Monitoring of the Water Levels in the Wetlands of Fourmile Branch Near the F- and H-Areas of SRS: FY97

by

K. L. Dixon

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

A. L. Schwartzman

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Kenneth L. Dixon
Adam L. Schwartzman

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Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

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Monitoring of the Water Levels in the Wetlands of Fourmile Branch Near the F- and H-Areas of SRS: FY97

K. L. Dixon and A. L. Schwartzman
Savannah River Technology Center
Westinghouse Savannah River Company
Aiken, SC 29802

Executive Summary

A remediation system for the groundwater in F- and H-Areas is being implemented in accordance with a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Part B Permit. The design of this system includes a network of extraction and injection wells to maintain hydraulic control of the 10,000 pCi/ml tritium plume. Drawdown of the water table near the extraction wells may result in drying of a portion of the wetland areas near Fourmile Branch. In order to assess potential impacts of the remediation effort on the riparian wetland system, a network of twenty three piezometers was installed. This network of piezometers was established along the groundwater outcrop (i.e., seepage line) for the water table aquifer, specifically targeting those areas closest to the extraction wells. The purpose of the piezometer network is to establish baseline hydraulic head data for the water table aquifer at the F- and H-Area seepage lines prior to startup of the groundwater extraction/injection remediation system.

Monthly water level measurements were taken from each piezometer, and are presented in this report. Additionally, some piezometers were instrumented with data loggers for continuous monitoring of water levels. The purpose of continuous monitoring is to investigate the natural variability of water levels in the riparian wetland system of Fourmile Branch. Of particular interest is the variation in water levels associated with rainfall events, and evapotranspiration demand. The frequency, magnitude, and duration of these natural variations are unknown, and more frequent monitoring is required to assess them. Additionally, following startup of the extraction/injection system, increased variation in the hydrologic system in and around the wetlands is expected. These variations are expected to be more pronounced at those locations closest to the extraction wells. Thus, the piezometers closest to the extraction wells were chosen for instrumentation. The establishment of a baseline for the natural variations, as well as for the variations associated with the remediation system startup, will allow for the determination of an appropriate monitoring frequency for the remaining piezometers.

Background

Seepage basins in the F- and H-Areas of the Savannah River Site (SRS) received low-level radioactive waste effluent from the chemical separations processes in the General Separations Area. This waste effluent consisted mostly of sodium hydroxide, nitric acid, low levels of various radionuclides (primarily tritium), and some metals (Killian et al., 1985a and b). Discharges to the seepage basins were discontinued in 1988 and the basins were capped and sealed in 1990. As a result of basin operations, groundwater beneath and down gradient of the basins was contaminated. The contamination is located primarily in the water table aquifer (Aquifer Zone IIB₂) and in the Barnwell/McBean Aquifer (Aquifer Zone IIB₁). In both F- and H-Area near the seepage basins, groundwater in Aquifer Zone IIB₂ and IIB₁ flows toward Fourmile Branch. Aquifer Zone IIB₂ discharges to the wetlands and Fourmile Branch whereas Aquifer Zone IIB₁ discharges primarily to Fourmile Branch. Contaminants originating from the seepage basins have been detected in shallow groundwater outcrops (i.e. the seepage) in the wetlands of Fourmile Branch in both F- and H-Area (Haselow et al., 1990; Dixon et al., 1993a; Dixon et al., 1993b, Dixon et al., 1994).

A remediation system for the groundwater in F- and H-Areas is being implemented in accordance with a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Part B Permit. The design of this system includes a network of extraction and injection wells to maintain hydraulic control of the 10,000 pCi/ml tritium plume.

The remediation system in F-Area will consist of a total of seventeen wells within Aquifer Zone IIB₂; nine extraction and eight injection wells. The remediation system in H-Area will consist of twenty three wells within Aquifer Zone IIB₂, fifteen extraction wells and eight injection wells. Figures 1 and 2 show the locations of the extraction/injection wells for the water table aquifer (Aquifer Zone IIB₂) in F-

Area and H-Area, respectively. The extraction wells are prefixed "FEX" and "HEX" and the injection wells are prefixed "FIN" and "HIN"

Decreases in water levels associated with drawdown near the extraction wells may result in drying of a portion of the wetlands, and an overall movement of the seepage towards Fourmile Branch. Chronic depression of the water table at the wetlands, and the associated reversal in direction of groundwater flow, may result in alterations of the wetland plant and animal communities in this area. Further, changes in the hydrology of the wetlands will impact contaminant transport and contaminant concentrations at the new seepines.

To aid in assessing the impacts of the remediation system on the wetlands, changes in water levels in and near the wetlands must be monitored. Baseline hydraulic head data for the water table aquifer at both the F- and H-Area seepines should be collected prior to initiation of groundwater extraction and continued following startup. This is critical to identifying the source of any wetland impacts that may be observed following startup of the extraction/injection system. To accomplish this, a network of piezometers was established in the wetlands of Fourmile Branch in both F- and H-Areas in 1996 (Dixon, 1996). Currently, this network consists of twenty three piezometers at seventeen different locations. The purpose of this report is to detail the results of monthly water level measurements.

METHODS

A total of twenty three water table piezometers have been installed at seventeen locations in the wetlands of Fourmile Branch near F- and H-Areas. During January and May of 1996, twenty piezometers were installed at fourteen locations in a network in both F- and H-Area (FPZ and HPZ prefixes). The network was designed to outline the current seepage focusing on those areas expected to be most impacted by the remediation system (Figures 1 and 2). At locations with heterogeneous stratigraphy,

piezometers were installed in clusters. The deeper piezometers were designated with the suffix "A", and the shallow piezometers were designated with the suffix "B". During June 1997, three additional piezometers were installed in a reference area located in the wetlands of Fourmile Branch, but outside the area of influence of the remediation system (Figure 3). These reference piezometers (FHR prefix) were intended to provide a baseline for comparison to water level changes observed in those piezometers located within the area of influence of the groundwater remediation system.

With the exception of FPZ003A, all piezometers were installed using hand augering equipment (3 1/4" bucket auger) according to WSRC-3Q5 (Chapter 7) procedures. Location FPZ003A is in an upland area, and due to the depth to the water table at this location, it was installed using a hollow stem augering method.

A detailed discussion of the installation methods for all piezometers but the reference piezometers has been presented by Dixon (1996). The installation methods for the reference piezometers were essentially the same as those described by Dixon (1996) and are not repeated here.

Table 1 gives the piezometer construction information for all the piezometers (FPZ, HPZ, and FHR series).

Measurement of Water Levels

Water levels in the piezometers were measured monthly using an electric water level tape. From these measurements, the elevation of the water table was determined for each location. Additionally, the water level of Fourmile Branch was measured at two locations. These two stream sites were located where Road C4 and Road E1 cross Fourmile Branch.

Instrumentation of Selected Piezometers

In an effort to investigate the natural variability of water levels in the riparian wetland system of Fourmile Branch, several piezometers were equipped with data logging equipment to allow for continuous water level monitoring. Of particular interest is the variation in water levels associated with rainfall events, and evapotranspiration demand. The frequency, magnitude, and duration of these natural variations are unknown, and more frequent monitoring is required to assess them. Additionally, following startup of the extraction/injection system, increased variation in the hydrologic system in and around the wetlands is expected. These variations are expected to be more pronounced at those locations closest to the extraction wells. Thus, the piezometers closest to the extraction wells were chosen for instrumentation. The establishment of a baseline for the natural variations, as well as for the variations associated with the remediation system startup, will allow for the determination of an appropriate monitoring frequency for the remaining piezometers.

The piezometers selected for instrumentation are shown in Figures 1 and 2, and are listed in Table 2. Table 2 also gives the date of instrumentation for each piezometer. Each of the selected piezometers was equipped with a pressure transducer (5 psig range) controlled by a Campbell Scientific, Inc. CR10X data logger. Additionally, at locations FPZ005A and HPZ003A, a tipping bucket rain gage was connected to the CR10X to provide rainfall data.

Water level measurements were monitored continuously at each location and averaged every thirty minutes. Additionally, rainfall amounts were totaled every thirty minutes for both F- and H-Areas.

Results and Discussion

Results from the monthly water level measurements for the period of September 1996 through August 1997 are presented in Tables 3A and 3B. The minimum, maximum, and average water level elevation, and standard deviation was computed for each location and is presented in Table 4. Table 4 also gives the average water level in each piezometer relative to ground elevation. Hydrographs for each location were created and are presented in Figures 4 through 17.

Preliminary evaluation of data collected from the continuous monitoring effort has confirmed an expected correlation between rainfall events and water levels in the wetlands. Figures 18 and 19 represent typical plots of data collected from the piezometers. From these figures, it can be seen that the response to rainfall was immediate as well as transient; however, more detailed study over a longer period of time is needed to determine the magnitude and duration of the transient surge in water levels associated with rainfall.

In addition to the rainfall response, diurnal fluctuations in water level due to evapotranspiration are also clearly shown in Figures 18 and 19. A periodic decline in water levels is observed during the middle portions of each day, which may be attributed to increased evapotranspiration demand. During the nighttime hours when evapotranspiration demands are lowest, the water levels recover. As seen in Figure 18, fluctuations of 0.1 ft are not uncommon during peak evapotranspiration periods.

Figures 18 and 19 demonstrate the natural variability in water levels in the wetlands of Fourmile Branch. In order to completely define baseline conditions for the wetlands, the magnitude, frequency, and duration of the variations must be quantified. Long term assessment of data collected from the instrumented piezometers will allow for a more

detailed analysis of the natural variations associated with these types of wetland systems.

References

- Dixon, K. L. 1996. Monitoring of the Water Levels in the Wetlands of Fourmile Branch Near the F- and H-Areas of SRS. WSRC-TR-96-0289. Westinghouse Savannah River Company, Savannah River Technology Center, Aiken SC.
- Dixon, K. L., V. A. Rogers, and B. B. Looney. 1993a. Results of the quarterly tritium survey of Four Mile Creek and its seep lines in the F- and H- Areas of SRS: September 1993. WSRC-TR-93-286-ESS, Rev. 1, Westinghouse Savannah River Company, Savannah River Technology Center, Aiken SC.
- Dixon, K. L. and V. A. Rogers. 1993b. Semi-annual sampling of Fourmile Branch and its seep lines in the F- and H-Areas of SRS: July 1992. WSRC-TR-93-289, Westinghouse Savannah River Company, Savannah River Technology Center, Aiken SC.
- Friday, G. P. 1997. Environmental Summary of the F- and H-Area Seepage Basins Groundwater Remediation Project, Savannah River Site. WSRC-TR-97-0130, Westinghouse Savannah River Company, Aiken, SC.
- Haselow, J. S., M. Harris, B. B. Looney, N. V. Halverson, and J. B. Gladden. 1990. Analysis of soil and water at the Four Mile Creek seep line near the F- and H-Areas of SRS. WSRC-RP-90-0591, Westinghouse Savannah River Company, Savannah River Technology Center, Aiken SC.
- Killian, T.H., N.L. Kolb, P. Corbo, and I.W. Marine. 1985a. F-Area seepage basins. DPST-85-704, E.I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken, SC.
- Killian, T.H., N.L. Kolb, P. Corbo, and I.W. Marine. 1985b. H-Area seepage basins. DPST-85-706, E.I. du Pont de Nemours and Company, Savannah River Laboratory, Aiken, SC.

Table 1. Construction information for the F- and H-Area wetlands piezometer network.

Piezometer	Latitude	Longitude	Ground Elevation (msl)	Total Drilled Depth (ft)	Top of Casing Elevation (msl)	Casing Stick Up (ft)	Total Length of Piezometer (ft)	Depth to Screen (ft)	Top of Screen Elevation (msl)	Total Screened Length ^a (ft)	Length of Sump Cap (ft)	Length of Sump (ft)	Bottom of Piezometer Elevation (msl)
FPZ001A	33.26827	81.68141	197.90	16.31	200.06	2.16	18.47	13.39	184.51	2.50	0.40	0	181.59
FPZ002A	33.26856	81.68131	201.20	12.27	203.41	2.21	14.48	9.35	191.85	2.50	0.40	0	188.93
FPZ003A	33.26779	81.67972	194.00	21.53	196.97	2.97	24.50	6.11	187.47	15.00	0.40	0	172.47
FPZ004A	33.27004	81.67879	203.10	11.56	205.94	2.84	14.40	8.64	194.46	2.50	0.40	0	191.54
FPZ005A	33.26910	81.67832	190.90	14.72	192.78	1.88	16.60	11.80	179.10	2.50	0.40	0	176.18
FPZ005B	33.26910	81.67832	190.90	6.95	192.88	1.98	8.93	1.95	188.95	5.00	0.40	0	183.95
FPZ006A	33.26899	81.67781	189.40	14.30	191.54	2.14	16.44	11.38	178.02	2.50	0.40	0	175.10
FPZ006B	33.26899	81.67781	189.40	7.70	191.60	2.20	9.90	2.70	186.70	5.00	0.40	0	181.70
FPZ007A	33.26978	81.67679	194.50	10.67	196.16	1.66	12.33	7.75	186.75	2.50	0.40	0	183.83
FPZ007B	33.26978	81.67679	194.50	5.40	196.40	1.90	7.30	0.40	194.10	5.00	0.40	0	189.10
FPZ008A	33.27046	81.67588	187.40	16.96	189.54	2.14	19.10	14.04	173.36	2.50	0.40	0	170.44
FPZ008B	33.27046	81.67588	187.40	10.50	189.60	2.20	12.70	3.00	184.40	7.50	0.40	0	176.90
HPZ001A	33.27431	81.65869	202.40	15.37	204.78	2.38	17.75	7.45	194.95	5.00	0.40	2.50	187.03
HPZ002A	33.27595	81.65820	218.80	12.07	220.88	2.08	14.15	6.65	212.15	5.00	0.40	0	206.73
HPZ003A	33.27452	81.65636	200.40	17.62	202.53	2.13	19.75	14.70	185.70	2.50	0.40	0	182.78
HPZ003B	33.27452	81.65636	200.40	7.43	202.80	2.40	9.83	2.43	197.97	5.00	0.40	0	192.97
HPZ004A	33.27545	81.65605	210.70	14.09	213.56	2.86	16.95	11.17	199.53	2.50	0.40	0	196.61
HPZ005A	33.27562	81.65490	213.80	9.89	215.66	1.86	11.75	6.97	206.83	2.50	0.40	0	203.91
HPZ005B	33.27562	81.65490	213.80	6.21	215.40	1.60	7.81	1.21	212.59	5.00	0.40	0	207.59
HPZ006A	33.27462	81.65424	201.70	9.41	205.29	3.59	13.00	3.99	197.71	5.00	0.40	0	192.29
FMB/C4			NA	NA	186.55 ^b	NA	NA	NA	NA	NA	NA	NA	NA
FMB/E1			NA	NA	215.18	NA	NA	NA	NA	NA	NA	NA	NA
FHR001	33.2691	81.62046	269.90	12.70	272.58	2.68	15.38	4.78	265.12	7.50	0.40	0	257.62
FHR002	33.2681	81.62034	275.40	17.62	277.65	2.25	19.87	7.20	268.20	10.0	0.40	0	258.20
FHR003	33.2708	81.64114	220.50	8.45	223.10	2.60	11.05	5.53	214.97	2.50	0.40	0	212.47

^aSlot size for all screens is 0.010 inches.^bStream locations are marked with a steel rod. This is the elevation of the steel rod.

Table 2. List of Piezometers having data logging.

Piezometer	Latitude	Longitude	Installation Date
FPZ001A	33.26827	81.68141	September 1996
FPZ002A	33.26856	81.68131	September 1996
FPZ004A	33.27004	81.67879	July 1996
FPZ005A	33.26910	81.67832	July 1996
FPZ006A	33.26899	81.67781	July 1996
HPZ002A	33.27595	81.65820	September 1996
HPZ003A	33.27452	81.65636	August 1996
HPZ004A	33.27545	81.65605	August 1996
HPZ005A	33.27562	81.65490	September 1996

Table 3. Water Level Measurements at Individual Piezometers, September 1996 - February 1997

Piezometer ID	Water Level Elevations (msl)						Ground Elevation (msl)
	Sep-96	Oct-96	Nov-96	Dec-96	Jan-97	Feb-97	
FPZ001A	197.90	197.98	197.96	197.97	197.96	198.02	197.90
FPZ002A	201.30	201.26	201.18	201.15	201.19	201.96	201.20
FPZ003A	188.49	187.84	187.92	188.33	189.29	191.22	194.00
FPZ004A	201.20	201.24	201.18	201.14	201.14	201.62	203.10
FPZ005A	191.02	191.12	191.10	191.13	191.17	191.24	190.90
FPZ005B	191.16	191.18	191.16	191.18	191.19	191.19	190.90
FPZ006A	189.34	188.88	189.04	189.12	189.33	189.67	189.40
FPZ006B	188.76	188.72	188.86	188.95	189.11	189.28	189.40
FPZ007A	192.91	192.91	192.95	193.02	193.14	193.34	194.50
FPZ007B	194.26	194.31	194.12	194.38	194.4	194.42	194.50
FPZ008A	187.59	187.60	187.56	187.62	187.66	187.71	187.40
FPZ008B	187.56	187.60	187.61	187.62	187.61	187.62	187.40
HPZ001A	202.28	202.32	202.33	202.33	202.35	202.38	202.40
HPZ002A	217.96	217.86	217.80	217.82	218.05	218.70	218.80
HPZ003A	200.79	201.00	201.05	201.39	201.34	201.53	200.40
HPZ003B	200.56	200.88	200.89	200.88	200.90	200.92	200.40
HPZ004A	209.96	210.23	210.27	210.28	210.29	210.35	210.70
HPZ005A	212.21	212.14	212.56	212.64	212.95	213.35	213.80
HPZ005B	213.08	212.08	212.62	212.70	213.07	213.44	213.80
HPZ006A	202.11	202.02	201.94	201.72	201.82	201.94	201.70
FMB/C4	178.24	178.19	177.78	177.81	177.82	178.21	NA
FMB/E1	214.35	214.39	214.44	214.47	214.47	214.67	NA
FHR001	NA	NA	NA	NA	NA	NA	NA
FHR002	NA	NA	NA	NA	NA	NA	NA
FHR003	NA	NA	NA	NA	NA	NA	NA

Table 4. Water Level Measurements at Individual Piezometers, March 1997- August 1997

Piezometer ID	Water Level Elevations (msl)						Ground Elevation (msl)
	Mar-97	Apr-97	May-97	Jun-97	Jul-97	Aug-97	
FPZ001A	197.96	197.96	197.91	197.89	197.96	197.92	197.90
FPZ002A	201.39	200.91	200.96	200.91	201.26	200.86	201.20
FPZ003A	189.55	188.61	188.74	188.36	189.15	187.27	194.00
FPZ004A	201.31	201.22	200.98	200.88	201.01	200.79	203.10
FPZ005A	191.18	191.17	191.41	191.07	191.11	191.05	190.90
FPZ005B	191.18	191.22	191.21	191.18	191.15	191.13	190.90
FPZ006A	189.32	189.43	189.00	188.81	189.09	188.82	189.40
FPZ006B	189.12	189.19	188.84	188.56	188.89	188.70	189.40
FPZ007A	193.11	193.20	192.93	192.77	192.96	192.81	194.50
FPZ007B	194.40	194.42	194.37	194.27	194.35	194.30	194.50
FPZ008A	187.64	187.68	187.62	187.60	187.60	187.59	187.40
FPZ008B	187.60	187.62	187.62	187.55	187.58	187.60	187.40
HPZ001A	202.38	202.37	202.32	202.22	202.33	202.28	202.40
HPZ002A	218.39	218.38	217.84	217.62	218.00	217.48	218.80
HPZ003A	201.38	201.38	201.13	201.23	201.40	201.23	200.40
HPZ003B	200.86	200.89	200.71	200.49	200.53	200.55	200.40
HPZ004A	210.26	210.28	209.76	210.08	210.08	210.06	210.70
HPZ005A	212.81	213.38	212.60	211.94	212.88	211.91	213.80
HPZ005B	212.90	213.54	212.85	211.89	212.98	213.90	213.80
HPZ006A	201.89	202.02	201.93	202.14	202.29	202.24	201.70
FMB/C4	178.03	178.31	178.39	178.4	178.81	178.41	NA
FMB/E1	214.48	214.64	214.41	214.38	207.18	214.35	NA
FHR001	NA	NA	NA	NA	268.99	268.58	269.90
FHR002	NA	NA	NA	NA	272.46	271.05	275.40
FHR003	NA	NA	NA	NA	219.87	219.90	220.50

Table 5. Average Water Level Measurements for the Period of September 1996 to August 1997.

Piezometer ID	Minimum Water Level (msl)	Maximum Water Level (msl)	Average Water Level (msl)	Standard Deviation (ft)	Water Level Relative to Ground Elevation ^a (ft)
FPZ001A	197.89	198.02	197.95	0.09	.05
FPZ002A	200.86	201.96	201.19	0.78	-.01
FPZ003A	187.27	191.22	188.73	2.79	-5.27
FPZ004A	200.79	201.62	201.14	0.59	-1.96
FPZ005A	191.02	191.41	191.15	0.28	0.25
FPZ005B	191.13	191.22	191.18	0.06	0.28
FPZ006A	188.81	189.67	189.15	0.61	-0.25
FPZ006B	188.56	189.28	188.92	0.51	-0.48
FPZ007A	192.77	193.34	193.00	0.40	-1.50
FPZ007B	194.12	194.42	194.33	0.21	-0.17
FPZ008A	187.56	187.71	187.62	0.11	0.22
FPZ008B	187.55	187.62	187.60	0.05	0.20
HPZ001A	202.22	202.38	202.32	0.11	-0.08
HPZ002A	217.48	218.70	217.99	0.86	-0.81
HPZ003A	200.79	201.53	201.24	0.52	0.84
HPZ003B	200.49	200.92	200.76	0.30	0.36
HPZ004A	209.76	210.35	210.16	0.42	-0.1
HPZ005A	211.91	213.38	212.61	1.04	-1.19
HPZ005B	211.89	213.90	212.92	1.42	-0.88
HPZ006A	201.72	202.29	202.01	0.40	0.31
FMB/C4	177.78	178.81	178.20	0.73	NA
FMB/E1	207.18	214.67	213.85	5.30	NA
FHR001 ^b	268.58	268.99	268.79	—	1.11
FHR002	271.05	272.46	271.76	—	3.64
FHR003	219.87	219.90	219.89	—	.61

^aPositive values indicate the water level is above ground elevation. Negative values indicate the water level is below ground elevation.

^bFHR001, FHR002, and FHR003 contain only two measurements.

Figure 1. Extraction/injection well locations and piezometer locations for Aquifer Zone IIB₂ (water table) in F-Area.

PIEZOMETER LOCATIONS

Figure 3. Reference piezometer locations.

E56000 E57000 E58000 E59000 E60000 E61000 E62000 E63000 E64000 E65000 E66000 E67000 E68000 E69000 E70000

LEGEND

- ▲ PIEZOMETER
- SRS FENCED AREA
- BASIN CLOSURE
- SRS TOPOGRAPHIC CONTOUR
- SRS STREAM

Figure 4. Monthly water level elevations at location FPZ001A.

Figure 5. Monthly water level elevations at location FPZ002A.

Figure 6. Monthly water level elevations at location FPZ003A.

Figure 7. Monthly water level elevations at location FPZ004A.

Figure 8. Monthly water level elevations at location FPZ005A and FPZ005B

Figure 9. Monthly water level elevations at location FPZ006A and FPZ006B

Figure 10. Monthly water level elevations at location FPZ007A and FPZ007B

Figure 11. Monthly water level elevations at location FPZ008A and FPZ008B

Figure 12. Monthly water level elevations at location HPZ001A

Figure 13. Monthly water level elevations at location HPZ002A

Figure 14. Monthly water level elevations at location HPZ003A and HPZ003B

Figure 15. Monthly water level elevations at location HPZ004A

Figure 16. Monthly water level elevations at location HPZ005A and HPZ005B

Figure 17. Monthly water level elevations at location HPZ006A

Figure 18. Continuous water level measurements taken from FPZ004A.

Figure 19. Continuous water level measurements taken from FPZ006A.