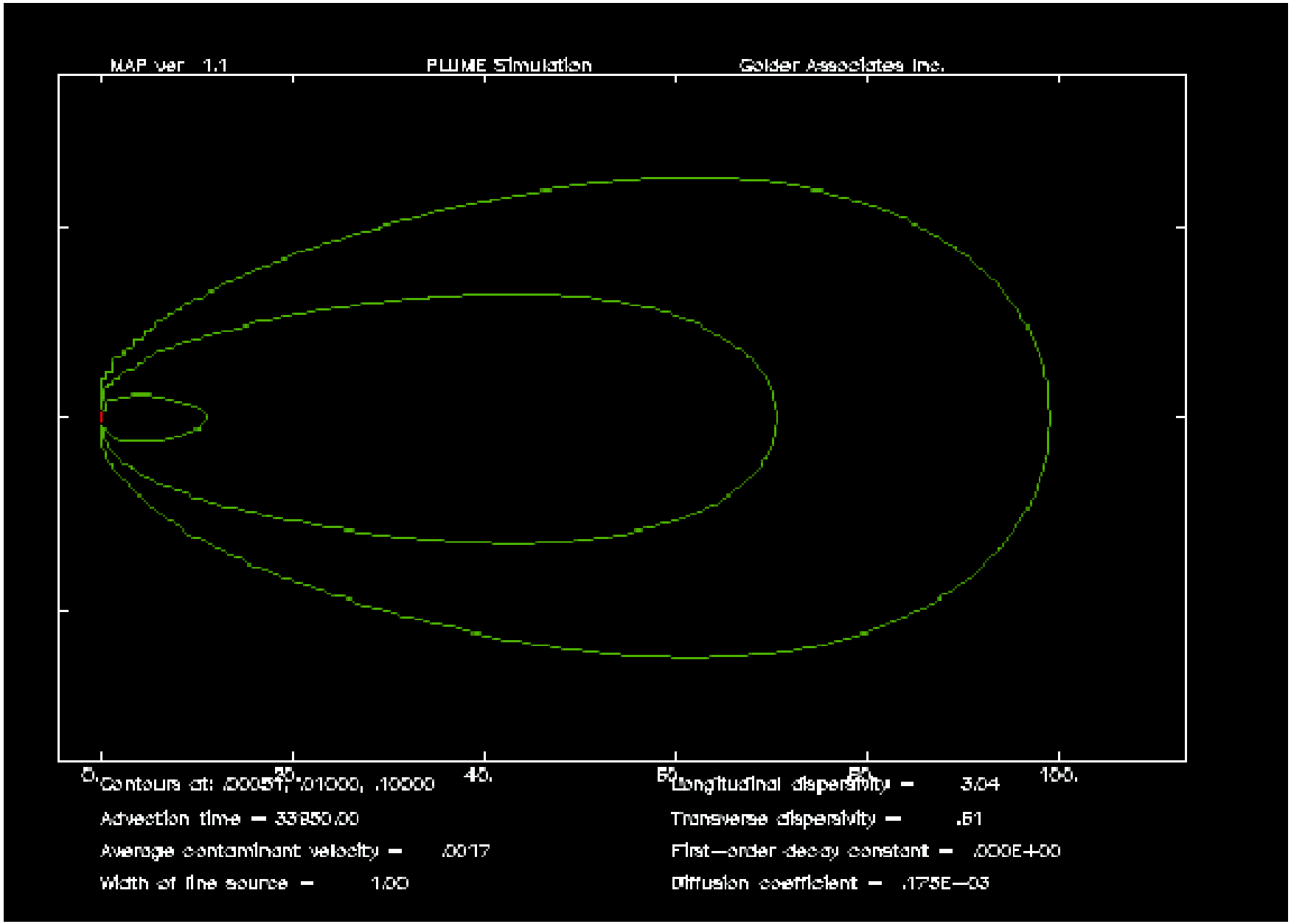
APPENDIX Q

ENVIRONMENTAL MONITORING

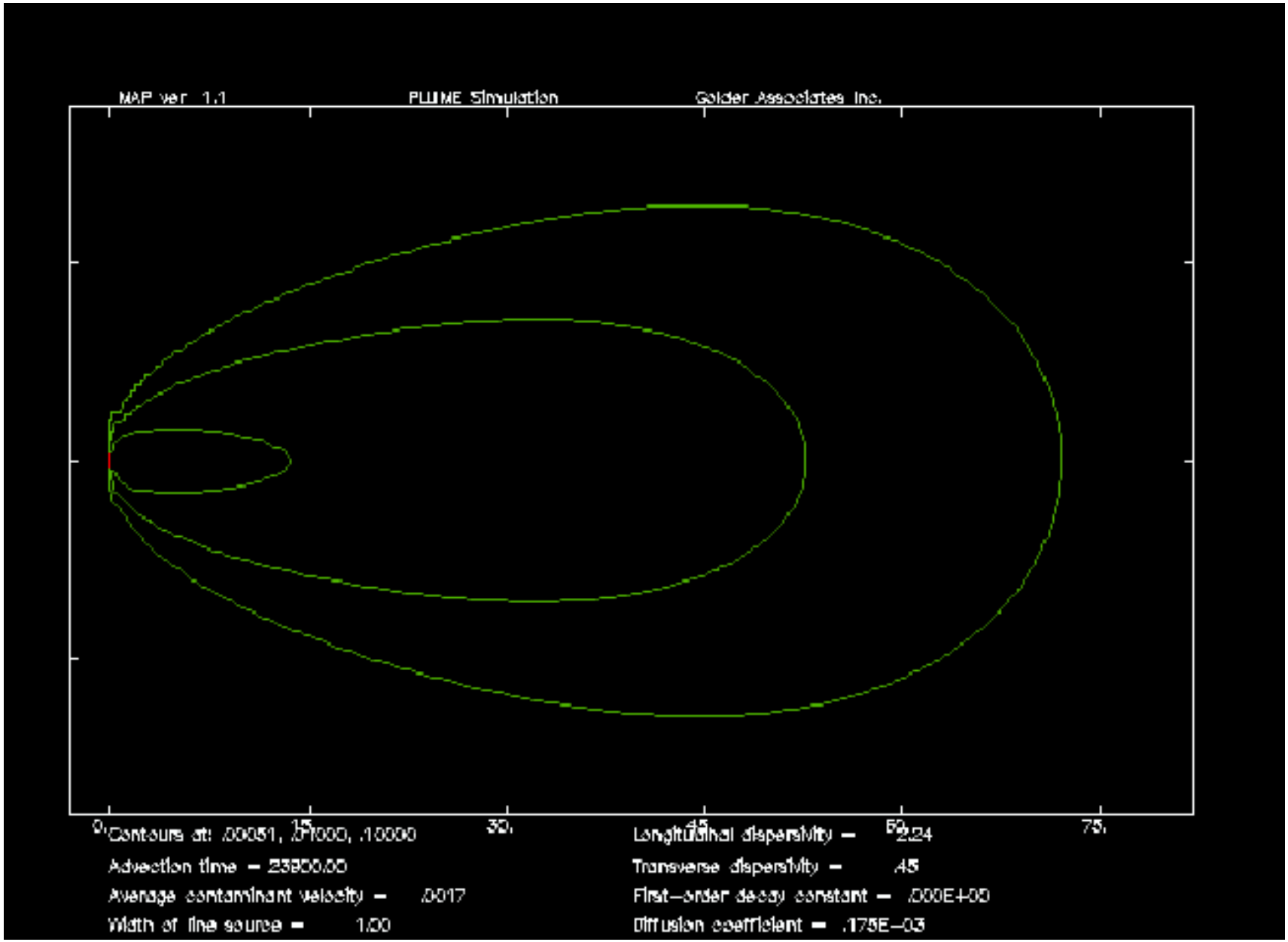
APPENDIX Q.1
Output PLUME Models

APTIM

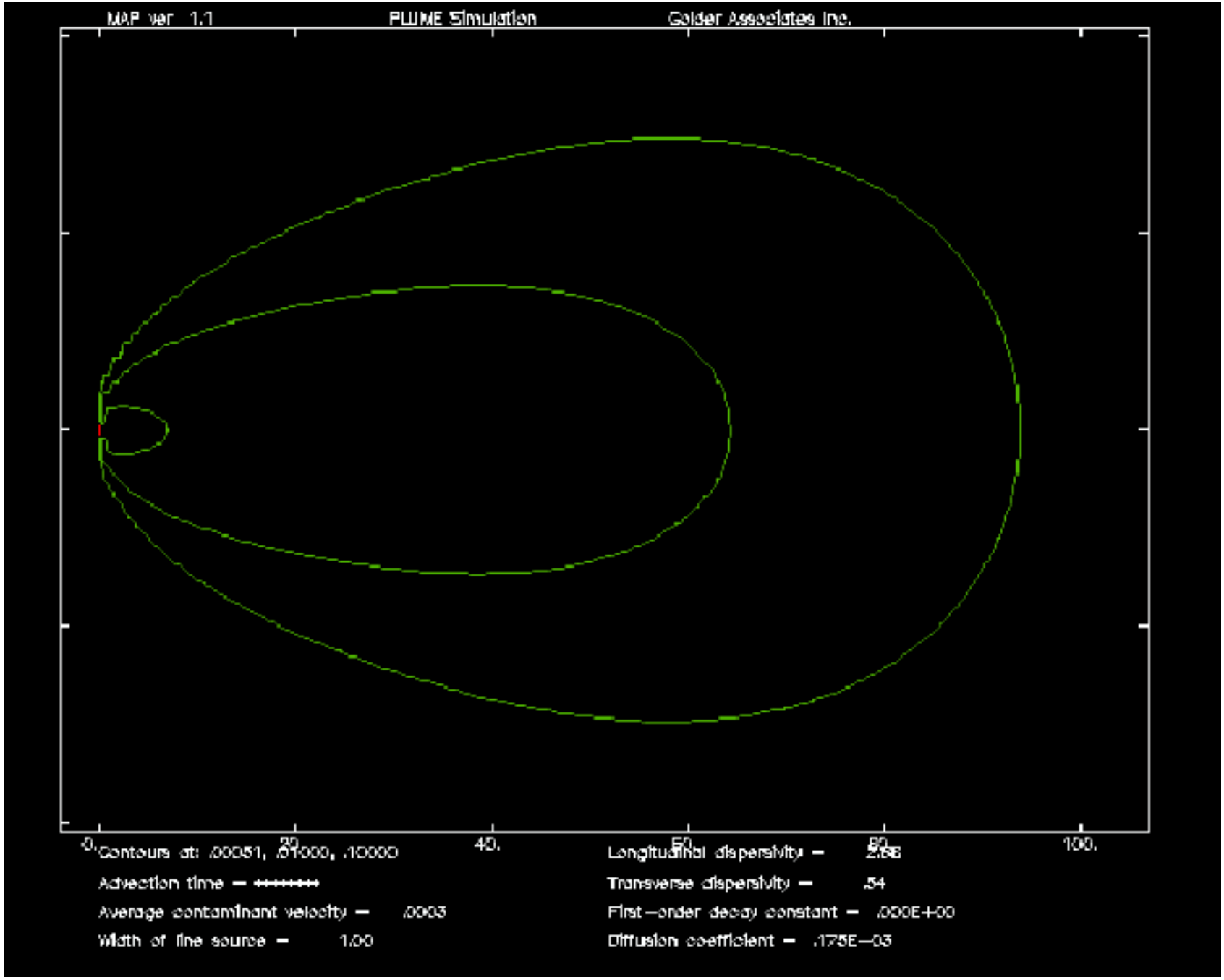
NORTHWEST PLUME



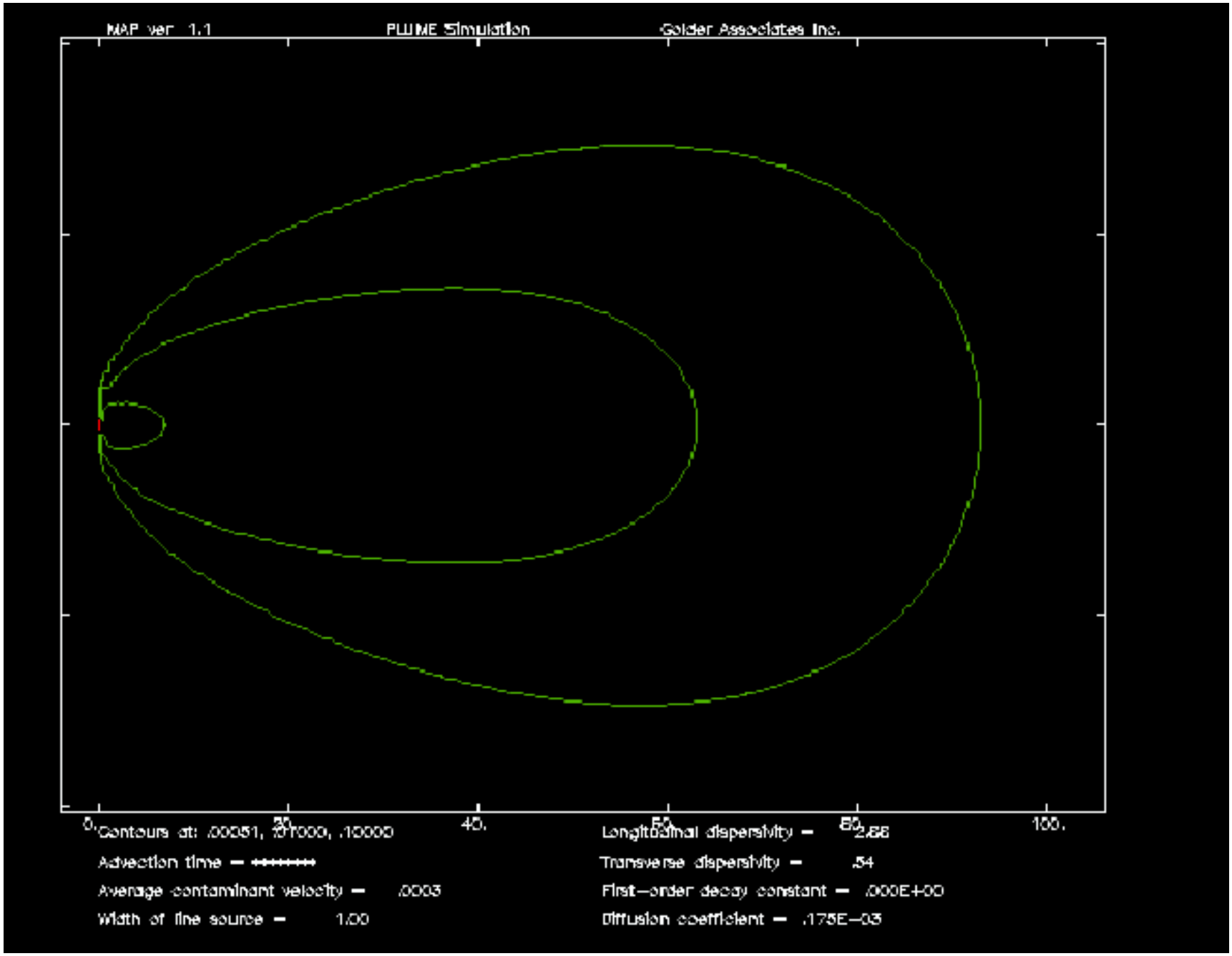
NORTH PLUME


MAP ver 1.1
PLUME Simulation
Golder Associates Inc.
0.
15.
30.
45.
60.
75.
Contours at: .00051, .01000, .10000
Advection time = 23800.00
Average contaminant velocity = .0017
Width of line source = 1.00
Longitudinal dispersivity = 2.24
Transverse dispersivity = .45
First-order decay constant = .000E+00
Diffusion coefficient = .175E-03

NORTHEAST PLUME



SOUTHEAST PLUME



APPENDIX Q.2
Existing Zion Landfill Applicable Groundwater Quality Standards (AGQSs)

0978020002 - Lake County
Advanced Disposal Services Zion Landfill
Permit No. 1995-343-LFM
Modification No. 139
Log No. 2018-275

ATTACHMENT 1

SHALLOW DRIFT AQUIFER

(Groundwater - Quarterly)

FIELD PARAMETERS	STORETS	MAPC/AGQS
pH	00400	7.13-10.24
Specific Conductance	00094	520.5
Temperature of Water Sample (°F)	00011	--------
Depth to Water (ft. below land surface)	72019	--------
Depth to Water (ft. below measuring point)	72109	--------
Elevation of Measuring Point (Top of casing ft. MSL)	72110	--------
Elevation of Groundwater Surface (ft. MSL)	71993	--------
Elevation of Bottom of Well (ft. MSL)	72020	--------
Ammonia (as Nitrogen; Dissolved) mg/L	00608	0.60
Arsenic (Dissolved) ug/L	01000	6.2
Boron (Dissolved) ug/L	01020	1,985
Cadmium (Dissolved) ug/L	01025	10.0
Chloride (Dissolved) mg/L	00941	18.0
Cyanide (Total) mg/L	00720	10.0
Iron (Dissolved) ug/L	01046	992.0
Lead (Dissolved) ug/L	01049	20.0
Manganese (Dissolved) ug/L	01056	63.0
Mercury (Dissolved) ug/L	71890	0.2
Nitrate (as Nitrogen, Dissolved) mg/L	00618	0.89
Phenols (Total Recoverable) ug/L	32730	63.9
Sulfate (Dissolved) mg/L	00946	166.8
Total Dissolved Solids (TDS, 180°C; Dissolved) mg/L	70300	594.4
Total Organic Carbon (TOC; Total) mg/L	00680	6.3
Zinc (Dissolved) ug/L	01090	32.0

(Groundwater - Annual)

PARAMETERS (ug/L)	STORETS	MAPC/AGQS
UNFILTERED (totals)		
Acetone	81552	100.0
Acrolein	34210	25.0
Acrylonitrile	34215	200.0

Attachment 1 (continued)
(Groundwater - Annual) (cont.)

PARAMETERS (ug/L)	STORETS	MAPC/AGQS
UNFILTERED (totals)		
Alachlor	77825	2.0
Aldicarb	39053	3.0
Aldrin	39330	1.0
Aluminum	01105	173078.4
Ammonia (as N) (mg/L)	00610	0.60
Antimony	01097	6.0
Arsenic	01002	7.0
Atrazine	39033	3.0
Barium	01007	248.0
Benzene	34030	5.0
Benzo(a)Pyrene	34247	0.2
Benzoic Acid	77247	100.0
Benzyl Alcohol	77147	10.0
Beryllium	01012	4.0
Beta-BHC	39338	0.05
Bis (chloromethyl) ether	34268	10.0
BOD (mg/L)	00310	9.0
Boron	01022	860.0
Bromobenzene	81555	5.0
Bromochloromethane (chlorobromomethane)	77297	1.0
Bromodichloromethane	32101	5.0
Bromoform (Tribromomethane)	32104	10.0
Bromomethane (Methyl Bromide)	34413	10.0
n-Butylbenzene	77342	5.0
sec-Butylbenzene	77350	5.0
tert-Butylbenzene	77353	5.0
Cadmium	01027	10.0
Calcium (mg/L)	00916	300.0
Carbofuran	81405	40.0
Carbon Disulfide	77041	5.0
Carbon Tetrachloride	32102	5.0
Chemical Oxygen Demand (COD) (mg/L)	00335	92.0
Chlordane	39350	2.0
Chloride (mg/L)	00940	12.0
Chlorobenzene	34301	5.0
Chloroethane (Ethyl Chloride)	34311	10.0
Chloroform (Trichloromethane)	32106	5.0
Chloromethane (Methyl Chloride)	34418	10.0
o-Chlorotoluene	77275	1.0

Attachment 1 (continued)
(Groundwater - Annual) (cont.)

PARAMETERS (ug/L)	STORETS	MAPC/AGQS
UNFILTERED (totals)		
p-Chlorotoluene	77277	5.0
Chromium	01034	270.0
Chlorodibromomethane (Dibromochloromethane)	32105	5.0
Cobalt	01037	100.0
Copper	01042	40.0
p-Cresol	77146	10.0
Dalapon	38432	20.0
DDT	39370	10.0
Dibromomethane (Methylene Bromide)	77596	10.0
m-Dichlorobenzene (1,3 Dichlorobenzene)	34566	5.0
o-Dichlorobenzene (1,2 Dichlorobenzene)	34536	10.0
p-Dichlorobenzene (1,4 Dichlorobenzene)	34571	5.0
Dichlorodifluoromethane	34668	5.0
Dichloromethane (Methylene Chloride)	34423	5.0
Dieldrin	39380	10.0
Diethyl Phthalate	34336	10.0
Dimethyl Phthlate	34341	10.0
Di-N-Butyl Phthlate	39110	10.0
Dinoseb (DNBP)	81287	1.0
Endothall	38926	50.0
Endrin	39390	0.2
Di(2-Ethylhexyl)Phthalate	39100	6.0
Ethanol	77004	1000.0
Ethylbenzene	78113	5.0
Ethylene Dibromide (EDB)(1,2-Dibromo ethane)	77651	0.05
Fluoride (mg/L)	00951	1.86
Heptachlor	39410	0.4
Heptachlor Epoxide	39420	0.2
Hexachlorobutadiene	39702	10.0
Hexachlorcyclopentadiene	34386	50.0
Iodomethane (Methyl Iodide)	77424	10.0
Iron	01045	26058.9
Isophorone	34408	10.0
Isopropylbenzene	77223	5.0
p-Isopropyltoluene	77356	5.0
Lead	01051	136.0
Lindane	39782	0.2
Magnesium (mg/L)	00927	140.0
Manganese	01055	1732.5

Attachment 1 (continued)
(Groundwater - Annual) (cont.)

PARAMETERS (ug/L)	STORETS	MAPC/AGQS
UNFILTERED (totals)		
Mercury	71900	0.2
Methoxyclor	39480	40.0
Naphthalene	34696	5.0
Nickel	01067	119.0
Nitrate-Nitrogen (mg/L)	00620	0.50
Oil(Hexane-Soluble or Equivalent) (mg/L)	00552	14.0
Parathion	39540	10.0
Pentachlorophenol	39032	1.0
Phosphorous	00665	1590.0
Picloram	39720	50.0
Polychlorinated Biphenyls	39516	0.5
Potassium (mg/L)	00937	11.0
n-Butyl alcohol (1-Butanol)	45265	5000.0
n-Propanol	77018	1000.0
n-Propylbenzene	77224	5.0
Selenium	01147	5.0
Silver	01077	50.0
Simazine	39055	2.0
Sodium (mg/L)	00929	110.0
Styrene	77128	10.0
Sulfate (mg/L)	00945	90.0
Tetrachloroethylene (Perchloroethylene)	34475	5.0
Tetrahydrofuran	81607	20.0
Thallium	01059	9.2
Toluene	34010	5.0
Toxaphene	39400	3.0
Trichloroethylene (Trichloroethene)	39180	5.0
Trichlorofluoromethane	34488	5.0
Vanadium	01087	75.0
Vinyl Chloride	39175	2.0
Vinyl Acetate	77057	10.0
Xylenes	81551	10.0
m-Xylene	77134	10.0
o-Xylene	77135	10.0
p-Xylene	77133	10.0
Zinc	01092	144.5
1,1,1,2-Tetrachloroethane	77562	5.0
1,1,1-Trichloroethane (Methylchloroform)	34506	5.0

Attachment 1 (continued)
(Groundwater - Annual) (cont.)

PARAMETERS (ug/L)	STORETS	MAPC/AGQS
UNFILTERED (totals)		
1,1,2,2-Tetrachloroethane	34516	10.0
1,1,2-Trichloroethane	34511	5.0
1,1-Dichloroethane	34496	5.0
1,1-Dichloroethylene	34501	5.0
1,1-Dichloropropene	77168	5.0
1,2,3-Trichlorobenzene	77613	5.0
1,2,3-Trichloropropane	77443	15.0
1,2,4-Trichlorobenzene	34551	10.0
1,2,4-Trimethylbenzene	77222	5.0
1,2-Dibromo-3-Chloropropane (DBCP)	38760	25.0
cis-1,2-Dichloroethylene	77093	5.0
trans-1,2-Dichloroethylene	34546	1.0
1,2-Dichloroethane	34531	5.0
1,2-Dichloropropane (Propylene Dichloride)	34541	5.0
1,3,5-Trimethylbenzene	77226	5.0
1,3-Dichloropropane	77173	5.0
1,3-Dichloropropene	34561	5.0
cis-1,3-Dichloropropene	34704	10.0
trans-1,3-Dichloropropene	34699	10.0
trans-1,4-Dichloro-2-Butene	49263	5.0
2-chloroethyl vinyl ether	34576	8.8
2,2-Dichloropropane	77170	15.0
2,4,5-TP (Silvex)	39760	2.0
2,4-Dichlorophenoxyacetic Acid (2,4-D)	39730	10.0
2-Butanone(Methyl Ethyl Ketone)	81595	10.0
2-Hexanone (Methyl Butyl Ketone)	77103	50.0
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)	78133	50.0
2-Propanol	81310	1000.0

INTRATILL SORTED SEDIMENTS
(Groundwater - Quarterly)

FIELD PARAMETERS	STORETS	MAPC	AGQS
pH	00400	6.67-8.64	6.67-8.64
Specific Conductance	00094		
Temperature of Water Sample (°F)	00011	----	----
Depth to Water (ft. below land surface)	72019	----	----

Attachment 1 (continued)
(Groundwater - Annual) (cont.)

PARAMETERS (ug/L)	STORETS	MAPC	AGQS
Acenaphthene	34205	420	420
Anthracene	34220	2,100	2,100
Benzo(a)anthracene	34526	0.13	0.13
Benzo(b)fluoranthene	34230	0.18	0.18
Benzo(k)fluoranthene	34242	0.17	0.17
Chrysene	34320	12	12
Dibenzo(a,h)anthracene	34556	0.3	0.3
Dicamba	82052	210	210
Fluoranthene	34376	280	280
Fluorene	34381	280	280
Indeno(1,2,3-cd)pyrene	34403	0.43	0.43
MCPP (Mecoprop)	38491	7	7
2-Methylnaphthalene	77416	28	28
2-Methylphenol (o-Cresol)	77152	350	350
P-Dioxane (1,4-Dioxane)	81582	7.7	7.7
Pyrene	34469	210	210
alpha-BHC	39337	0.11	0.11
Perchlorate	61209	4.9	4.9
MTBE	46491	70	70

Attachement 2

Site Name: ADS Zion Landfill
Site Number: 0978020002

IEPA Permit No: 1995-343-LFM
Permit Log No: 2018-275

List G1 & G2 Intrawell Value Table (Shallow Drift Aquifer)

Parameter	STORET	Monitoring Wells								
		C129	G131	G132	G160	G161	G162	G163	G164	G165
Field Parameters										
pH	00400	--	--	--	--	--	--	--	6.57 - 7.86	--
Specific Conductance (umhos/cm)	00094	1,194	295.2	--	722.2	913.0	1,035.4	861.2	1,463.4	833.0
Indicator Parameters										
Boron (Dissolved) ug/L	01020	--	2,111.0	1,879.0	1,446.8	709.7	601.1	673.6	660.0	574.0
Manganese (Dissolved) ug/L	01056	--	--	--	--	--	--	--	671.7	197.0
Sulfate (Dissolved) mg/L	00946	728.8	210.0	--	261.5	331.4	346.4	348.7	537.5	286.8
Total Dissolved Solids (TDS) mg/L	70300	742.9	328.4	--	562.2	683.3	773.6	612.2	1,111.5	575.0
Unfiltered Parameters										
Boron (Total) ug/L	01022	925.0	2,007.0	2,366.0	924.0	800.0	681.0	811.0	757.0	707.0
Sulfate (Total) mg/L	00945	580.9	28.2	33.3	230.0	370.7	300.0	301.1	300.0	242.4

Parameter	STORET	Monitoring Wells								
		G166	G167	G176	G177	G178	G179	G180	G181	G182
Field Parameters										
pH	00400	--	--	--	--	--	--	--	--	--
Specific Conductance (umhos/cm)	00094	1,690.0	638.0	464.0	398.7	395.2	576.2	318.2	366.9	676.9
Indicator Parameters										
Boron (Dissolved) ug/L	01020	914.0	684.0	727.0	701.8	3,771.5	691.8	1,760.5	1,000.0	2,950.3
Manganese (Dissolved) ug/L	01056	--	--	--	--	--	--	--	--	--
Sulfate (Dissolved) mg/L	00946	322.5	69.5	50.1	30.0	22.3	73.3	140.0	21.0	122.8
Total Dissolved Solids (TDS) mg/L	70300	1,063.3	501.2	301.8	335.9	272.2	362.9	262.2	284.4	472.8
Unfiltered Parameters										
Boron (Total) ug/L	01022	825.0	751.0	769.0	860.0	2,871.0	854.0	1,061.0	1,379.0	1,200.0
Sulfate (Total) mg/L	00945	354.5	112.3	49.8	34.5	50.7	41.1	31.7	20.7	52.0

Attachement 2 - Continued

Site Name: Veolia ES Zion Landfill
Site Number: 0978020002

IEPA Permit No: 1995-343-LFM
Permit Log No: 2018-275

List G1 & G2 Intrawell Value Table (Shallow Drift Aquifer) - Continued

Parameter	STORET	Monitoring Wells								
		G183	G184	G185	G186	G187	G188	G191	G193	R124
Field Parameters										
pH	00400	--	--	--	--	--	--	--	--	--
Specific Conductance (umhos/cm)	00094	466.0	315.3	333.2	489.0	276.0	369.7	501.0	257.0	789.7
Indicator Parameters										
Boron (Dissolved) ug/L	01020	712.2	1,246.6	740.7	582.9	830.5	641.5	727.0	879.7	750.1
Manganese (Dissolved) ug/L	01056	--	--	--	--	--	--	--	--	--
Sulfate (Dissolved) mg/L	00946	55.2	22.2	10.7	93.2	14.0	9.7	64.6	21.6	291.5
Total Dissolved Solids (TDS) mg/L	70300	240.0	314.4	253.7	336.1	252.2	312.2	391.4	843.6	568.6
Unfiltered Parameters										
Boron (Total) ug/L	01022	790.0	3,359.0	814.0	--	--	--	608.0	1,735.0	909.0
Sulfate (Total) mg/L	00945	69.8	42.8	44.8	--	--	--	59.0	28.8	286.1

Parameter	STORET	Monitoring Wells					
		R126	R128	G132	R133	T001	T002
Field Parameters							
pH	00400	--	--	--	--	--	--
Specific Conductance (umhos/cm)	00094	2,554.9	466.0	278.7	354.9	488.0	488.0
Indicator Parameters							
Boron (Dissolved) ug/L	01020	992.2	852.7	1,139.6	920.1	643.0	669.0
Manganese (Dissolved) ug/L	01056	454.4	--	--	--	--	--
Sulfate (Dissolved) mg/L	00946	1,400.0	90.4	26.2	36.6	53.3	50.4
Total Dissolved Solids (TDS) mg/L	70300	2,000.0	281.8	284.4	503.8	338.2	260.0
Unfiltered Parameters							
Boron (Total) ug/L	01022	1,621.0	894.0	--	1,121.0	674.0	--
Sulfate (Total) mg/L	00945	1,400.0	115.1	--	22.0	55.0	--

Attachement 2 - Continued

Site Name: Veolia ES Zion Landfill
Site Number: 0978020002

IEPA Permit No: 1995-343-LFM
Permit Log No: 2018-275

Parameter	STORET	Monitoring Wells								
		C129	G131	G132	G160	G161	G162	G163	G164	G165
Field Parameters										
pH	00400	--	--	--	--	--	--	--	--	--
Specific Conductance (umhos/cm)	00094	--	--	--	--	--	--	--	--	--
Indicator Parameters										
Boron (Dissolved) ug/L	01020	--	--	--	--	--	--	--	--	--
Chromium (Dissolved) ug/L	01030	10	10	10	10	10	10	10	10	10
Magnesium (Dissolved) mg/L	00925	163	3.5	3.5	48.2	76.6	72	51.2	65.6	63.3
Sulfate (Dissolved) mg/L	00946	--	--	--	--	--	--	--	--	--
Total Dissolved Solids (TDS) mg/L	70300	--	--	--	--	--	--	--	--	--

Parameter	STORET	Monitoring Wells								
		G167	G168	G169	G175	G176	G177	G178	G179	G180
Field Parameters										
pH	00400	--	--	--	--	--	--	--	--	--
Specific Conductance (umhos/cm)	00094	--	637	484	2239	--	--	--	--	--
Indicator Parameters										
Boron (Dissolved) ug/L	01020	--	601	649	1369	--	--	--	--	--
Chromium (Dissolved) ug/L	01030	10	10	10	10	10	10	10	10	10
Magnesium (Dissolved) mg/L	00925	31.3	21.6	19.7	34.6	17.6	25.3	8.1	38	7.6
Sulfate (Dissolved) mg/L	00946	--	232.5	55.5	812.8	--	--	--	--	--
Total Dissolved Solids (TDS) mg/L	70300	--	668.4	415.9	1533	--	--	--	--	--

Parameter	STORET	Monitoring Wells								
		G181	G183	G184	G185	G191	R124	R126	R128	R133
Field Parameters										
pH	00400	--	--	--	--	--	--	--	--	--
Specific Conductance (umhos/cm)	00094	--	--	--	--	--	--	--	--	--
Indicator Parameters										
Boron (Dissolved) ug/L	01020	--	--	--	--	--	--	--	--	--
Chromium (Dissolved) ug/L	01030	10	10	10	10	10	10	10	10	10
Magnesium (Dissolved) mg/L	00925	6.5	22.5	5.1	11.8	36.9	82.1	340.9	8.7	3.9
Sulfate (Dissolved) mg/L	00946	--	--	--	--	--	--	--	--	--
Total Dissolved Solids (TDS) mg/L	70300	--	--	--	--	--	--	--	--	--

Attachement 2 - Continued

Site Name: Veolia ES Zion Landfill
Site Number: 0978020002

IEPA Permit No: 1995-343-LFM
Permit Log No: 2018-275

Parameter	STORET	Monitoring Wells								
		R166	R182	R193	T003	T004	G170	T005	T006	--
Field Parameters										
pH	00400	--	--	--	--	--	--	--	--	--
Specific Conductance (umhos/cm)	00094	--	--	--	555	834	799	--	--	--
Indicator Parameters										
Boron (Dissolved) ug/L	01020	--	--	--	615	660	--	--	--	--
Chromium (Dissolved) ug/L	01030	10	10	10	10	10	10	10	10	--
Magnesium (Dissolved) mg/L	00925	44.6	48.7	5.8	25.9	36.4	34.5	10.9	19.5	--
Sulfate (Dissolved) mg/L	00946	--	--	--	71.8	212.5	--	--	--	--
Total Dissolved Solids (TDS) mg/L	70300	--	--	--	373.9	421.3	--	--	--	--

Parameter	STORET	Monitoring Wells								
		GG2S	RE2S	G201	G202	G203	G204	G205	G206	GF7S
Field Parameters										
pH	00400	--	--	--	--	--	--	--	--	--
Specific Conductance (umhos/cm)	00094	--	--	--	--	--	--	--	--	--
Indicator Parameters										
Boron (Dissolved) ug/L	01020	4,616	--	--	--	--	--	--	--	--
Chloride (Dissolved) mg/L	00941	--	174	--	--	--	--	--	--	268
Chromium (Dissolved) ug/L	01030	--	--	10	10	10	10	10	10	--
Magnesium (Dissolved) mg/L	00925	--	--	19.4	20.3	19.5	17.3	17	18.5	--
Sulfate (Dissolved) mg/L	00946	--	--	--	--	--	--	--	--	1003
Total Dissolved Solids (TDS) mg/L	70300	--	--	--	--	--	--	--	--	1935
Boron (Total) ug/L	01022	4,095	--	--	--	--	--	--	--	--
Potassium (Total) mg/L	00937	6.56	--	--	--	--	--	--	--	--
Chloride (Total) mg/L	00940	--	184	--	--	--	--	--	--	295
Sodium (Total) mg/L	00929	130	--	--	--	--	--	--	--	--
Sulfate (Total) mg/L	00945	--	--	--	--	--	--	--	--	1030

TJD:SWS:IMS\0978020002-811LF-SM139-2018275-Attachment 2.xls

APPENDIX Q.3
Typical As-Built Diagrams for Groundwater Monitoring Wells

APTIM

Illinois Environmental Protection Agency **Well Completion Report**

Site Number: _____ County: _____

Site Name: _____ Well #: _____

State Plane Coordinate: X _____ Y _____ (or) Latitude: ____ ____ ____ Longitude: ____ ____ ____ Borehole #: _____

Surveyed by: _____ IL Registration #: _____

Drilling Contractor: _____ Driller: _____

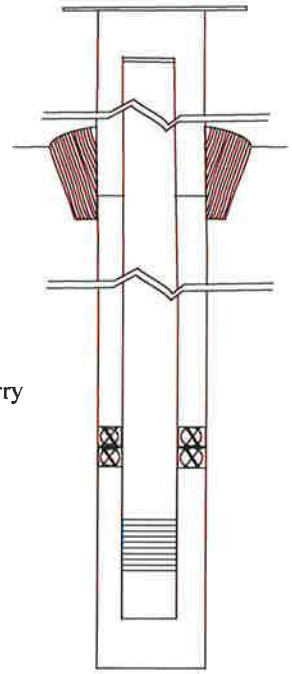
Consulting Firm: _____ Geologist: _____

Drilling Method: _____ Drilling Fluid (Type): _____

Logged By: _____ Date Started: _____ Date Finished: _____

Report Form Completed By: _____ Date: _____

ANNULAR SPACE DETAILS



Type of Surface Seal: _____

Type of Annular Sealant: _____

Installation Method: _____

Setting Time: _____

Type of Bentonite Seal - - Granular, Pellet, Slurry
(Choose One)

Installation Method: _____

Setting Time: _____

Type of Sand Pack: _____

Grain Size: _____ (Sieve Size)

Installation Method: _____

Type of Backfill Material: _____
(if applicable)

Installation Method: _____

	Elevations (MSL)*	Depths (BGS)	(.01ft.)
	_____	_____	Top of Protective Casing
	_____	_____	Top of Riser Pipe
	_____	_____	Ground Surface
	_____	_____	Top of Annular Sealant
	_____	_____	Static Water Level (After Completion)
	_____	_____	Top of Seal
	_____	_____	Top of Sand Pack
	_____	_____	Top of Screen
	_____	_____	Bottom of Screen
	_____	_____	Bottom of Well
	_____	_____	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIAL

(Choose one type of material for each area)

Protective Casing	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Above W.T.	SS304, SS316, PTFE, PVC, or Other
Riser Pipe Below W.T.	SS304, SS316, PTFE, PVC, or Other
Screen	SS304, SS316, PTFE, PVC, or Other

CASING MEASURMENTS

Diameter of Borehole (inches)	
ID of Riser Pipe (inches)	
Protective Casing Length (feet)	
Riser Pipe Length (feet)	
Bottom of Screen to End Cap (feet)	
Screen Length (1st slot to last slot) (feet)	
Total Length of Casing (feet)	
Screen Slot Size **	

**Hand-Slotted Well Screens are Unacceptable

APPENDIX Q.4
IEPA Well Construction Report Form and Well Abandonment Form

Illinois Department of Public Health
WATER WELL CONSTRUCTION REPORT

Date _____

TYPE OR PRESS FIRMLY WITH BLACK INK PEN. COMPLETE WITHIN 30 DAYS OF WELL COMPLETION AND SEND TO THE APPROPRIATE HEALTH DEPARTMENT.

1. Type of Well a. **Driven** Well Casing diam. _____in. Depth _____ft.
b. **Bored** Well Buried Slab ☐ Yes ☐ No
Hole Diameter ____in. to _____ft.; ____in. to_____ft.; ____in. to_____ft.
c. **Drilled** Well **PVC** casing Formation packer set at depth of _____ft.
Hole Diameter ____in. to _____ft. ____in. to_____ft. ____in. to_____ft.

Type of Grout	# of Bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)

d. **Drilled** Well **Steel** Casing- - - Mechanically Driven ☐ Yes ☐ No
Hole Diameter ____in. to _____ft. ____in. to_____ft. ____in. to_____ft.

Type of Grout	# of Bags	Grout Weight	From (ft.)	To (ft.)	Tremie Depth (ft.)

e. Well finished within ☒ Unconsolidated Materials ☐ Bedrock

f. Kind of Gravel Sand Pack Grain Size/Supplier # From (ft.) To (ft.)

2. Well Use ☐ Domestic ☐ Irrigation ☐ Commercial ☐ Livestock ☒ Monitoring ☐ Other
3. Date Well Completed _____ Well Disinfected ☐ Yes ☒ No
Driller's estimated well yield _____gpm
4. Date Permanent Pump Installed_____
5. Pump Capacity _____gpm Set at (depth) _____ft.
6. Pitless Adapter Model and Manufacturer _____
7. Well Cap Type and Manufacturer _____
8. Pressure Tank Working Cycle_____gals. Captive Air ☐ Yes ☐ No
9. Pump System Disinfected ☐ Yes ☐ No
10. Name of Pump Company _____
11. Pump Installer _____ License # _____
12. _____License # _____
Licensed Pump Contractor Signature

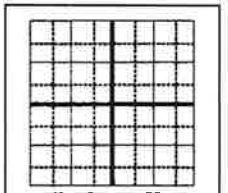
Illinois Department of Public Health
Division of Environmental Health
525 W. Jefferson St.
Springfield, IL 62761

DO NOT write on these lines

IMPORTANT NOTICE: This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act 85-0863. **DISCLOSURE OF THIS INFORMATION IS MANDATORY**. This form has been approved by the Forms Management Center.

GEOLOGICAL AND WATER SURVEY WELL RECORD

13. Property Owner _____ Well # _____
14. Driller _____ License # _____
15. Name of Drilling Co._____
16. Permit No. _____ Date Issued _____
17. Date Drilling Started _____
18. Well **SITE** address _____
19. Township Name _____Land ID # _____
20. Subdivision Name _____ Lot # _____
21. Location a. County _____
b. Township _____ Range _____Section _____
c._____ Quarter ____Quarter _____ Quarter
d. Coordinates _____ Site Elevation ____ ft. (msl)


For Survey Use

22. Casings, Liners* and Screen Information

Diam. (in.)	Material	Joint	Slot Size	From (ft.)	To (ft.)

(*) _____
(List reason for liner, type of upper and lower seals installed)

23. Water from _____at a depth of _____ft. to _____ft.
a. Static water level _____ ft. below casing which is ____in. above ground
b. Pumping level is _____ ft. pumping _____gpm after pumping for _____hours

24. Earth Materials Passed Through

	From (ft.)	To (ft.)

(If **dry hole**, fill out log and indicate how hole was sealed.)

_____ _____
25. Licensed Water Well Contractor Signature License Number

SEE REVERSE SIDE FOR ADDITIONAL INFORMATION)

Print Form

ILLINOIS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
525 W. JEFFERSON ST.
SPRINGFIELD, IL 62761

WATER WELL SEALING FORM

PDF FILLABLE/SAVABLE

RETURN ALL COPIES TO IDPH OR LOCAL HEALTH DEPARTMENT

This form shall be submitted to this Department or the local health department not more than 30 days after a water well, boring or monitoring well is sealed. Such wells are to be sealed not more than 30 days after they are abandoned in accordance with the sealing requirements in the Illinois Water Well Construction Code. THE LOCAL HEALTH DEPARTMENT OR REGIONAL PUBLIC HEALTH DEPARTMENT MUST BE NOTIFIED AT LEAST 48 HOURS PRIOR TO SEALING.

1. Ownership (Name of Controlling Party)

2. Well Location: Well Site Address | City | Zip

Lot # | Land I.D.# | County: Effingham | Township

Range | Section | SW | Quarter of the | SW | Quarter of the | NW | Quarter

GPS: North Degrees | Minutes | Seconds | West Degrees | Minutes | Seconds

Report decimal minutes to minutes and seconds by multiplying the decimal part of the minutes by 60, e.g. latitude 38 degrees 46.07 minutes N would be latitude 38 degrees 46 minutes 4.2 seconds (0.07 x 60 = 4.2) N. Report GPS coordinates to the nearest 0.1 second.

3. Year Drilled

4. Drilling Permit Number (and date, if known

5. Type of Well: Drilled

6. Total Depth (ft.)

Diameter (in.)

7. Formation clear of obstruction: Yes

8. Detains of Plugging (bentonite, neat cement or other materials)

Filled with		From (ft.)		to (ft.)	
Kind of plug		From (ft.)		to (ft.)	
Filled with		From (ft.)		to (ft.)	
Kind of plug		From (ft.)		to (ft.)	
Filled with		From (ft.)		to (ft.)	
Kind of plug		From (ft.)		to (ft.)	

9. CASING RECORD Upper 2 feet of casing removed: No

10. Date well was sealed

11. Licensed water well driller or other person approved by the Department performing well sealing

Name | Complete License Number

Address | City | State: Illinois | Zip Code

This state agency is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Public Act-0863. Disclosure of this information is mandatory. This form has been approved by the Forms Management Center. IL 482-0631- Revised 5/09

Questions regarding the completion of this form should be directed to the local health department or the Illinois Department of Public Health 217-782-5830, TTY (for hearing impaired only) 800-547-0466.

APPENDIX Q.5
Sampling Procedures

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SAMPLING PROCEDURES

The procedure for collecting a representative sample from a groundwater or leachate monitoring well typically consists of the following seven basic steps:

Step 1 - Preparations
Step 2 - Well Inspection/Measurements
Step 3 - Decontamination of Sampling Equipment
Step 4 - Low Flow Monitoring for Stabilization
Step 5 - Low Flow Collection of Representative Samples
Step 6 - Cleanup and Decontamination

These steps are discussed in detail below.

Step 1 - Preparations

1. A sample kit will be prepared. It will contain (at a minimum) the proper number and sizes of sample containers, a sturdy cooler or ice chest, preservatives, chain of custody forms, cold packs, and protective packaging. The selected environmental laboratory will provide complete sample kits for each sampling event. Cold packs will be refrigerated prior to traveling to the field. Alternatively, bags of ice will be purchased while en route to the site.

2. The site manager will be contacted a minimum of 24 hours prior to the sampling event to confirm the date(s) that personnel will be on site.

3. Field personnel will review the standard operating procedures for groundwater sampling and organize all necessary equipment and paperwork before traveling to the site. Typically, the necessary equipment can be packed easily into the back of a pick up or sport utility type vehicle. A 4 wheel drive vehicle will be used to access certain monitoring well locations. Keys for access gates and monitoring well casings at closed facilities will be provided by the site representative. Keys for operating facilities will be obtained from the Site Manager upon arrival at the landfill.

4. The location of the monitoring well to be sampled will be determined. If the monitoring location is not accessible by vehicle, then all required equipment will be hand carried to the monitoring site and organized.

5. All sample container label information will be completed using a permanent, fine point marker. The selected environmental laboratory will provide blank labels or if possible, they will pre label the appropriate sample containers prior to shipping the sample kits. As a minimum, the completed label will include:

    - Parameter(s) to be tested
    - Monitor well identification
    - Date of sample
    - Time of sample

- Site location
- Project number
- Identification of sampler

This information will also completed for the chain of custody forms.

When not in use, sample containers will be stored in the sample kit (cooler) with the lid closed. DO NOT OPEN THE SAMPLE CONTAINERS PRIOR TO USE AT THE MONITORING WELL LOCATION.

6. A "clean area" will be established near the monitoring well where the sample containers and equipment will be stored while not in use. Every effort will be made to keep the sampling equipment and containers from contacting the ground surface. If necessary, a disposable tarp will be used as a ground spread to prevent potential contamination of the sample containers. Typically, the back of the field vehicle will be used as the "clean area".

7. A clean, 8 ounce, wide mouth glass jar will be set out in a convenient place near the well. The jar will be used to contain an aliquot of groundwater to monitor the pH, conductance, and temperature values during well purging.

Step 2 - Well Inspection/Measurements

The padlock from the well protector will be removed and hung in the eyelet of the open cover. The outer well protector will be visually inspected. Any deterioration of the grout plug at the base of the well protector or any difficulty in opening the well protector will be noted. The well will be inspected for any signs of tampering or other deterioration. Any abnormalities will be reported to the Site Manager.

The volume of static water in the well will be determined so that a minimum of three well volumes can be purged from the well, if possible. Wells will only be purged to the top of the well screen to prevent volatilization of organics. The procedures below will be used to determine the volume of static water in a monitoring well.

1. The inner protective well casing cap will be removed and placed in the "clean area".

2. The static water level elevation will be determined. An electronic water level indicator will be used to determine water levels inside the monitoring well casing. Water level measurements will be recorded from the top of the inner well casing to the water surface to the nearest 0.01 foot.

3. The depth to the bottom of the well will be measured every time the well is sampled using either the electronic water level indicator, a weighted tape measure, or a bottom of well sounder. DEPTH TO BOTTOM IS NOT COLLECTED FROM THE LEACHATE MONITORING PORTS. Any discrepancies between the measured well depth and the well depth will be recorded on the as built diagram. When not in use, the water level measurement tools will be placed in the "clean area".

4. The well volume in the groundwater monitor well will be calculated. This calculation is not required for leachate monitor well sampling. Well volume is calculated by using the following formula:

$$V = 23.5r^2L$$

where:

V = Well volume to be calculated (gallons).

r = Inside radius of the well casing (feet).

L = Elevation of the static water level minus the elevation of the bottom of the well (feet).

All monitoring well information will be recorded such as identification, static water level, well volume, date, time, etc., on a typical groundwater sampling summary form.

Step 3 - Decontamination

Prior to purging or collecting any samples, all equipment that will be in contact with the sample will be cleaned by use of a spray bottle away from the well or using the following decontamination (decon) procedures:

1. Mix a solution of standard lab/industrial cleanser, such as Alconox, and distilled water according to the directions on the packaging.

2. Thoroughly clean all equipment that will be in contact with the samples with the solution using a stiff brush.

3. Thoroughly rinse with generous amounts of DISTILLED water.

4. Any cleaner and distilled water will be disposed of away from the well (surface flow away from the well) in an area that will not cause erosion or stress vegetation.

Step 4 - Low Flow Monitoring For Stabilization

The specific sampling method used to collect groundwater samples will be indicated on the Illinois EPA's Chemical Analysis Forms (LPC 160). Specifically, if low-flow groundwater sampling is conducted, an "L" shall be recorded in space 60. If another sampling method is utilized, an "F" shall be recorded in space 60.

If a dedicated pump has been installed in a well, it shall be located in the middle or slightly above the middle of the screened interval. Where the well is screened across the water table, the dedicated pump intake shall be located at the top of the water column. Due to on-site construction activities, it may be necessary to place the pump intake lower in the well to assure sample recovery. Low-flow groundwater samples shall not be collected within 24 hours of low-flow pump equipment installation. When collecting groundwater

samples using dedicated low-flow groundwater sampling equipment, the groundwater samples shall be collected using either one of two low-flow sampling methods, low-rate pumping or passive sampling. These methods and the criteria for selecting the specific method are described below:

(1) Low-Rate Pumping – Low-rate pumping shall be used at wells where it has been found that a low-flow rate can be established with a drawdown of less than 0.1 meter and with minimal fluctuation of the water level during pumping. At these wells, the flow rate should not exceed 0.5 liter/minute. Groundwater samples will be collected at these wells as follows:

a) A water level probe or pneumatic probe will be lowered into the well to determine the static water level and to monitor water level during the initial low-flow groundwater sampling activities. Once recharge characteristics have been determined for the well, the data can be used as guide for conducting subsequent sampling events.

b) Initially, the pump shall be operated at the minimum flow capacity of the pump, then gradually increased until some initial drawdown is observed. The flow rate then will be reduced slightly to achieve a stabilized pumping water level drawdown of less than 0.1 meter. This pumping rate will be established as the maximum purge rate for that well. In any case, the flow rate shall not exceed 0.5 liter/minute.

c) The well shall be purged at the maximum purge rate until the indicator parameters, pH, temperature, and specific conductivity have stabilized. Indicator parameters shall be monitored no less than 1 minute and no more than 5 minutes apart using a flow through cell or hand held field meter. Stabilization of the field parameters shall be considered complete when 3 consecutive readings are within ± 0.1 unit or 1% for pH, ± 5% for specific conductance, and ± 0.5º C or 3% for temperature of the measured unit.

d) Groundwater samples shall be collected immediately following purging and indicator parameter measurement.

(2) Passive Sampling – Where the yield of the well is too low to maintain minimal drawdown at very low pumping rate, 0.5 liter/minute or less, the well will be sampled by purging only 1.5 to 2 times the volume of the sampling equipment and tubing. Groundwater samples will be collected at these wells as follows:

a) A water level probe or pneumatic probe will be lowered into the well to determine the static water level and to monitor water level during the initial low-flow groundwater sampling activities. Once recharge characteristics have been determined for the well, the data can be used as guide for conducting subsequent sampling events.

b) If the yield of the well is too low to maintain minimal drawdown in the well at a very low pumping rate, 0.5 liter/minute or less, the well will be sampled by purging only 1.5 to 2 times the volume of the sampling device and tubing.

c) If filtration of the groundwater sample is necessary, an in-line filtration device may be utilized. If necessary, the filter shall be pre-rinsed following the manufacturers guidelines. If pre-rinsing is not necessary, a minimum of one liter of groundwater shall be passed through the filter following purging and prior to sampling.

d) Groundwater samples shall be collected immediately following purging.

In addition to the protocols outlined above, low-rate pumping protocols for wells with extremely slow recharge characteristics (those that cannot be sampled at any purge rate without exceeding the drawdown limit) will allow drawdown to exceed the 0.1 meter mark and will be sampled after one pump and tubing volume is removed from the well. In these wells, water levels will only be monitored to ensure that drawdown is not below the screen where the screen interval is fully saturated or below the pump intake where the screen interval is only partially saturated.

Sample Temperature

This measurement is made in all water samples at the time and place of well purging and sampling. Typically an electronic thermometer is placed in the aliquot of sample water. Allow the thermometer to equilibrate for approximately 20 seconds before recording the temperature. Note the units of measurement, i.e. in degrees Celsius or Fahrenheit.

Specific Conductance (Conductivity) of the Sample

1. Insert the conductivity probe or "stick" into the sample aliquot and turn the switch on to obtain a reading.

2. Record the instrument reading. Note the units of measurement, i.e. µmohs/cm or µS/cm.

pH Measurement of the Sample

1. Remove the probe cap and insert the pH probe or "stick" into the sample aliquot and turn the instrument on.

2. Allow the instrument to equilibrate (approximately 20 seconds) before recording the pH value.

3. Rinse the probe or "stick" electrode with distilled water and replace the cap.

No field measurements will be taken in samples which are to be submitted to the laboratory for analysis.

The electronic temperature, conductance, and pH probes are sensitive instruments, and require periodic calibration. Refer to the instrument manufacturer's instructions regarding calibration, handling and storage procedures. ALWAYS CLEAN THE INSTRUMENTS AFTER USE.

Step 5 - Low Flow Collection of Representative Samples

1. If preservatives have not already been added to the sample containers by the laboratory, add the sample preservatives to the appropriate containers and loosely replace the caps (the environmental laboratory should provide instructions as to which preservatives are to be added to specific sample containers). Extreme caution will be used when adding the preservatives because some of them are highly concentrated acids.

2. All equipment that will be in contact with the groundwater will be decontaminated in accordance with the procedures described above.

3. A representative sample of groundwater will be obtained using low flow sampling methods (either low rate pumping or passive sampling as described in the previous section). Care will be taken to not agitate the samples to cause volatilization of VOAs. The sample containers will be carefully filled. A decontaminated stainless steel, glass, or fluorocarbon resin funnel and a ring stand device may be set up above the sample container to be used to assist with filling the containers. All sample bottles except VOAs will be filled to within one (1) inch of the top. VOA samples will be carefully filled to over flowing and then capped to prevent the formation and/or inclusion of any air bubbles. Check for bubbles by inverting the container and shaking it. If bubbles are present, the jar will be re filled. This is to avoid cross contamination of the sample preservatives. Excessive agitating of samples will be avoided. The sample containers will be filled in order of their susceptibility to volatilization. The following order is recommended by the U.S. EPA in RCRA Groundwater Monitoring Technical Enforcement Guidance Document (OSWER 9950.1):

    a. Volatile organics (VOA)
    b. Purgeable organic carbon (POC)
    c. Purgeable organic halogens (POX)
    d. Total organic halogens (TOX)
    e. Total organic carbon (TOC)
    f. Extractable organics
    g. Total metals
    h. Dissolved metals
    i. Phenols
    j. Cyanide
    k. Sulfate and chloride
    l. Turbidity
    m. Nitrate and ammonia
    n. Radionuclides

4. Sample container lids will be placed in the “clean area” while filling the sample container. The sample containers will be immediately capped after they have been filled.

5. If filtration of the groundwater sample is necessary, an inline filtration device may be utilized. If necessary, the filter shall be pre-rinsed following

the manufacturers guidelines. If pre-rinsing is not necessary, a minimum of one liter of groundwater shall be passed through the filter following purging and prior to sampling.

In the event a sample cannot be filtered in the field, the clean sample storage container will be preserved at approximately 4 degrees Celsius and allowed to stand for up to 24 hours. This will allow the fine suspended material to settle from the sample. The clear portion of the sample will be poured into a second clean container, leaving the sediment in the initial container. The sample in the second container can then be filtered using the previously described procedure.

6. Each sample container will be placed in the sample kit cooler immediately after it has been filled. The inside temperature of the cooler will be maintained at 4 degrees Celsius, i.e. using frozen cold packs or ice.

7. If dictated by the method being used to analyze a sample for a particular constituent, aliquots will be preserved with an appropriate preservative as listed in Attachment 1 of this Sampling Protocol.

8. To prevent breakage during transport, protective packaging such as bubble wrap or Styrofoam will be used on sample containers. The sample kits will be handled as extremely fragile.

9. The chain of custody form will be completed. This form will accompany the samples during all aspects of sample collection, handling, and transport.

10. The sample kit will be secured during transport.

Step 6 - Clean Up and Decontamination

1. The protective cover will be closed and the lock replaced.

2. All disposable solid waste such as disposable coveralls, gloves, plastic tarps, aluminum foil, etc. will be collected and packed into a plastic trash bag for disposal into an on site trash container. All such trash will be treated as non hazardous unless warranted otherwise by conditions at the site.

3. All non dedicated field equipment (field instruments, work gloves, etc.) will be decontaminated prior to use at any other groundwater monitoring locations.