

## Monitoring Well Input for Simple Activity-Flux Calculations

This example is for a transect that is about 175 feet away from a large body of water. This worksheet is for general hydrologic data entry. The worksheet titled "TransectPlanView" shows the general layout of the problem with the large body of water and monitoring wells plotted relative to the transect. Nearby monitoring wells which are off the transect are projected onto the transect. For a vertical conceptualization of the problem and hydrostratigraphy, see the worksheet titled "TransectVertical".

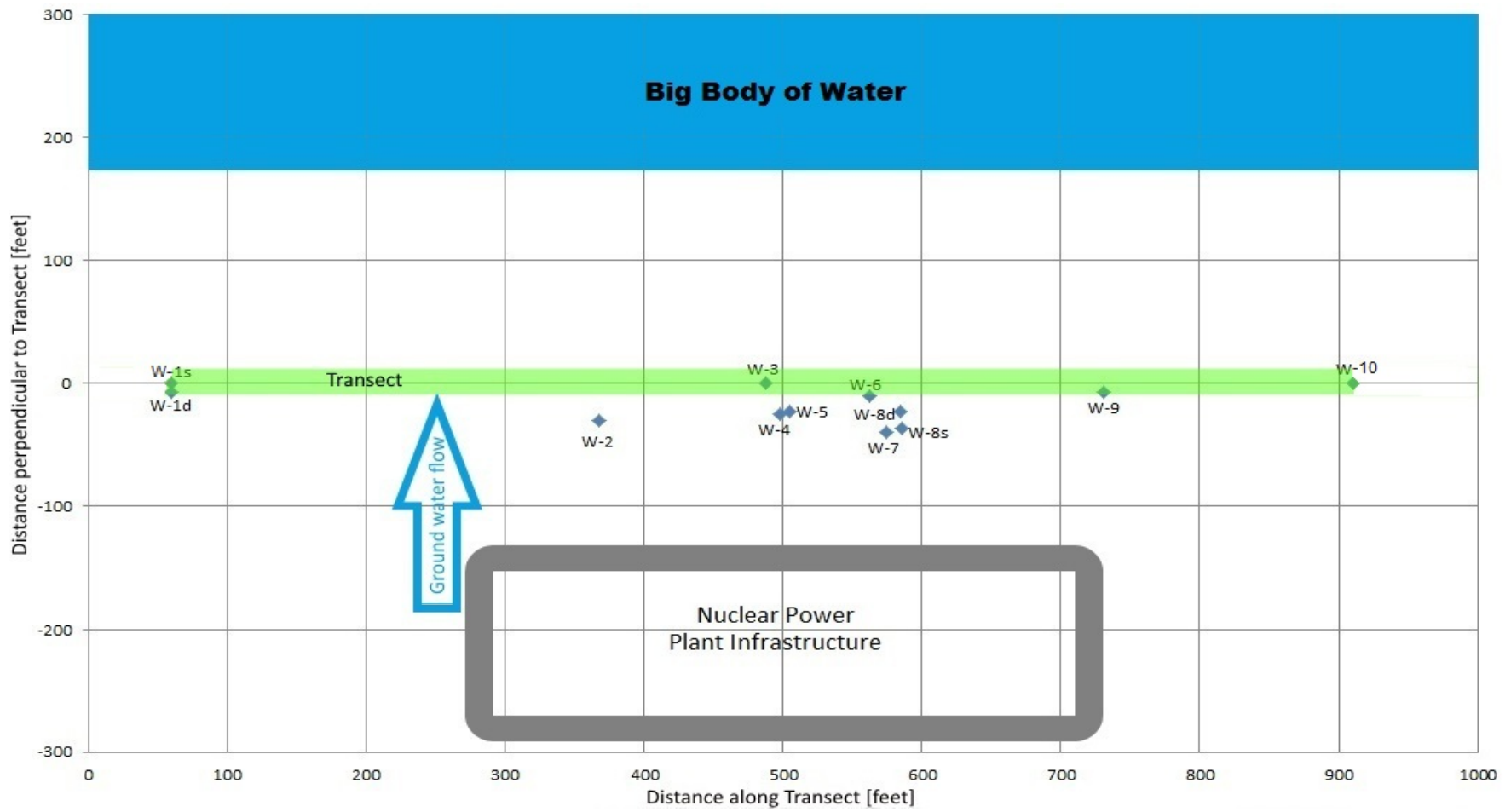
Calculated (or derived) quantities are displayed using an *italic* font. The following worksheets have the monitoring data and activity-flux calculations (see "MonitoringData" and "ActivityFlux" worksheets). This spreadsheet is for the case that assumes uniform hydraulic properties within each saturated unit and, within the rectangular portion of the transect represented by the monitoring well, a uniform concentration within each saturated unit. The activity flux rate (at an instant in time) is the simple product of the specific discharge, the concentration, the transect-block area (A), and constants for unit conversions; in this case, we need the conversion from liters to cubic feet. Specific discharge is estimated by Darcy's Law  $q = -KI$  with the Hydraulic Gradient (I) approximated perpendicular to the transect.

Material Properties:	K [ft/day]	Hydraulic Gradient	Specific Discharge [ft/day]	Porosity	Seepage Velocity [ft/day]
Sand	86.4	0.008	<i>0.6912</i>	0.3	<i>2.304</i>
Silty Sand	43.2	0.008	<i>0.3456</i>	0.3	<i>1.152</i>

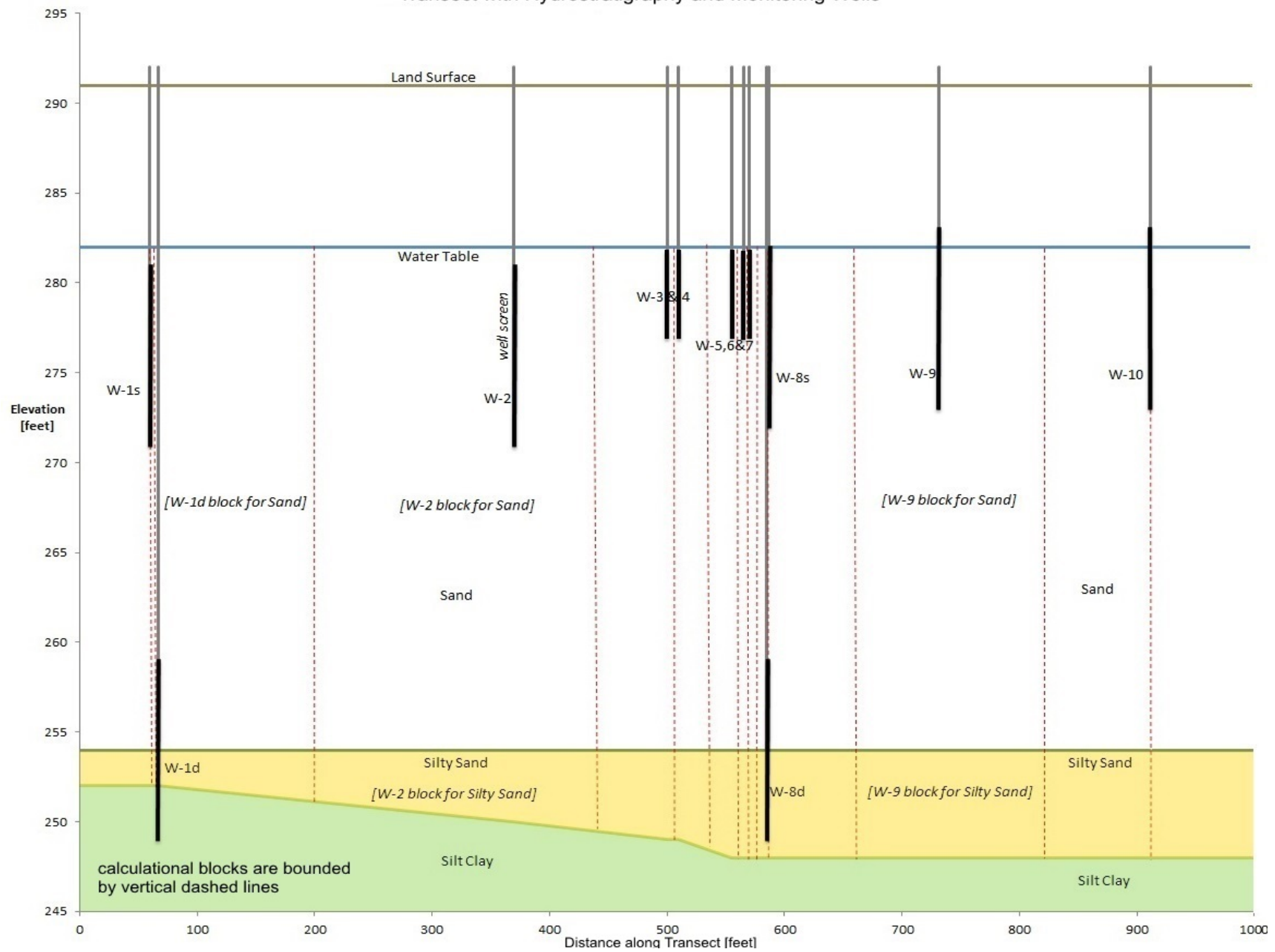
The seepage velocity is the specific discharge,  $q$  divided by the porosity. The bulk water flux through a transect block is the specific discharge times the transect-block area which is the width of the block times the saturated thickness of the block.

Well or Boring ID	W-1s	W-1d	W-2	W-3	W-4	W-5	W-6	W-7	W-8d	W-8s	W-9	W-10	
Distance along Transect [ft]	60	67	370	500	510	555	565	570	585	587	731	911	
Elevations	Water Table	282	282	282	282	282	282	282	282	282	282	282	
	Base of	Sand	254	254	254	254	254	254	254	254	254	254	254
		Silty Sand	252	252	250	249	249	248	248	248	248	248	248
	Screened Interval	Top	281	254	281	282	282	282	282	254	282	283	283
Bottom		271	249	271	277	277	277	277	249	272	273	273	
Transect Blocks	Width [feet]	<i>3.5E+00</i>	<i>1.6E+02</i>	<i>2.2E+02</i>	<i>7.0E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>7.5E+00</i>	<i>1.0E+01</i>	<i>8.5E+00</i>	<i>7.3E+01</i>	<i>1.6E+02</i>	<i>9.0E+01</i>
	Thickness [feet]	Sand	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>	<i>2.8E+01</i>
		Silty Sand	<i>2.0E+00</i>	<i>3.0E+00</i>	<i>3.5E+00</i>	<i>4.5E+00</i>	<i>5.5E+00</i>	<i>5.5E+00</i>	<i>6.0E+00</i>	<i>6.0E+00</i>	<i>6.0E+00</i>	<i>6.0E+00</i>	<i>6.0E+00</i>
Bulk Water Flux [cubic ft/day]	Sand	<i>6.8E+01</i>	<i>3.0E+03</i>	<i>4.2E+03</i>	<i>1.4E+03</i>	<i>5.3E+02</i>	<i>5.3E+02</i>	<i>1.5E+02</i>	<i>1.9E+02</i>	<i>1.6E+02</i>	<i>1.4E+03</i>	<i>3.1E+03</i>	<i>1.7E+03</i>
	Silty Sand	<i>2.4E+00</i>	<i>1.6E+02</i>	<i>2.6E+02</i>	<i>1.1E+02</i>	<i>5.2E+01</i>	<i>5.2E+01</i>	<i>1.6E+01</i>	<i>2.1E+01</i>	<i>1.8E+01</i>	<i>1.5E+02</i>	<i>3.4E+02</i>	<i>1.9E+02</i>
Total Water Flux:	<i>1.8E+04</i> cubic ft/day												

<b>The activity-flux equation:</b>		Time of Travel to Large Body of Water (~175 feet away from the Transect):												
Activity flux = $Q \cdot C \cdot 28.3168$		Sand		76 days									Since Tritium has a 4500 day half-life, there will be minimal decay from the time that it passes through the transect to the time that it enters the body of water; i.e., we wouldn't expect the concentrations to decrease much simply due to radioactive decay, but we'll calculate it on the "ActivityFlux" worksheet.	
		Silty Sand		152 days										
where:														
Q = bulk water flux [cubic ft/day]														
C = tritium concentration [pCi/l]														
28.3168 = the number of liters in a cubic foot.														



### Transect with Hydrostratigraphy and Monitoring Wells



Transect-Block Tritium Concentrations

		Date	Layer	W-1s	W-1d	W-2	W-3	W-4	W-5	W-6	W-7	W-8d	W-8s	W-9	W-10
Representative Tritium Concentrations by Layer [pCi/l]	10/15/2009	Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	724	2238	20018	20018	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
	11/15/2009	Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	24769	217351	217351	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
	12/15/2009	Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	6769	40828	40828	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
	1/15/2010	Sand	<MDL	<MDL	1046	<MDL	<MDL	<MDL	<MDL	<MDL	47432	11029	11029	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
	2/15/2010	Sand	<MDL	<MDL	1509	<MDL	<MDL	<MDL	<MDL	<MDL	28324	889	889	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
	3/15/2010	Sand	<MDL	<MDL	2696	<MDL	<MDL	<MDL	<MDL	<MDL	24707	647	647	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
	4/15/2010	Sand	<MDL	<MDL	2688	<MDL	<MDL	<MDL	<MDL	<MDL	8752	8126	8126	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
	5/15/2010	Sand	<MDL	<MDL	1707	<MDL	<MDL	<MDL	<MDL	<MDL	13234	1492	1492	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
	6/15/2010	Sand	<MDL	<MDL	2083	<MDL	<MDL	<MDL	<MDL	<MDL	6902	7701	7701	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
	7/15/2010	Sand	<MDL	<MDL	2944	<MDL	<MDL	<MDL	<MDL	<MDL	5495	1886	1886	<MDL	<MDL
		Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
8/15/2010	Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	4722	1160	1160	<MDL	<MDL	
	Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	
9/15/2010	Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	
	Silty Sand	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	

"< MDL" (Minimum Detection Level) Substitution: 500 pCi/liter

Activity-Flux Calculator

		W-1s	W-1d	W-2	W-3	W-4	W-5	W-6	W-7	W-8d	W-8s	W-9	W-10
Date	Layer	Activity Flux through each Transect Block [pCi/day]											
10/15/2009	Sand	9.59E+05	4.25E+07	5.93E+07	1.92E+07	7.54E+06	7.54E+06	2.98E+06	1.23E+07	9.32E+07	8.01E+08	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
11/15/2009	Sand	9.59E+05	4.25E+07	5.93E+07	1.92E+07	7.54E+06	7.54E+06	2.06E+06	1.36E+08	1.01E+09	8.70E+09	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
12/15/2009	Sand	9.59E+05	4.25E+07	5.93E+07	1.92E+07	7.54E+06	7.54E+06	2.06E+06	3.71E+07	1.90E+08	1.63E+09	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
1/15/2010	Sand	9.59E+05	4.25E+07	1.24E+08	1.92E+07	7.54E+06	7.54E+06	2.06E+06	2.60E+08	5.14E+07	4.41E+08	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
2/15/2010	Sand	9.59E+05	4.25E+07	1.79E+08	1.92E+07	7.54E+06	7.54E+06	2.06E+06	1.55E+08	4.14E+06	3.56E+07	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
3/15/2010	Sand	9.59E+05	4.25E+07	3.20E+08	1.92E+07	7.54E+06	7.54E+06	2.06E+06	1.35E+08	3.01E+06	2.59E+07	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
4/15/2010	Sand	9.59E+05	4.25E+07	3.19E+08	1.92E+07	7.54E+06	7.54E+06	2.06E+06	4.80E+07	3.79E+07	3.25E+08	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
5/15/2010	Sand	9.59E+05	4.25E+07	2.03E+08	1.92E+07	7.54E+06	7.54E+06	2.06E+06	7.25E+07	6.95E+06	5.97E+07	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
6/15/2010	Sand	9.59E+05	4.25E+07	2.47E+08	1.92E+07	7.54E+06	7.54E+06	2.06E+06	3.78E+07	3.59E+07	3.08E+08	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
7/15/2010	Sand	9.59E+05	4.25E+07	3.49E+08	1.92E+07	7.54E+06	7.54E+06	2.06E+06	3.01E+07	8.79E+06	7.55E+07	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
8/15/2010	Sand	9.59E+05	4.25E+07	5.93E+07	1.92E+07	7.54E+06	7.54E+06	2.06E+06	2.59E+07	5.40E+06	4.64E+07	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
9/15/2010	Sand	9.59E+05	4.25E+07	5.93E+07	1.92E+07	7.54E+06	7.54E+06	2.06E+06	2.74E+06	2.33E+06	2.00E+07	4.44E+07	2.47E+07
	Silty Sand	3.43E+04	2.28E+06	3.71E+06	1.54E+06	7.40E+05	7.40E+05	2.20E+05	2.94E+05	2.50E+05	2.14E+06	4.76E+06	2.64E+06
<b>Total Transect Activity Flux:</b>													
		<b>Sand</b>			<b>Silty Sand</b>								
<b>Date</b>	<b>pCi/day</b>	<b>Ci/day</b>	<b>Ci/year</b>	<b>pCi/day</b>	<b>Ci/day</b>	<b>Ci/year</b>							
10/15/2009	1.12E+09	1.12E-03	4.07E-01	1.93E+07	1.93E-05	7.07E-03							
11/15/2009	1.01E+10	1.01E-02	3.67E+00	1.93E+07	1.93E-05	7.07E-03							
12/15/2009	2.07E+09	2.07E-03	7.56E-01	1.93E+07	1.93E-05	7.07E-03							
1/15/2010	1.03E+09	1.03E-03	3.75E-01	1.93E+07	1.93E-05	7.07E-03							
2/15/2010	5.23E+08	5.23E-04	1.91E-01	1.93E+07	1.93E-05	7.07E-03							
3/15/2010	6.33E+08	6.33E-04	2.31E-01	1.93E+07	1.93E-05	7.07E-03							
4/15/2010	8.79E+08	8.79E-04	3.21E-01	1.93E+07	1.93E-05	7.07E-03							
5/15/2010	4.90E+08	4.90E-04	1.79E-01	1.93E+07	1.93E-05	7.07E-03							
6/15/2010	7.78E+08	7.78E-04	2.84E-01	1.93E+07	1.93E-05	7.07E-03							
7/15/2010	6.12E+08	6.12E-04	2.24E-01	1.93E+07	1.93E-05	7.07E-03							
8/15/2010	2.86E+08	2.86E-04	1.04E-01	1.93E+07	1.93E-05	7.07E-03							
9/15/2010	2.33E+08	2.33E-04	8.52E-02	1.93E+07	1.93E-05	7.07E-03							
<b>12-Month Tritium activity release (at transect):</b>		5.69E-01	Curies			8.48E-02	Curies						
<b>2010 annual activity discharge from each layer:</b>		5.62E-01	Curies			8.28E-02	Curies						
<b>2010 Annual Total Tritium Activity discharged via ground-water to water body:</b>						6.45E-01	Curies						
<b>2010 Transect Average Tritium Concentration discharged to water body:</b>						3.50E+03	pCi/l						