	04-7,8,9-97	0.062	0.070	0.058	0.025	0.060	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	07-7-16-97	0.060	0.080	0.054	0.015	0.054	-	<0.002	<0.002	<0.002	<0.	-	-	-	-	-	-	-	-	-	-	-	-	-
46	11-11-13-97	0.051	0.056	0.045	0.019	0.043	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47	04-13-15-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48	07-13-15-98	0.051	0.075	0.058	0.02	0.044	-	<0.005	<0.005	<0.005	<0.	-	-	-	-	-	-	-	-	-	-	-	-	-
49	11-16-18-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	04-05-08-99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51	07-27-29-99	0.02	0.062	0.041	0.023	0.034	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	11-17-18-99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	04-10-12-00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	07-17-19-00	<0.005	0.108	0.041	<0.005	0.081	-	<0.005	<0.005	<0.005	<0.(	-	-	-	-	-	-	-	-	-	-	-	-	-
55	11-13-15-00	-	-	-	-	-	-	-	-	-	-	<0.005	<0.005	<0.005	0.019	0.005	-	-	-	-	-	-	-	-
56	04-02-04-01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	07-09-12-01	0.051	0.05	0.030	0.034	0.036	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	11-05-07-01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
59	04-15-17-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	07-15-18-02	0.035	0.059	0.027	0.029	0.056	-	<0.002	<0.002	<0.002	<0.(	<0.002	<0.002	<0.002	0.028	0.004	-	-	-	-	-	-	-	-
61	11-18-25-02	-	-	-	-	-	-	-	-	-	-	-	-	-	0.022	-	-	-	-	-	-	-	-	-
62	04-07-10-03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	07-14-17-03	0.003	*0.047*	*0.02*	0.009	*0.039*	-	<0.002	<0.002	<0.002	<0.(	<0.002	<0.002	-	0.006	-	0.006	<0.002	<0.002	<0.002	0.002	<0.002	*0.042*	0.006

Spreadsheet master prepared by and data for rounds 1 through 32 entered by GZA GeoEnvin
Sampling rounds 1 through 33 were completed by GZA. Subsequent rounds were completed
- Indicates no testing performed.
< Indicates result is less than the detection limit shown.
Indicates an upgradient sampling location.
Results > Ambient Groundwater Quality Standard (AGQS) for arsenic are shown in bol
and in boldface italics type after the June 2003 revision (new standard: (0.01 mg/l).

Br used to distinguish SOURCE [illegible]

NORTH COUNTRY ENVIRONMENTAL SERVICES, INC., - BETHLEHEM, NEW HAMPSHIRE
2001 - 2003 Bromide Application Rate & Analytical Results Summary

		STAGE II, PHASE I			STAGE II, PHASE II			STAGE III		
Sampling Date	ANALYTICAL METHOD	Sodium Bromide Average Application Rate	Primary Leachate Concentration (mg/l)	Secondary Leachate Concentration (mg/l)	Sodium Bromide Average Application Rate	Primary Leachate Concentration (mg/l)	Secondary Leachate Concentration (mg/l)	Sodium Bromide Average Application Rate	Primary Leachate Concentration (mg/l)	Secondary Leachate Concentration (mg/l)
January 25, 2001	EPA 300.0	0 lb/week	19.3	0.920	0 lb/week	11.7	4.92	300 lb/week	0.101	< 0.100
	EPA 320.1		< 2.0	< 2.0		4.8	2.4		4.5	3.2
February 19, 2001	EPA 300.0	0 lb/week	20.5	0.707	0 lb/week	13.4	5.82	300 lb/week	3.79	0.987
	EPA 320.1		< 2.0	< 2.0		3.8	4.9		5.3	2.3
March 15, 2001	EPA 300.0	300 lb/week	26.4	0.909	300 lb/week	11.6	6.17	300 lb/week	9.15	7.02
	EPA 320.1		< 2.0	3.7		< 2.0	< 2.0		1.8	< 2.0
April 12, 2001	EPA 300.0	300 lb/week	21.1	1.590	300 lb/week	15.5	4.58	300 lb/week	2.77	2.13
	EPA 320.1		< 2.0	< 2.0		< 2.0	3.2		< 2.0	< 2.0
May 15, 2001	EPA 300.0	300 lb/week	8.58	1.380	300 lb/week	16.3	7.27	300 lb/week	6.9	4.88
	EPA 320.1		< 2.0	2.1		7.4	5.19		< 2.0	< 2.0
June 13, 2001	EPA 300.0	300 lb/week	28.0	1.140	300 lb/week	19.2	7.53	300 lb/week	2.68	0.148
	EPA 320.1		< 2.0	< 2.0		< 2.0	2.5		< 2.0	< 2.0
July 9,2001	EPA 300.0	300lb./week	12.2	5.250	300lb./week	10.2	1.44	300lb/week	16.1	<0.200
	EPA 320.1		<2.0	3.7		<2.0	<2.0		<2.0	<2.0
August 8, 2001	EPA 300.0	300lb./week	34.7	20.1	300lb./week	23.2	8.37	300lb/week	60.2	0.313
	EPA 320.1		<2.0	<2.0		<2.0	3.6		<2.0	<2.0
September 11, 2001	EPA 300.0	300lb./week	51.5	22.4	300lb./week	23.0	3.76	300lb/week	58.5	0.308
	EPA 320.1		<2.0	<2.0		<2.0	4.58		<2.0	2.1
October 9, 2001	EPA 300.0	300lb./week	27.3	0.498	300lb./week	11.6	1.62	300lb/week	24.0	0.243
	EPA 320.1		<2.0	<2.0		<2.0	2.60		<2.0	<2.0
November 13, 2001	EPA 300.0	300lb./week	15.9	0.590	300lb./week	15.4	1.36	300lb./week	7.23	0.385
	EPA 320.1		16.0	<2.0		<2.0	<2.0		<2.0	<2.0
December 10, 2001	EPA 300.0	300lb./week	20.3	<0.400	300lb./week	17.0	3.65	300lb./week	3.91	0.122
	EPA 320.1		<2.0	<2.0		16.0	3.50		<2.0	<2.0
January 8, 2002	EPA 300.0	300lb./week	20.9	1.10	300lb./week	7.78	0.742	300lb./week	48.0	0.900
	EPA 320.1		5.99	<2.0		<2.0	<2.0		6.29	<2.0
February 11, 2002	EPA 300.0	0 lb/week	18.4	0.952	0 lb/week	16.5	1.30	300lb./week	52.0	2.27
	EPA 320.1		21.5	<2.0		5.84	3.05		<2.0	<2.0
March 13, 2002	EPA 300.0	0 lb/week	18.9	0.340	0 lb/week	29.6	0.426	300lb./week	35.1	<0.100
	EPA 320.1		9.99	5.29		4.00	<2.0		<2.0	<2.0
April 8, 2002	EPA 300.0	0 lb/week	15.4	0,177	0 lb/week	17.6	1.22	300lb./week	48.5	0.146
	EPA 320.1		<2.0	<2.0		<2.0	3.1		<2.0	<2.0
May 8, 2002	EPA 300.0	0 lb/week	21.0	0.380	0 lb/week	10.3	1.48	300lb./week	87.7	0.480
	EPA 320.1		<2.0	3.00		16.5	5.09		29.5	6.69
June 17, 2002	EPA 300.0	0 lb/week	15.2	0.3	0 lb/week	22.4	11.1	300lb./week	87.6	1.41
	EPA 320.1		4.1	<2.0		4.5	2.1		2.35	<2.0
July 9, 2002	EPA 300.0	0 lb/week	59.1	<0.400	0 lb/week	12.9	35.7	300lb./week	66.1	<0.200
	EPA 320.1		<2.0	<2.0		9.29	<2.0		<2.0	<2.0
August 8, 2002	EPA 300.0	0 lb/week	26.3	<0.400	0 lb/week	33.4	38.3	300lb./week	149.0	14.0
	EPA 320.1		<2.0	<2.0		16.5	6.79		<2.0	<2.0
September 11, 2002	EPA 300.0	0 lb/week	36.7	<4.00	0 lb/week	24.6	35.8	300lb./week	169.0	94.0
	EPA 320.1		<2.0	5.09		6.69	6.49		<2.0	2.60
October 16, 2002	EPA 300.0	0 lb/week	28.3	<0.400	0 lb/week	39.1	29.3	300lb./week	204.0	1.07
	EPA 320.1		<2.0	<2.0		7.54	<2.0		<2.0	<2.0
November 7, 2002	EPA 300.0	0 lb/week	53.2	0.329	0 lb/week	27.9	37.4	300lb./week	222.0	<0.100
	EPA 320.1		<2.0	<2.0		13.6	2.7		<2.0	<2.0
December 4, 2002	EPA 300.0	0 lb/week	46.5	0.218	0 lb/week	35.9	33.6	300lb./week	42.0	1.30
	EPA 320.1		<2.0	2.7		<2.0	<2.0		<2.0	<2.0
January 8, 2003	EPA 300.0	0 lb/week	23.1	7.20	0 lb/week	19.0	21.2	300lb./week	169.0	<1.00
	EPA 320.1		<2.0	<2.0		<2.0	<2.0		<2.0	<2.0
February 10, 2003	EPA 300.0	0 lb/week	39.2	5.18	0 lb/week	22.5	17.0	300lb./week	233.0	9.31
	EPA 320.1		<2.0	<2.0		<2.0	3.0		<2.0	<2.0
March 11, 2003	EPA 300.0	0 lb/week	39.6	4.23	0 lb/week	33.8	18.9	300lb./week	117.0	8.46
	EPA 320.1		<2.0	<2.0		<2.0	<2.0		<2.0	<2.0
April 7, 2003	EPA 300.0	0 lb/week	21.9	1.02	0 lb/week	14.7	19.6	300lb./week	64.4	2.84
	EPA 320.1		<2.0	<2.0		<2.0	<2.0		<2.0	<2.0
May 12, 2003	EPA 300.0	0 lb/week	20.9	0.79	0 lb/week	12.2	13.4	300lb./week	69.8	4.33
	EPA 320.1		<2.0	<2.0		<2.0	<2.0		<2.0	<2.0
June 5, 2003	EPA 300.0	0 lb/week	10.6	1.27	0 lb/week	4.03	7.00	300lb./week	142.0	0.723
	EPA 320.1		<2.0	<2.0		<2.0	3.60		<2.0	<2.0
July 7, 2003	EPA 300.0	0 lb/week	23.4	2.25	0 lb/week	19.2	8.77	300lb./week	175.0	0.816
	EPA 320.1		<2.0	<2.0		<2.0	4.80		<2.0	<2.0

Notes:
1. Stage II, Phase II waste acceptance began on March 29, 1999.
2. Weekly, rather than daily sodium bromide application began in Stage 2, Phase 2 on November 19, 1999.
3. Sodium bromide application in Stage 2, Phase 1 was re-instituted on November 19, 1999. The application of sodium bromide to Stage 2, Phase 1 is currently on a weekly basis.
4. NA=January 24, 2000 sample analysis did not pass laboratory QA/QC criteria.
5. Application of sodium bromide in Stage II was discontinued following the June 29, 2000 application due to the degree of filling in the landfill. Additional applications would be too close to an outer slope.
6. Stage III waste acceptance began on December 26, 2000.
7. Sodium bromide application in Stage III initiated on January 11, 2001.
8. Sodium bromide application in Stage II was re-instituted in March 2001.
9. Sodium bromide application in Stage II was conditionally eliminated by permit modification (type II) on December 10, 2001.

1) Br conc in primary & secondary leachate should be same ideally

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2) Difference due to spatial variability of Br [illegible] "pin hole leaks"

3) [illegible] flows.