

Appendix B

Supplemental Surface Water, Treated Effluent, and Sediment Information

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Contents

Appendix B Supplemental Surface Water, Treated Effluent, and Sediment Information	B-1
Attachment B.1 Surface Water and Treated Effluent	B.1-1
Attachment B.2 Sediment	B.2-1

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Acronyms

DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FFCA	Federal Facilities Compliance Agreement
FRL	Final Remediation Level
IEMP	Integrated Environmental Monitoring Plan
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
PF	Parshall Flume
SWRB	Storm Water Retention Basin

Measurement Abbreviations

cfs	cubic feet per second
gpm	gallons per minute
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
pCi/g	picoCuries per gram
pCi/L	picoCuries per liter

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Appendix B presents additional surface water, treated effluent, and sediment data in support of Chapter 4 of this 2007 Site Environmental Report. This appendix consists of two attachments as follows:

- Attachment B.1 provides an evaluation of the final remediation levels (FRLs) exceedances for surface water and treated effluent including an assessment of potential cross-media impacts to the groundwater pathway. This attachment also provides information on any storm water-related bypasses pertaining to compliance with the Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996) total uranium treated effluent discharge limits.
- Attachment B.2 provides additional details pertaining to the 2007 sediment analytical results and historical results for comparison purposes.

References

DOE (U.S. Department of Energy), 2006, "Comprehensive Legacy Management and Institutional Controls Plan, Revision 1," Fernald Closure Project, DOE, Fernald Office, Cincinnati, OH, November.

DOE (U.S. Department of Energy), 1996, "Final Record of Decision for Remedial Actions at Operable Unit 5," 7478 U-007-501.4, Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH, January.

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Attachment B.1

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B.1.0 Surface Water and Treated Effluent

During 2007, surface water and treated effluent samples were collected under the Integrated Environmental Monitoring Plan (IEMP) which is Attachment D of the Comprehensive Legacy Management and Institutional Controls Plan (DOE 2006). Figures B.1-1 and B.1-2 show all surface water monitoring locations. The following information is discussed in this attachment:

- Surveillance monitoring (Section B.1.1)
- Federal Facilities Compliance Agreement (FFCA)/Operable Unit 5 Record of Decision compliance (Section B.1.2)
- Controlled and uncontrolled areas (Section B.1.3).

The National Pollutant Discharge Elimination System (NPDES) Permit sampling is not discussed in this attachment as it is discussed in sufficient detail in Chapter 4 of this report.

B.1.1 Surveillance Monitoring

Surveillance monitoring is the comparison of surface water and treated effluent analytical results to the surface water FRLs in order to determine effects of remediation activities on the surface water pathway. Surveillance monitoring also includes an assessment of the effects surface water may have on the groundwater pathway (referred to as cross-media impacts).

All 2007 data were compared to FRLs. Samples collected at the Parshall Flume (PF 4001) are used in the surveillance evaluation because this is the last point treated effluent is sampled prior to discharge to the Great Miami River.

Water discharges to the Great Miami River are required to be below the FRLs at the point where discharged water is completely mixed with water in the Great Miami River (i.e., outside the mixing zone). In cases where the Parshall Flume data are already below the FRLs no further action is taken. When the Parshall Flume data are above the FRL, to make a determination of each constituents concentration at this point in the Great Miami River, the following calculation is applied:

$$C_{PF4001} = \frac{[Q_{10}][C_{GMR}] + [Q_{PF}][C_{PF}]}{[Q_{10}] + [Q_{PF}]}$$

where:

C_{PF4001}	=	Flow-weighted average concentration outside the mixing zone in the Great Miami River, picoCuries per liter (pCi/L) or milligrams per liter (mg/L)
Q_{10}	=	7-day, 10-year low flow, 706 cubic feet per second (cfs)
C_{GMR}	=	Background concentration in Great Miami River from Table 4-2 in Attachment D of the 2006 Legacy Management and Institutional Controls Plan, pCi/L or mg/L (zero was used when no background concentration was available)
Q_{PF}	=	Daily flow at Parshall Flume (PF 4001), cfs
C_{PF}	=	Daily concentration at Parshall Flume (PF 4001), pCi/L or mg/L

Note: Flow conditions at the Hamilton Dam gauge are periodically reviewed to determine if there is a lower flow than the 7-day, 10-year low flow of 706 cfs. The lowest daily flow measured at the Hamilton Dam gauge (if lower than 706 cfs) is used in the equation to see if an exceedance could potentially occur. The low flow of 706 cfs went into effect during the 2003 NPDES Permit renewal process.

B.1.1.1 Evaluation of Constituents Above FRLs for 2007

As shown in Table B.1-1, there was one exceedance in 2007 of surface water FRLs. The following are general observations:

- No FRL exceedances occurred at the Parshall Flume (PF 4001), thus there was no need to run the mixing equation to determine the concentration in the Great Miami River.
- There was one surface water analytical result from an established sampling location, SWD-05, that exceeded the surface water FRL for total uranium (530 µg/L). Figures B.1-3 through B.1-17 are plots of the total uranium concentration versus time for the surface water sample locations.

There were a number of results from the sampling of the swale area adjacent to former waste pit 3 that were above the surface water FRL for uranium. The location in question is a series of small puddles and drainage ditches due west of the center of former waste pit 3, which drain generally south to a depression near the former cement pond. This area does not drain directly to Paddys Run. The area of impact at peak water retention is approximately one-half acre in overall aerial extent and the actual surface water area is much less. As a result of this sampling effort, one of the new surface water sampling locations selected in the IEMP was location SWD-05.

B.1.1.2 Evaluation of Cross-Media Impacts for 2007

Another objective of the IEMP surveillance monitoring program is to provide an ongoing assessment of the potential for cross-media impacts from surface water to the underlying Great Miami Aquifer. To conduct this assessment, sample locations were selected to evaluate contaminant concentrations in surface water just upstream from those areas where site drainages have eroded through the protective glacial overburden (e.g., the storm sewer outfall ditch, Pilot Plant Drainage Ditch, and certain reaches of Paddys Run). In areas where the glacial overburden is absent, a direct pathway exists for contaminants to reach the aquifer. Key sample locations associated with these areas of direct infiltration are SWP-02, SWD-02, STRM 4005, and SWD-03.

Because it is the primary contaminant at the site, total uranium is used as an indicator to evaluate the impact of surface water on the Great Miami Aquifer. A conservative assumption is used in this assessment, which considers the total uranium concentration (and all other constituent concentrations) in the surface water to be at the same concentration when the water reaches the Great Miami Aquifer through infiltration. However, the more likely scenario is that the total uranium concentration (and all other constituent concentrations) would decrease because dilution and adsorption occur as the water infiltrates through the ground and is mixed with the groundwater in the Great Miami Aquifer.

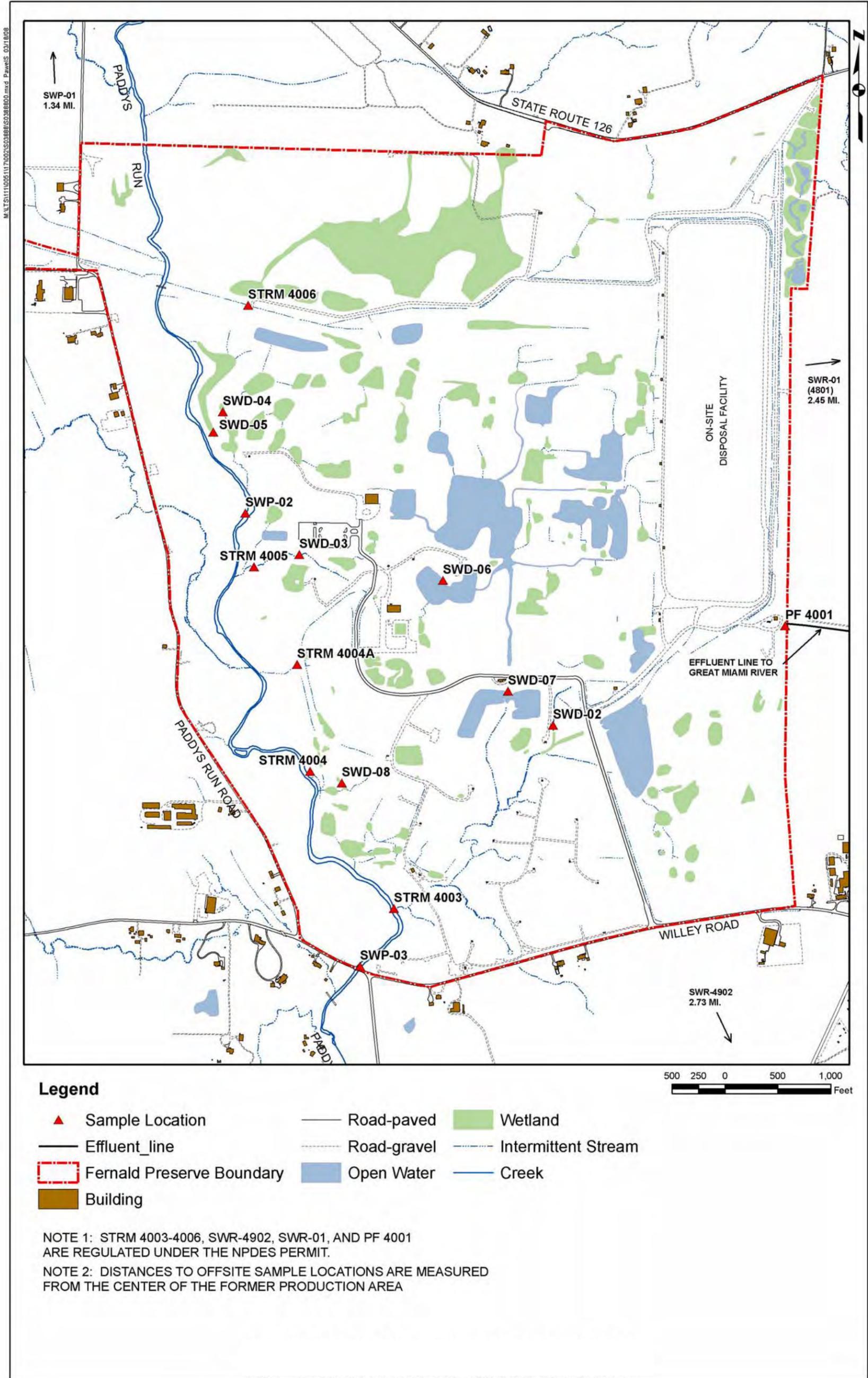


Figure B.1-1. IEMP/NPDES Surface Water and Treated Effluent Sample Locations

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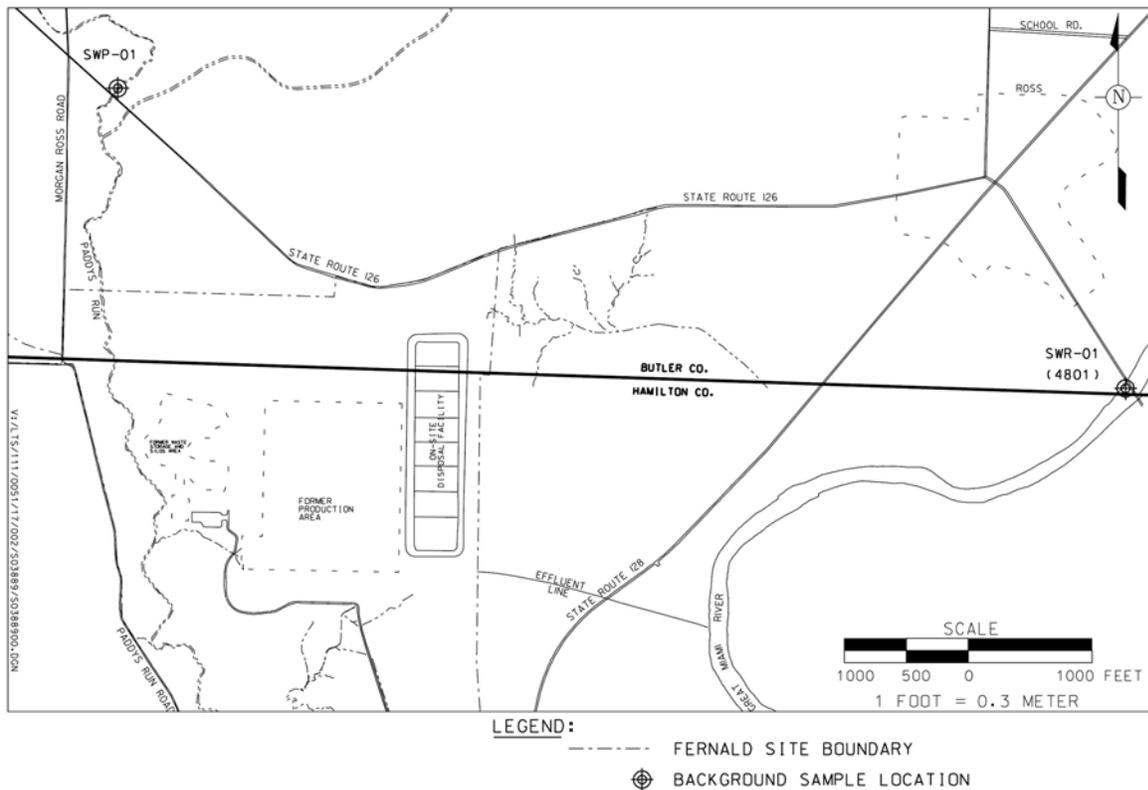


Figure B.1-2. IEMP Background Surface Water Sample Locations

The results of the cross-media impact assessment for 2007 indicate two of the four surface water locations (STRM 4005 and SWD-03) evaluated had results that exceeded the total uranium groundwater FRL of 30 µg/L. Figures B.1-8 through B.1-11 present the total uranium concentrations for all cross-media impact sample locations.

As identified in Section B.1.1.1 above, one of the newly established surface water monitoring locations, SWD-05, is the point at which drainage from the swale area adjacent to former waste pit 3 collects and infiltrates into the underlying aquifer. As discussed in Chapter 3 and Appendix A, this may be contributing to increased uranium concentrations in adjacent groundwater monitoring wells. However, the area in question remains within the capture zone of extraction well EW-33a.

The design of the groundwater restoration systems has accounted for this potential contaminant pathway by installing extraction wells downgradient of these areas where direct infiltration can occur.

DOE intends to reevaluate all surface water monitoring locations for their potential cross-media impacts during the next review cycle of the LMICP/IEMP.

B.1.2 FFCA/Operable Unit 5 Record of Decision Compliance

The Operable Unit 5 Record of Decision and subsequent Explanation of Significant Differences stipulate compliance with a monthly flow-weighted average total uranium concentration of 30

µg/L at the Great Miami River via the Parshall Flume (PF 4001). In addition to the concentration limitation, the Operable Unit 5 Record of Decision stipulated that the total mass discharged during a year not exceed 600 pounds.

During 2007, the total uranium concentrations were monitored daily at the Parshall Flume (PF 4001) to demonstrate compliance with these limitations. The Fernald Preserve was in compliance with the total mass limitation as uranium discharges totaled 533.45 pounds, which is below the 600-pound limit. The Fernald Preserve was in compliance with the monthly flow-weighted concentration limit every month in 2007, as identified on Figure B.1-17.

B.1.2.1 Storm Water-Related Bypasses

The Operable Unit 5 Record of Decision allowed the Fernald Preserve to directly discharge water collected in the Storm Water Retention Basin to the Great Miami River during periods of significant precipitation (up to 10 days each year). These were referred to as bypass events (when storm water bypasses treatment and goes directly to the Great Miami River). The Operable Unit 5 Record of Decision allowed the Fernald Preserve to eliminate the flow-weighted concentration for these bypass days due to significant precipitation in order to comply with the flow-weighted concentration total uranium limit.

The Storm Water Retention Basins were removed from service in February 2006 so no direct precipitation or maintenance related bypasses occurred from the Storm Water Retention Basins during 2007.

B.1.2.2 Maintenance-Related Bypasses

Bypassing during scheduled treatment plant maintenance was permissible under the Operable Unit 5 Record of Decision, provided prior notice is given to the U.S. Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (OEPA). For those days when a maintenance activity was performed, the uranium concentration could be eliminated from the monthly total uranium concentration calculation. There were no such bypasses in 2007.

B.1.3 Controlled and Uncontrolled Storm Water Runoff Areas

In 2007, there were no previously uncontrolled areas that were added to the Fernald Preserve controlled storm water system (refer to Figure B.1-18). At the conclusion of remediation in October 2006, control of storm water runoff is no longer required. The only storm water collected for treatment is that which falls on the controlled pad of the CAWWT.

Table B.1-1. Summary Statistics and Trend Analysis for Constituents with 2007 Results above Surface Water Final Remediation Levels

Location ^a	Constituent	No. of Samples ^{b,c,d}	No. of Samples Above FRL ^{b,c,d}	No. of Samples Above FRL for 2007 ^{c,d}	FRL ^e	Min. ^{b,c,d,f,g}	Max. ^{b,c,d,f,g}	Avg. ^{b,c,d,f,g}	SD ^{b,c,d,f,g}	Trend ^{b,c,d,f,g}
SWD-05 (Waste Storage Area)	Uranium	3	1	1	530 µg/L	19.3 µg/L	677.4 µg/L	255.2 µg/L	NA ^h	NA ^h

^aRefer to Figure B.1-1.

^bBased on samples collected from August 28, 2007 through December 31, 2007.

^cIf more than one sample is collected per surface water location per day (e.g., duplicate, grab, composite), then only one sample is counted for the number of samples, and the sample with the maximum concentration is used for determining the summary statistics (minimum, maximum, average, and standard deviation), Mann-Kendall test for trend, and in determining FRL exceedances.

^dRejected data qualified with either an R or Z were not included in the count, the summary statistics, or Mann-Kendall test for trend.

^eFrom Operable Unit 5 Record of Decision, Table 9-5.

^fFor results where the concentrations are below the detection limit, the results used in the summary statistics and Mann-Kendall test for trend are each set at half the detection limit.

^gIf the number of samples is greater than or equal to four, then all of the summary statistics and the Mann Kendall test for trend are reported. If the total number of samples is equal to three, then the minimum, maximum, and average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then the data point is reported as the minimum.

^hNA

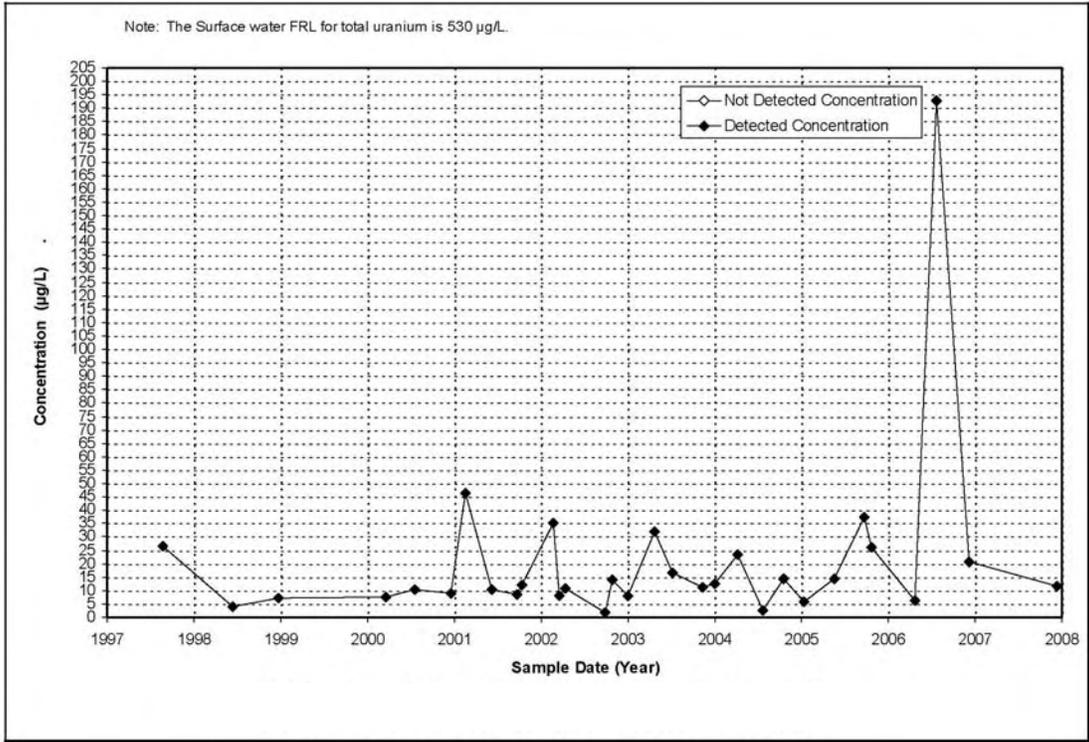


Figure B.1-5. Total Uranium Concentration versus Time Plot for Location STRM 4004/4004A (Drainage to Paddys Run)

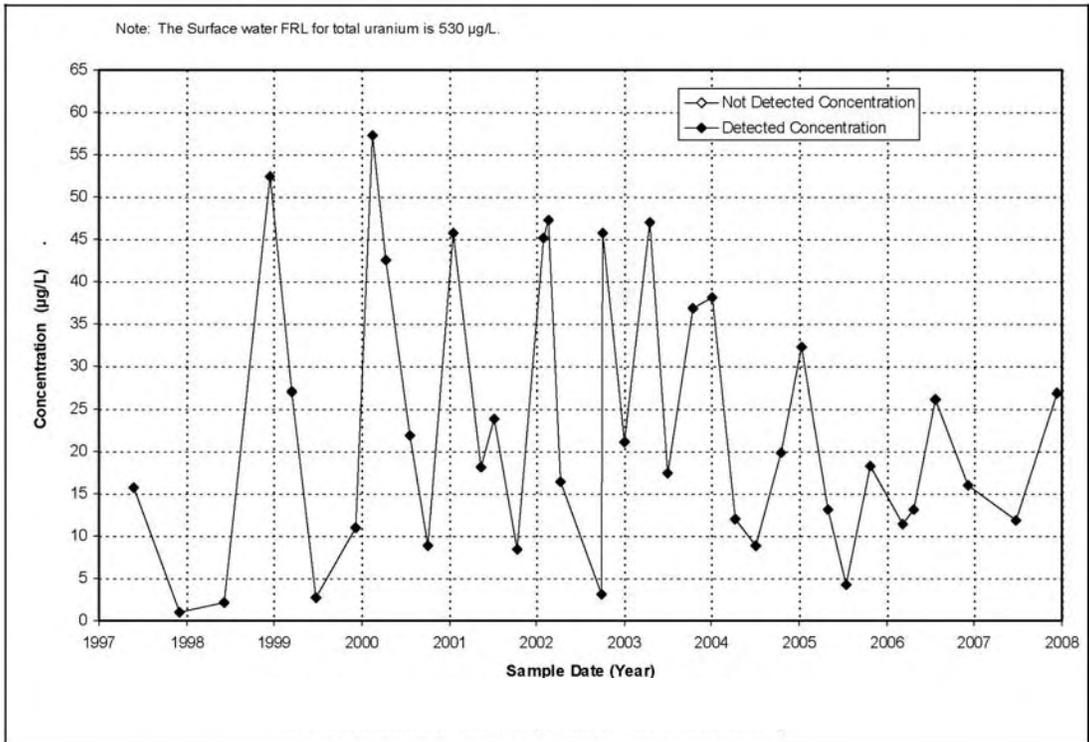


Figure B.1-6. Total Uranium Concentration versus Time Plot for Location STRM 4006 (Drainage to Paddys Run)

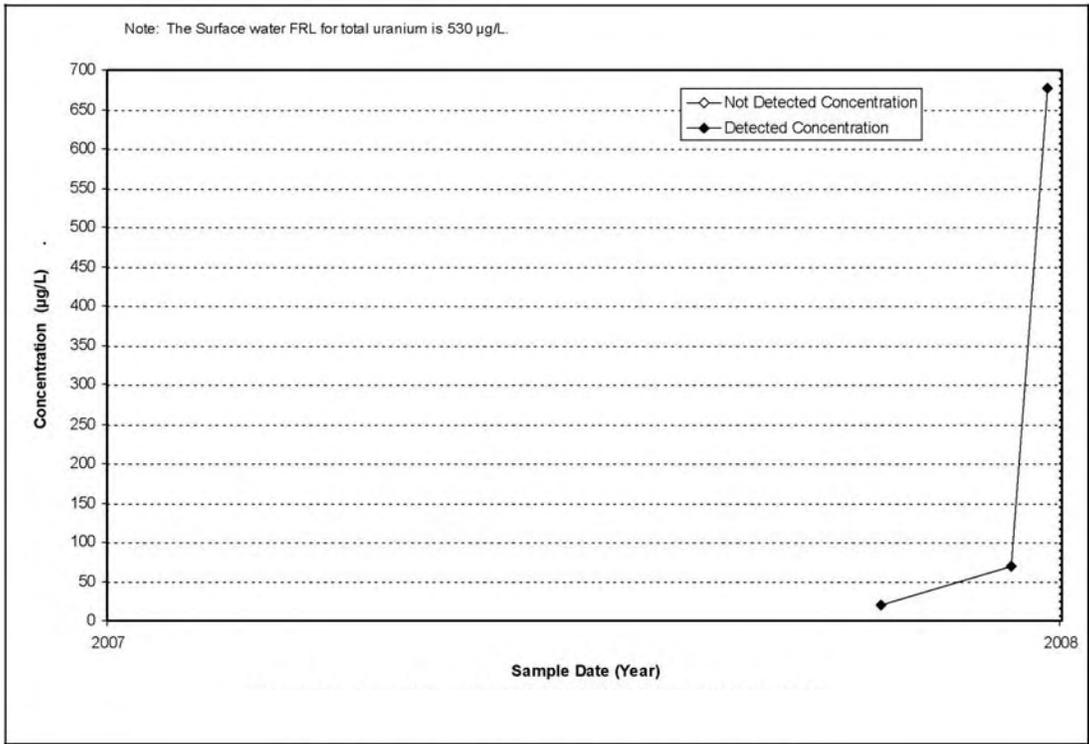


Figure B.1-13. Total Uranium Concentration versus Time Plot for Location SWD-05 (Former Waste Storage Area)

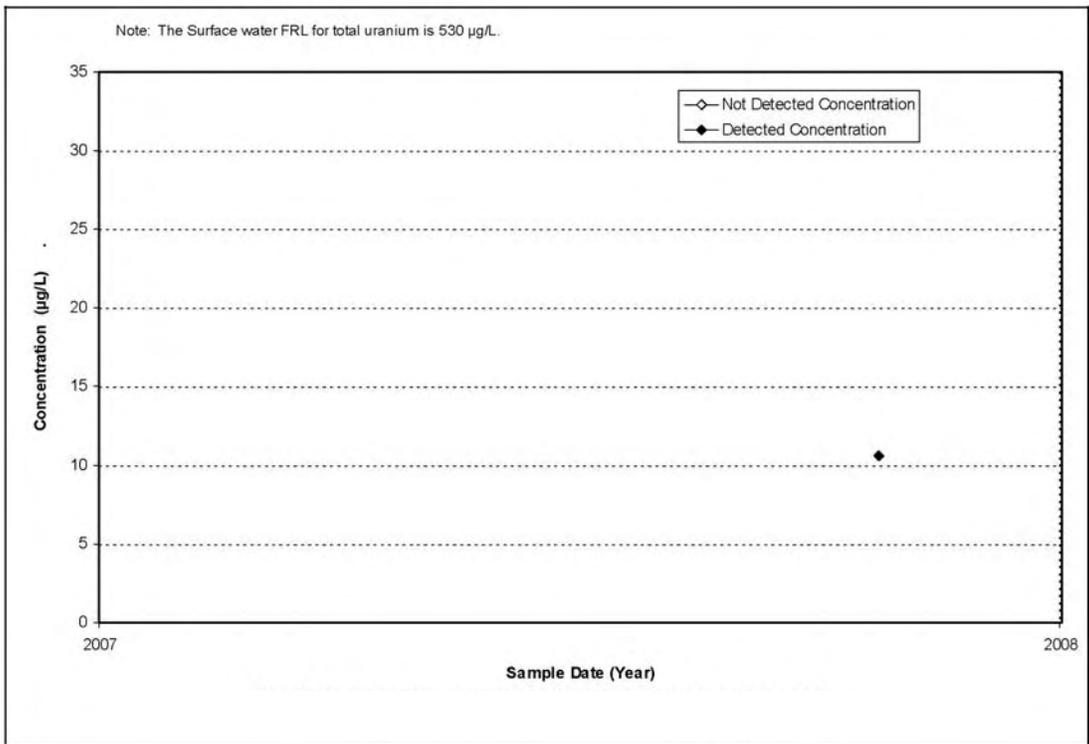


Figure B.1-14. Total Uranium Concentration versus Time Plot for Location SWD-06 (Former Pilot Plant)

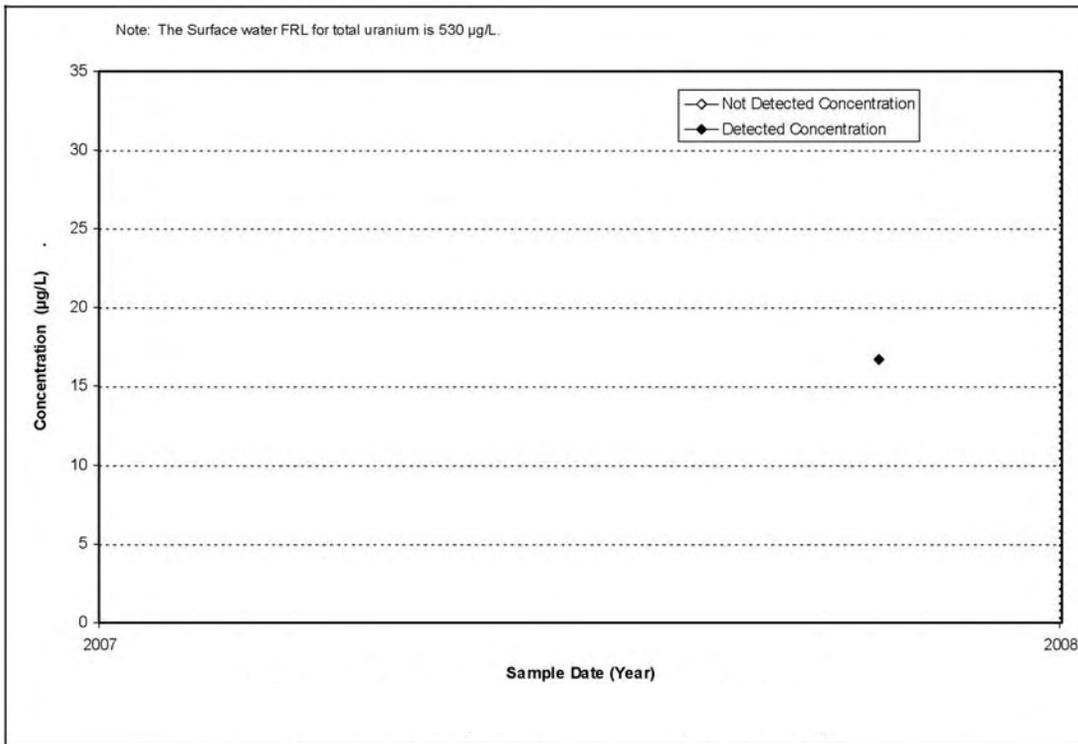


Figure B.1-15. Total Uranium Concentration versus Time Plot for Location SWD-07 (Former Production Area Drainage)

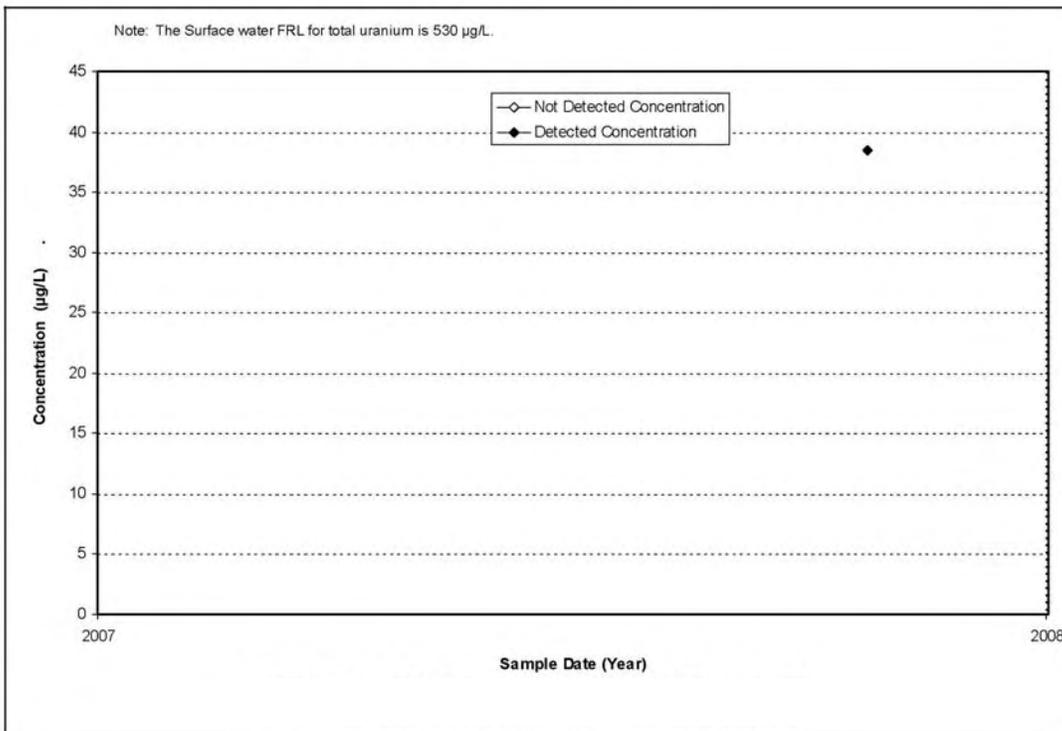


Figure B.1-16. Total Uranium Concentration versus Time Plot for Location SWD-08 (Former Southern Waste Units)

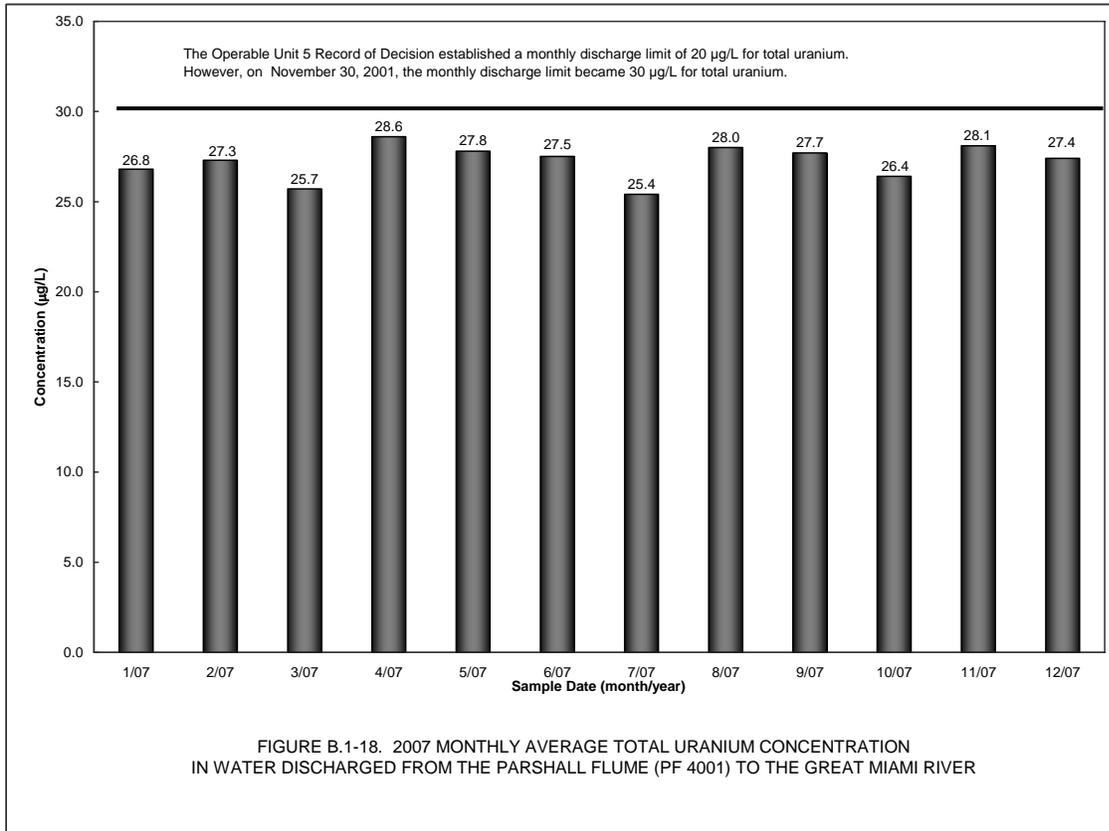
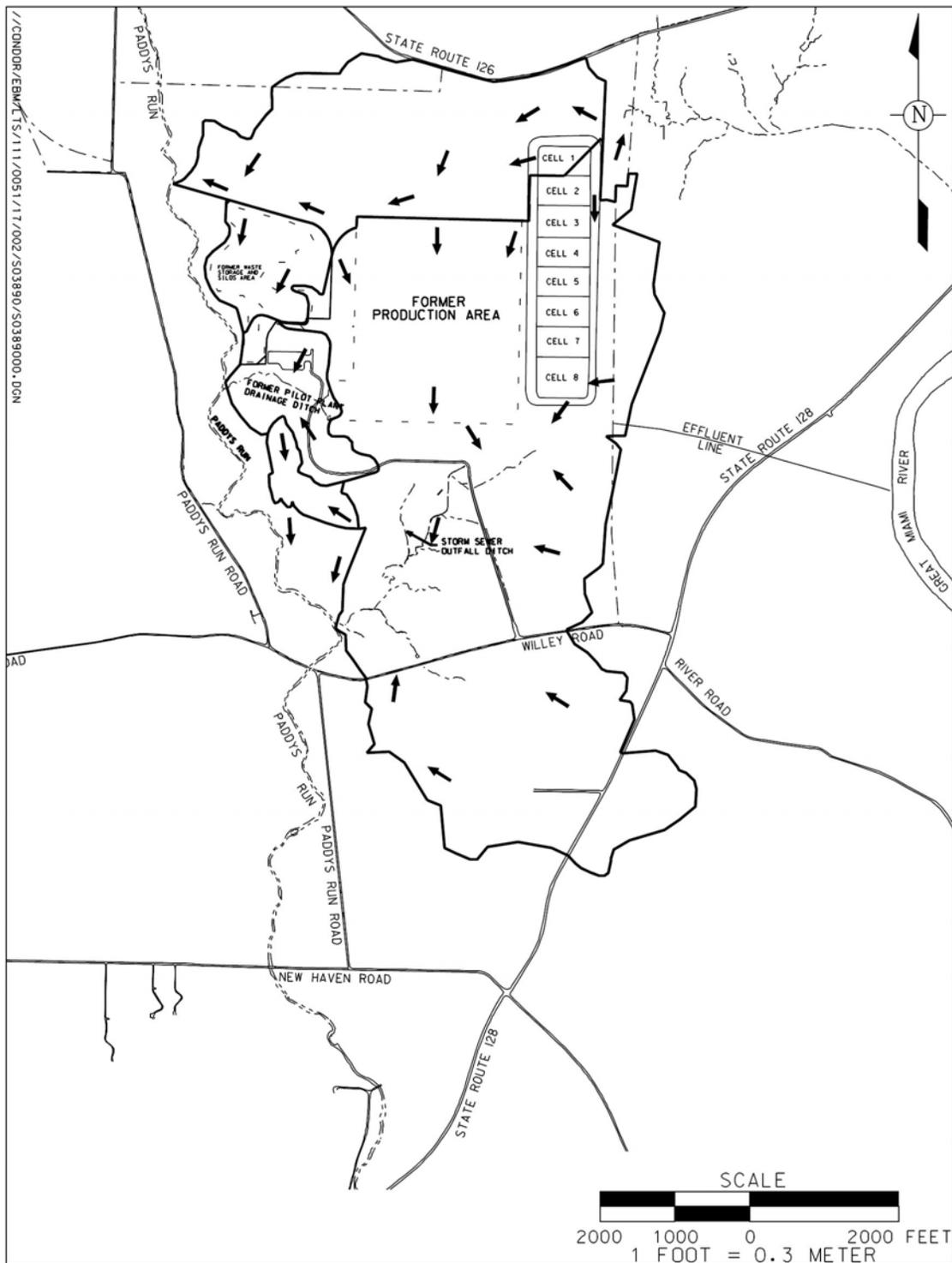


Figure B.1-17. 2007 Monthly Average Total Uranium Concentration in Water Discharged from the Parshall Flume (PF 4001) to the Great Miami River



LEGEND:

- FERNALD SITE BOUNDARY
- DRAINAGE BASIN BOUNDARY
- RUNOFF FLOW DIRECTION

Figure B.1-18. Controlled Surface Water Areas and Uncontrolled Runoff Flow Directions

Attachment B.2

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B.2.0 Sediment

Sediment is a secondary exposure pathway and is monitored annually to assess the impact of remediation activities on sediments deposited along surface water drainages. In 2007 sediment was collected at strategic locations in the Great Miami River (i.e., upgradient and downgradient of the effluent line). The year 2007 marks the ninth year that sediment was collected under the IEMP.

Sediment samples in the Great Miami River were collected in August of 2007 at two locations (refer to Figure B.2-1) in accordance with the IEMP. Samples collected at these locations were analyzed for total uranium. Table B.2-1 and Figure B.2-2 identifies the 2007 uranium results and historical uranium results from the Great Miami River. Uranium results from the river were less than 2 milligram per kilogram (mg/kg), which are comparable to historical results. Note the sediment FRL for uranium is 200 mg/kg.

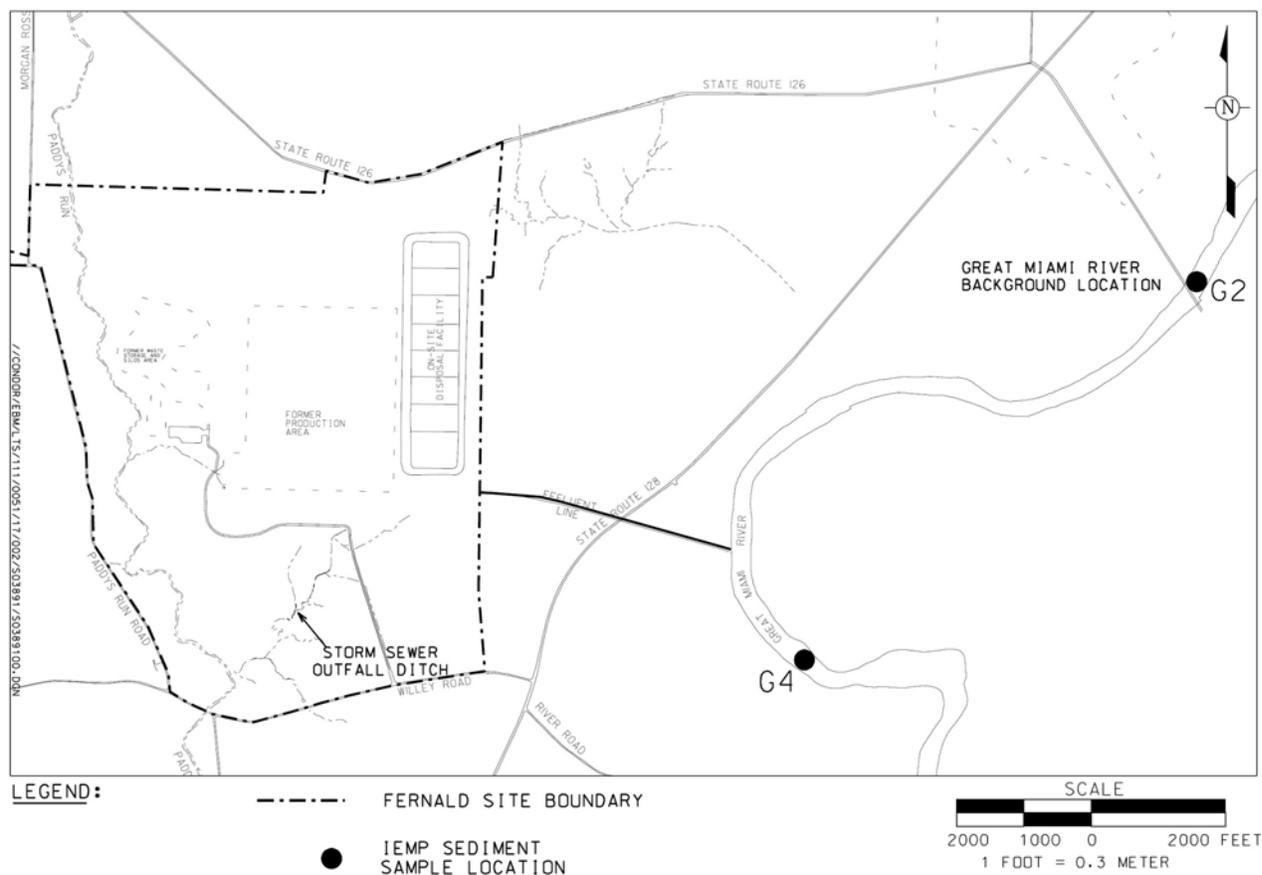


Figure B.2-1. 2007 Sediment Sample Locations

Table B.2-1. Summary Statistics for Sediment Monitoring Program

Radionuclide	No. of Samples ^a	2007 Results – Concentration	No. of Samples ^a	2006 Results – Concentration
		(mg/kg)		(mg/kg)
Great Miami River, North of the Effluent Line (G2)				
Uranium, Total	1	0.55	1	0.739
Great Miami River, South of The Effluent Line (G4)				
Uranium, Total	1	0.75	1	1.60

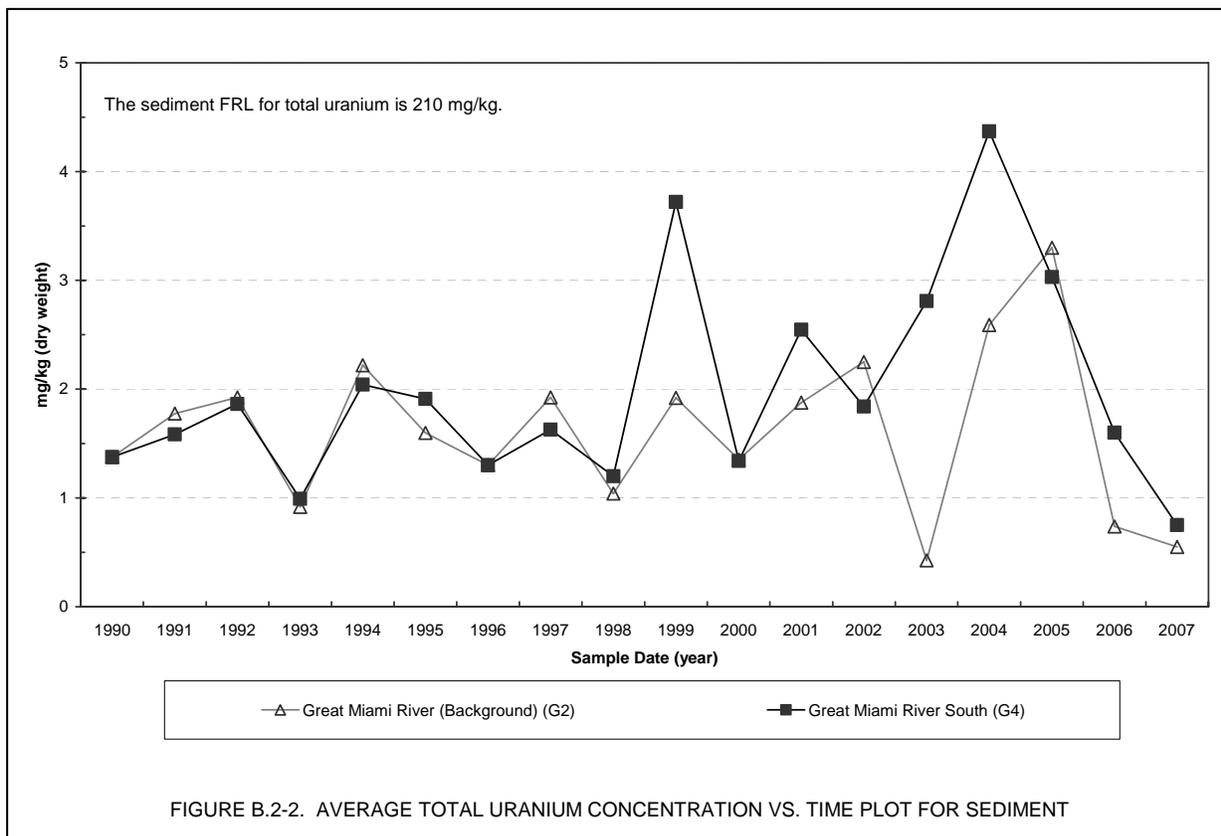


Figure B.2-2. Average Total Uranium Concentration versus time Plot for Sediment

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