ATTACHMENT VII-1

EXAMPLE POTENTIOMETRIC/VELOCITY MAP SHOWING THE WASTE MANAGEMENT AREAS (WMAS) AND COORDINATES AND ELEVATIONS OF THE MONITORING WELLS

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LEGEND

- MONITORING WELL LOCATION
- MONITORING WELL ABANDONED
- MW-78 AND MW-79 WERE ABANDONED ON JANUARY 28 THROUGH 29, 2019.
- POTENTIOMETRIC SURFACE CONTOUR FEET ABOVE M.S.L (INTERVAL = 1 FT.) (DASHED WHERE INFERRED)
- TOPOGRAPHIC SURFACE CONTOUR
- * DATA NOT USED FOR CONTOURING
- NM NOT MEASURED
- #4 WASTE MANAGEMENT AREA
- TRIANGULAR ELEMENT USED IN VELOCITY CALCULATION

	ADJUSTED	SEEPAGE
VELOCITY (FT/DAY) =	10^{-3} - 10^{-2}	10^{-4} - 10^{-3}
VELOCITY (FT/DAY) =	10^{-2} - 10^{-1}	10^{-3} - 10^{-2}
VELOCITY (FT/DAY) =	10^{-1} - 10^{0}	10^{-2} - 10^{-1}

NOTES

Groundwater flow directions and seepage velocities were calculated pursuant to Condition D.4.b of Module VII of the Clean Harbors Grassy Mountain Facility Permit (Part B). These flow directions and rates were calculated using a systematic and simple method that was developed specifically to calculate groundwater velocities from irregularly spaced groundwater elevation data points (Pinder, 1981). Thirty-nine triangular elements were developed based upon monitoring well locations, hydraulic conductivity data availability, and the locations of active and closed landfill cells. The triangular elements are displayed on the site potentiometric surface map.

Also displayed are the calculated flow vectors. The vectors begin in the center of each triangle and indicate the calculated direction of flow. The vectors are color-coded based upon calculated groundwater seepage velocities. The seepage velocities were calculated from measured values of hydraulic conductivity, (K) hydraulic gradient, (i) and porosity, (n).

The legend also presents two ranges of seepage velocity which attempt to characterize the heterogeneous nature of subsurface conditions at the site. The ranges include seepage velocity based on "K" values derived from slug tests responding mainly to the upper clayey-silty water bearing unit. However adjusted "K" values are based on pump test data which describe groundwater flow affected by a potentially more permeable, underlying silty sand unit. Seepage velocity estimates incorporating the silty sand unit result in values that are effectively one order of magnitude higher than seepage velocity values based on the clay-silt unit alone.

UReferences

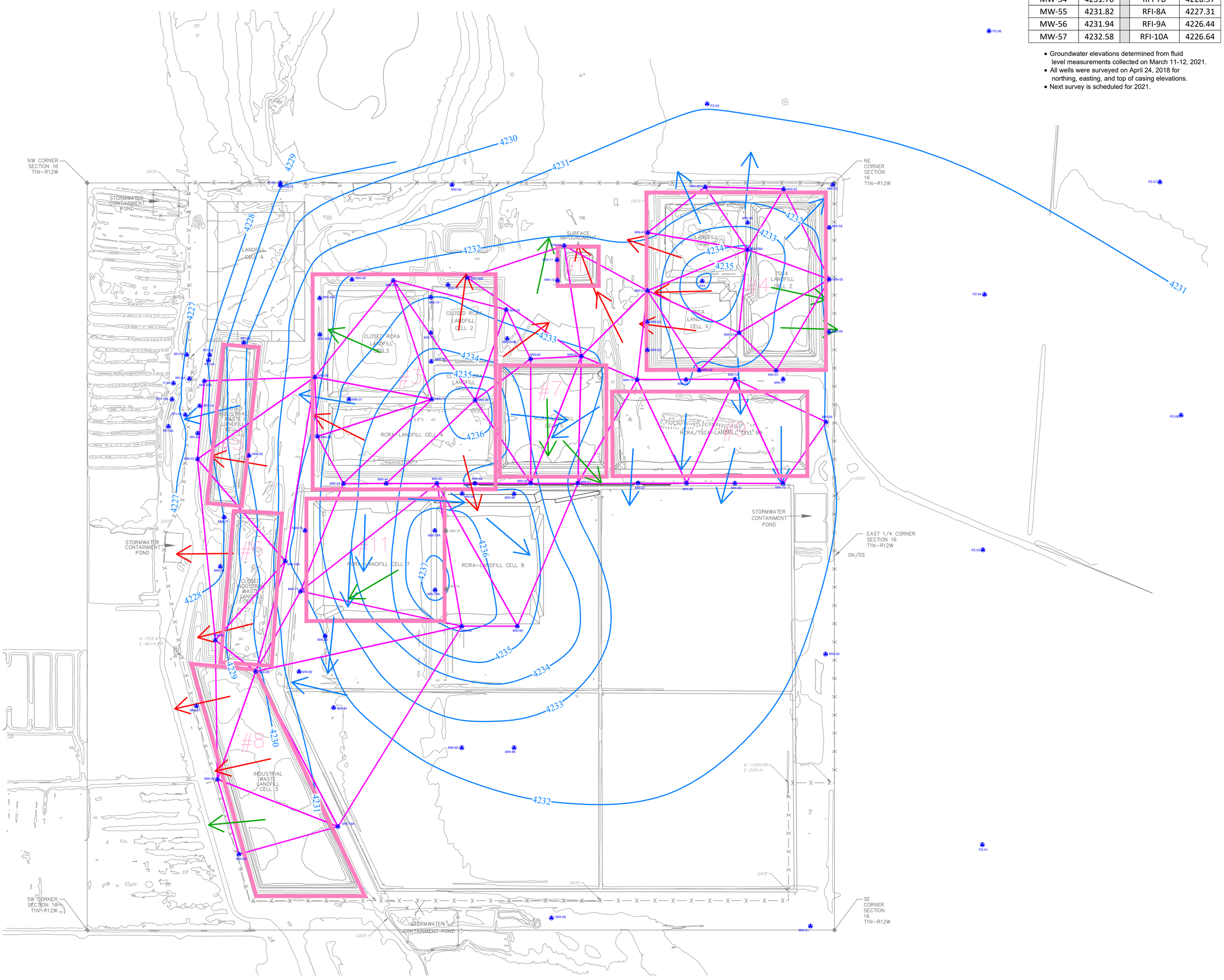
Pinder, George F., Michael Celia, and William G. Gray. 1981. Velocity calculation from randomly located hydraulic heads. Ground Water. v. 19, no. 3, pp. 262-264.

Monitoring Wells			Average K (ft/day)	Gradient (dh/dl)	Velocity		
					Darcey	Seepage	Adjusted
MW-17	MW-27A	MW-59	0.077957	0.002484	0.000194	0.000387	0.003873
MW-26	MW-25	MW-27A	1.945367	0.002744	0.005338	0.010677	0.106768
MW-72	MW-68	MW-70	0.636	0.001208	0.000768	0.001537	0.015367
MW-72	MW-70	MW-09	4.7448	0.001032	0.004896	0.009792	0.097923
MW-37A	MW-36	MW-57	1.259067	0.001488	0.001873	0.003747	0.037469
MW-37A	MW-55	MW-38A	0.113233	0.001764	0.0002	0.0004	0.003995
MW-38A	MW-53	MW-40A	0.322367	0.004741	0.001528	0.003057	0.03057
MW-37A	MW-38A	MW-21	7.7296	0.00164	0.012673	0.025347	0.253468
MW-18A	MW-59	MW-33	1.651123	0.005272	0.008704	0.017408	0.174084
MW-59	MW-32A	MW-33	0.38539	0.003988	0.001537	0.003074	0.03074
MW-26	MW-60	MW-50	0.3601	0.004463	0.001607	0.003214	0.032145
MW-18A	MW-33	MW-35	1.8833	0.006343	0.011946	0.023892	0.238918
MW-26	MW-44	MW-50	2.39387	0.003048	0.007296	0.014592	0.145922
MW-38A	MW-40A	MW-41	0.890933	0.003701	0.003297	0.006595	0.065948
MW-74	MW-51	MW-68	0.515733	0.001252	0.000646	0.001292	0.012918
MW-10	MW-58A	MW-52	0.353133	0.000755	0.000267	0.000533	0.005335
MW-19A	MW-05	MW-48	1.000633	0.005044	0.005047	0.010094	0.100936
MW-05	MW-18A	MW-35	2.794833	0.005185	0.014492	0.028983	0.289831
MW-68	MW-72	MW-74	0.72	0.001262	0.000908	0.001817	0.01817
MW-57	MW-55	MW-37A	0.186067	0.00153	0.000285	0.000569	0.005692
MW-55	MW-53	MW-38A	0.3748	0.004405	0.001651	0.003302	0.033018
MW-21	MW-38A	MW-41	8.559733	0.002017	0.017268	0.034536	0.345358
MW-21	MW-36	MW-37A	8.861067	0.001536	0.013613	0.027227	0.272267
MW-52	MW-21	MW-10	8.036633	0.000722	0.005806	0.011613	0.116125
MW-52	MW-74	MW-21	8.208	0.000926	0.007599	0.015199	0.151988
MW-50	MW-52	MW-60	0.602567	0.000482	0.00029	0.000581	0.005809
MW-50	MW-51	MW-52	0.3287	0.001016	0.000334	0.000668	0.006677
MW-51	MW-74	MW-52	0.549333	0.001266	0.000695	0.001391	0.013907
MW-26	MW-60	MW-25	2.193533	0.003272	0.007177	0.014353	0.143535
PZ-04	PZ-08	PZ-07	0.040733	0.000489	1.99E-05	3.98E-05	0.000398
MW-55	PZ-08	PZ-07	0.100367	0.000488	4.9E-05	9.79E-05	0.000979
MW-78	MW-45	MW-43	3.554667	0.000792	0.002815	0.005631	0.056308
MW-76	MW-77	MW-78	1.291933	0.001118	0.001444	0.002889	0.028889
MW-79	MW-78	MW-77	0.622567	0.000466	0.00029	0.00058	0.005797
MW-79	MW-77	MW-05	1.471433	0.003275	0.004819	0.009638	0.096381
MW-19A	MW-79	MW-05	1.042633	0.002034	0.002121	0.004241	0.04241
MW-79	MW-51	MW-45	1.6795	0.000303	0.000509	0.001018	0.010176
MW-76	MW-78	MW-43	2.681533	0.001837	0.004926	0.009852	0.098525

DARCY VELOCITY: Vd=K(dH/dL)
SEEPAGE VELOCITY: Vs=Vd/n, N=0.50
ADJUSTED VELOCITY: Va=Vs*10

POTENTIOMETRIC SURFACE ELEVATIONS March 2021 Data			
Well Identification	Elevation (Ft/MSL)	Well Identification	Elevation (Ft/MSL)
MW-01	4231.87	MW-58A	4232.81
MW-02	4231.26	MW-59	4231.69
MW-04	4231.32	MW-60	4233.19
MW-05	4229.80	MW-67	4232.30
MW-06	4230.16	MW-68	4232.27
MW-07	4228.99	MW-69	4232.29
MW-08	4231.74	MW-70	4232.13
MW-09	4231.99	MW-71	4232.62
MW-10	4232.13	MW-72	4232.85
MW-11	4232.13	MW-73	4233.02
MW-12	4232.27	MW-74	4232.99
MW-13	4232.80	MW-75	4228.01
MW-14	NM	MW-76	4232.48
MW-15	4233.86	MW-77	4231.90
MW-16	4234.38	MW-78A	4236.97
MW-17	4235.83	MW-79A	4237.05
MW-18A	4231.99	MW-80	4231.74
MW-19A	4231.51	MW-81	4231.88
MW-20	4231.96	MW-82	4231.98
MW-21	4232.34	MW-83	4236.24
MW-22	4232.37	MW-84	4235.72
MW-23	4232.48	MW-85	4232.17
MW-24	4231.61	MW-86	4232.16
MW-25	4232.48	MW-95	4235.12
MW-26	4236.98	MW-96	4235.14
MW-27A	4232.47	P-3A	4226.59
MW-28	4232.19	P-3B	4226.67
MW-29A	4231.78	P-3C	4228.61
MW-30A	4231.72	P-4A	4228.27
MW-31	4233.41	P-4B	4230.00
MW-32A	4227.72	P-4C	4229.34
MW-33	4227.05	PXY	4235.16
MW-34	4227.80	PZ-01	4231.80
MW-35	4228.70	PZ-03	4231.71
MW-36	4232.77	PZ-04	4231.47
MW-37A	4233.70	PZ-05	4230.97
MW-38A	4234.09	PZ-06	4230.45
MW-39	4232.84	PZ-07	4230.65
MW-40A	4231.44	PZ-08	4231.47
MW-41	4231.86	RFI-1A	4227.55
MW-42	4232.21	RFI-1B	4227.73
MW-43	4233.57	RFI-2A	4228.05
MW-44	4234.33	RFI-2B	4227.64
MW-45	4235.08	RFI-3A	4228.01
MW-46	4234.73	RFI-3B	4227.51
MW-47	NM	RFI-4A	4227.33
MW-48	NM	RFI-4B	4227.12
MW-49	NM	RFI-5A	4227.87
MW-50	4234.30	RFI-5B	4226.93
MW-51	4232.61	RFI-6A	4229.92
MW-52	4233.11	RFI-6B	4228.94
MW-53	4231.43	RFI-7A	4227.10
MW-54	4231.70	RFI-7B	4226.97
MW-55	4231.82	RFI-8A	4227.31
MW-56	4231.94	RFI-9A	4226.44
MW-57	4232.58	RFI-10A	4226.64

- Groundwater elevations determined from fluid level measurements collected on March 11-12, 2021.
- All wells were surveyed on April 24, 2018 for northing, easting, and top of casing elevations.
- Next survey is scheduled for 2021.



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FEET

BY	DATE
DRAWN JGM	05/12/21
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REVISED	
APPROVED	
APPROVED	

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POTENTIOMETRIC SURFACE MAP AND GROUNDWATER VELOCITY MAP
MARCH 2021

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