

Appendix B

Supplemental Surface Water, Treated Effluent, and Sediment Information

This page intentionally left blank

Contents

Acronyms	B-iii
Measurement Abbreviations	B-iii
References	B-v
Attachment B.1. Surface Water and Treated Effluent	B.1-1
Attachment B.2. Sediment	B.2-1

This page intentionally left blank

Acronyms

FFCA	Federal Facilities Compliance Agreement
FRL	Final Remediation Level
GMA	Great Miami Aquifer
IEMP	Integrated Environmental Monitoring Plan
LMICP	<i>Comprehensive Legacy Management and Institutional Controls Plan</i>
NPDES	National Pollutant Discharge Elimination System
OU5 ROD	<i>Final Record of Decision for Remedial Actions at Operable Unit 5</i>

Measurement Abbreviations

cfs	cubic feet per second
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
pCi/g	picocuries per gram
pCi/L	picocuries per liter
µg/L	micrograms per liter

This page intentionally left blank

Appendix B presents additional surface water, treated effluent, and sediment data in support of Chapter 4 of this 2008 *Site Environmental Report*. This appendix consists of two attachments as follows:

- Attachment B.1 provides an evaluation of the final remediation level exceedances for surface water and treated effluent including an assessment of potential cross-media impacts to the groundwater pathway.
- Attachment B.2 provides additional details pertaining to the 2008 sediment analytical results and historical results for comparison purposes.

References

DOE (U.S. Department of Energy), 1996. *Final Record of Decision for Remedial Actions at Operable Unit 5*, 7478 U-007-501.4, prepared by S.M. Stoller Corporation for DOE, Fernald Area Office, Cincinnati, Ohio, January.

DOE (U.S. Department of Energy), 2001. *Explanation of Significant Differences for Operable Unit 5*, Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio, November.

DOE (U.S. Department of Energy), 2008. *Comprehensive Legacy Management and Institutional Controls Plan*, LMS/FER/S03496, Revision 2, prepared by S.M. Stoller Corporation for DOE, Fernald Area Office, Cincinnati, Ohio, May.

This page intentionally left blank

Attachment B.1

This page intentionally left blank

B.1.0 Surface Water and Treated Effluent

During 2008, 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* (LMICP) (DOE 2008). Figures B.1–1 and B.1–2 show all surface water monitoring locations. The following information is discussed in this attachment:

- Surveillance monitoring (see Section B.1.1).
- Federal Facilities Compliance Agreement (FFCA)/*Final Record of Decision for Remedial Actions at Operable Unit 5* (OU5 ROD) (DOE 1996) compliance (see Section B.1.2).
- Controlled and uncontrolled areas (see Section B.1.3).

The National Pollutant Discharge Elimination System (NPDES) Permit sampling is not discussed in this attachment as it is discussed in detail in Chapter 4, “Surface Water and Treated Effluent Pathway,” 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 final remediation levels (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 2008 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 constituent’s 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 2008 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 lowest daily flow recorded during 2008 was 616 cfs, which occurred on November 10. 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 2008

As shown in Table B.1-1, there were 18 exceedances in 2008 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, and seventeen surface water analytical results from sampling location SWD-09 that exceeded the surface water FRL for total uranium (530 micrograms per liter [$\mu\text{g/L}$]), Figures B.1-3 through B.1-18 are plots of the total uranium concentration versus time for the surface water sample locations. SWD-09 (formerly W-196A-U) is a new monitoring point established to monitor the surface water uranium concentration in the area west of the former waste pits.

B.1.1.2 Evaluation of Cross-Media Impacts for 2008

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 (GMA). 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, SWD-03, SWD-04, SWD-05, SWD-07, SWD-08, and STRM 4005.

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 GMA. 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 GMA 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 GMA.

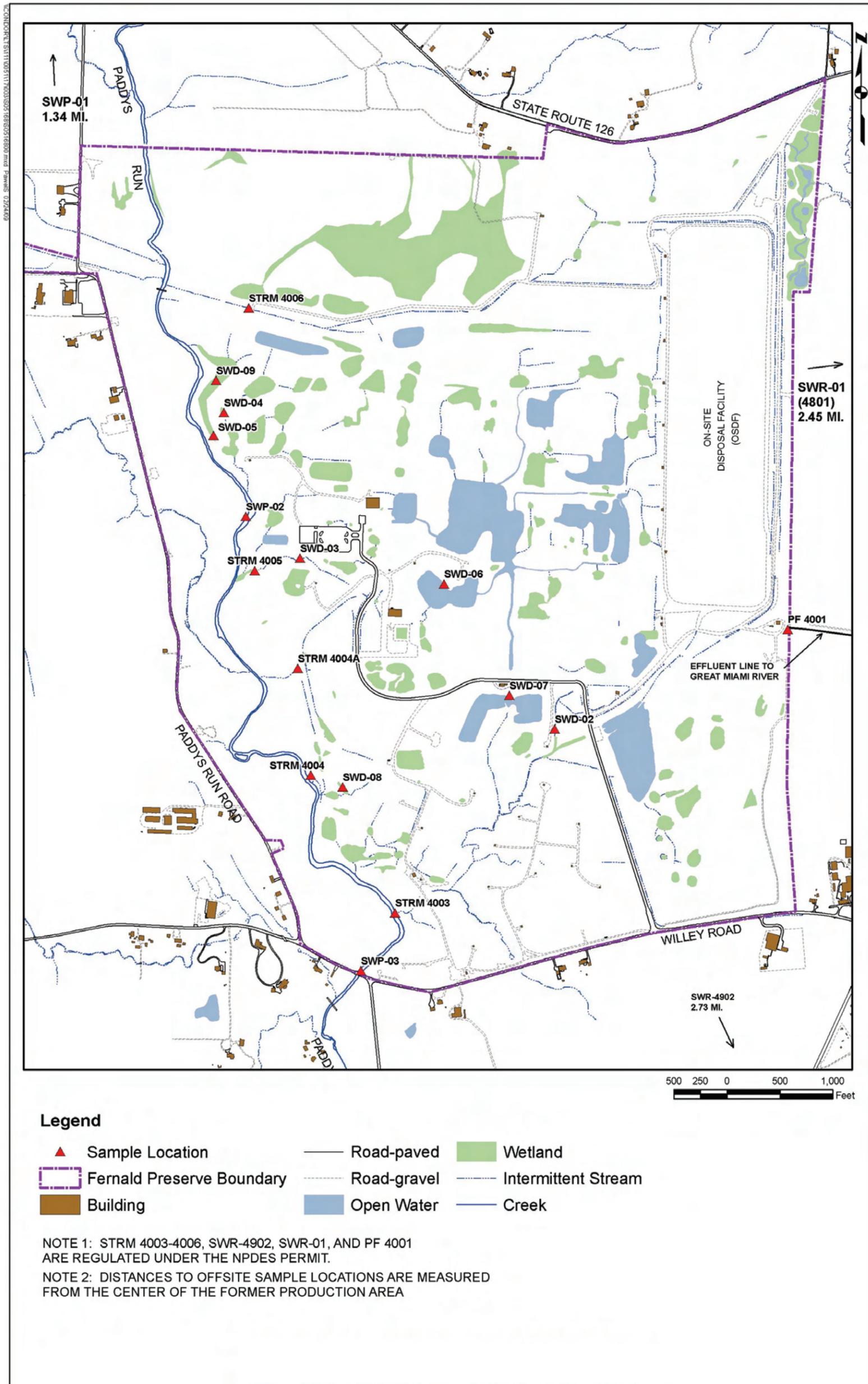


Figure B.1-1. IEMP/NPDES Surface Water and Treated Effluent Sample Locations

This page intentionally left blank

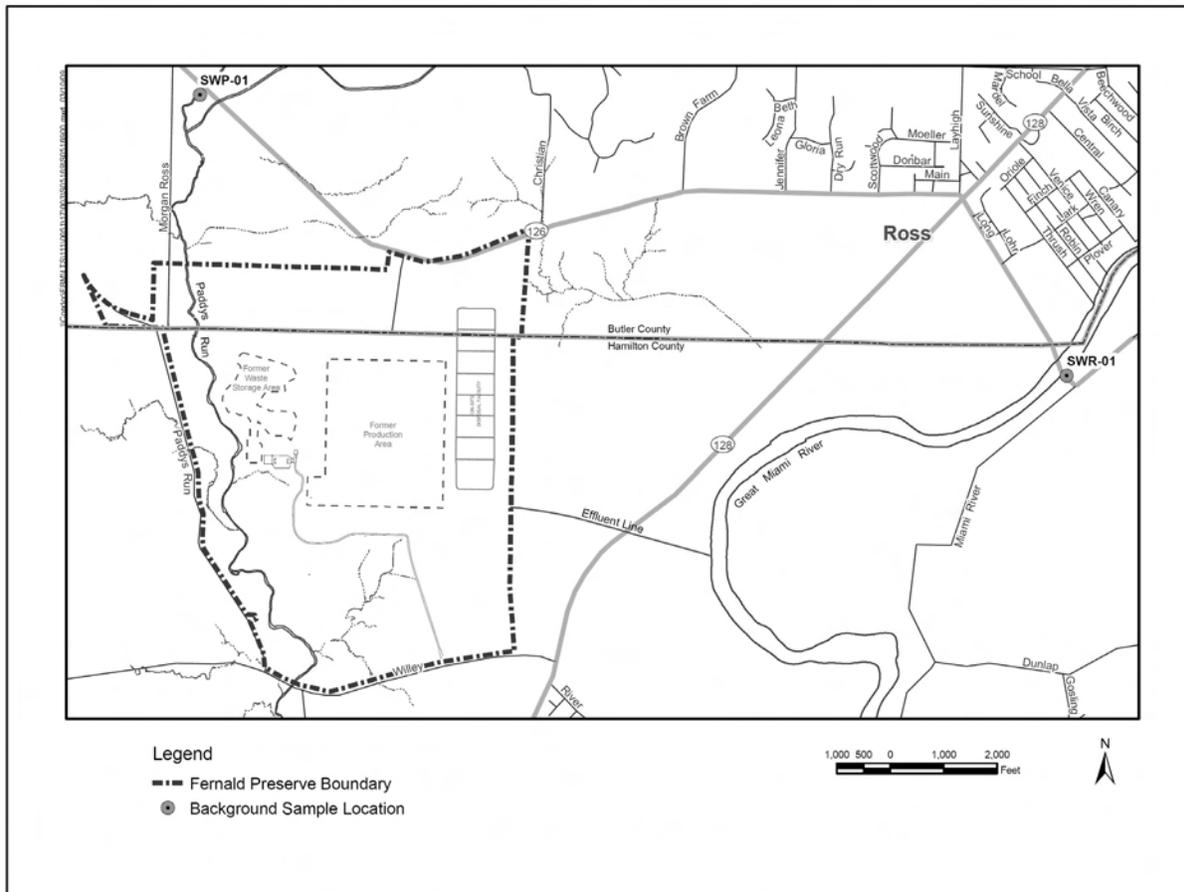


Figure B.1-2. IEMP Background Surface Water Sample Locations

The results of the cross-media impact assessment for 2008 indicate two of the nine surface water locations (SWD-04 and SWD-05) evaluated had results that exceeded the total uranium groundwater FRL of 30 $\mu\text{g/L}$. Figures B.1-11 through B.1-18 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 Waste Storage Area Module extraction well 33347 (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.

The U.S. Department of Energy will reevaluate all surface water monitoring locations for their potential cross-media impacts during the next review cycle of the LMICP.

B.1.2 FFCA/OU5 ROD Compliance

The OU5 ROD and subsequent *Explanation of Significant Differences for Operable Unit 5* (DOE 2001) 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 OU5 ROD stipulated that the total mass discharged during a year not exceed 600 pounds.

During 2008, 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 559 pounds, which is below the 600-pound limit. The Fernald Preserve was in compliance with the monthly flow-weighted concentration limit every month in 2008, as identified on Figure B.1-19.

B.1.3 Controlled and Uncontrolled Storm Water Runoff Areas

In 2008, there were no previously uncontrolled areas that were added to the Fernald Preserve controlled storm water system (refer to Figure B.1-20). 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 Converted Advanced Wastewater Treatment Facility.

Table B.1-1. Summary Statistics and Trend Analysis for Constituents with 2008 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 2008 ^{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	43	8	1	530 µg/L	19.3 µg/L	988 µg/L	312 µg/L	249 µg/L	Down, Marginal
SWD-09 (Waste Storage Area)	Uranium	32	22	17	530 µg/L	40.8 µg/L	1,580 µg/L	775 µg/L	388 µg/L	Down, Marginal

^aRefer to Figure B.1-1.

^bBased on samples collected from January 5, 2007 through December 31, 2008.

^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 OU5 ROD, 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.

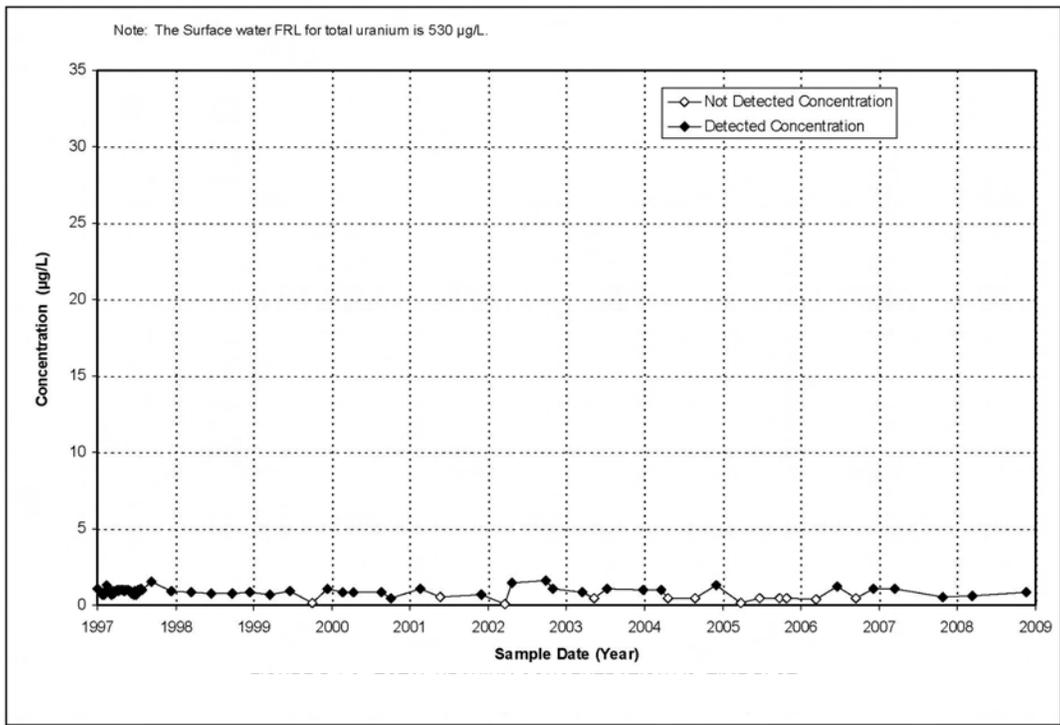


Figure B.1-3. Total Uranium Concentration versus Time Plot for Location SWP-01 (Paddys Run Background)

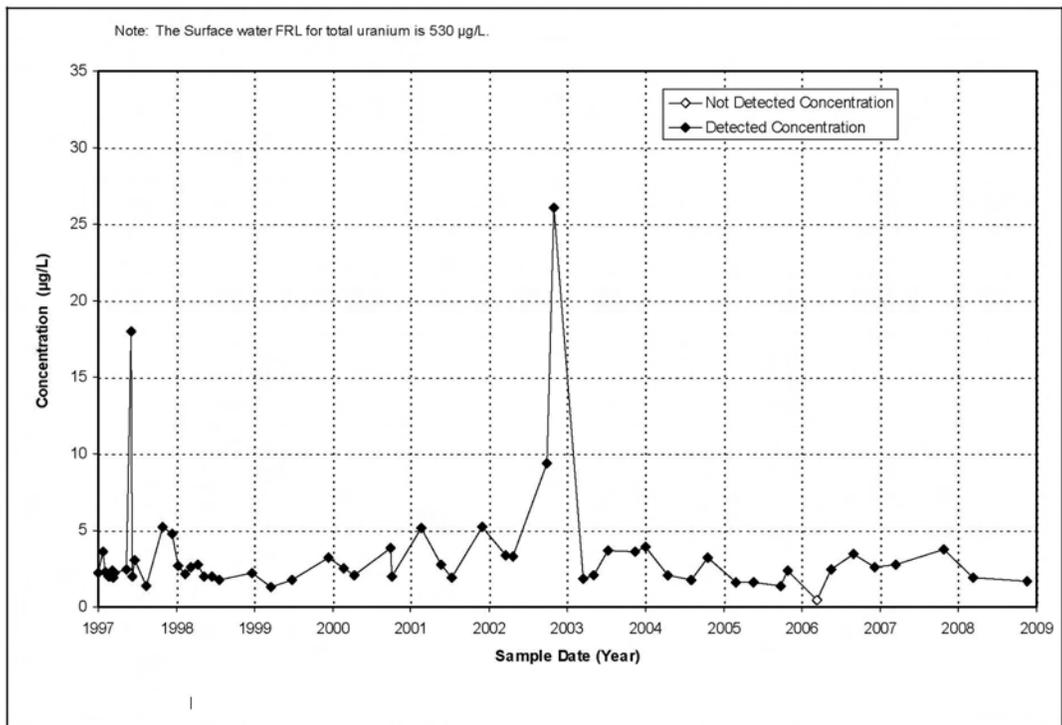


Figure B.1-4. Total Uranium Concentration versus Time Plot for Location SWP-03 (Paddys Run at Downstream Property Boundary)

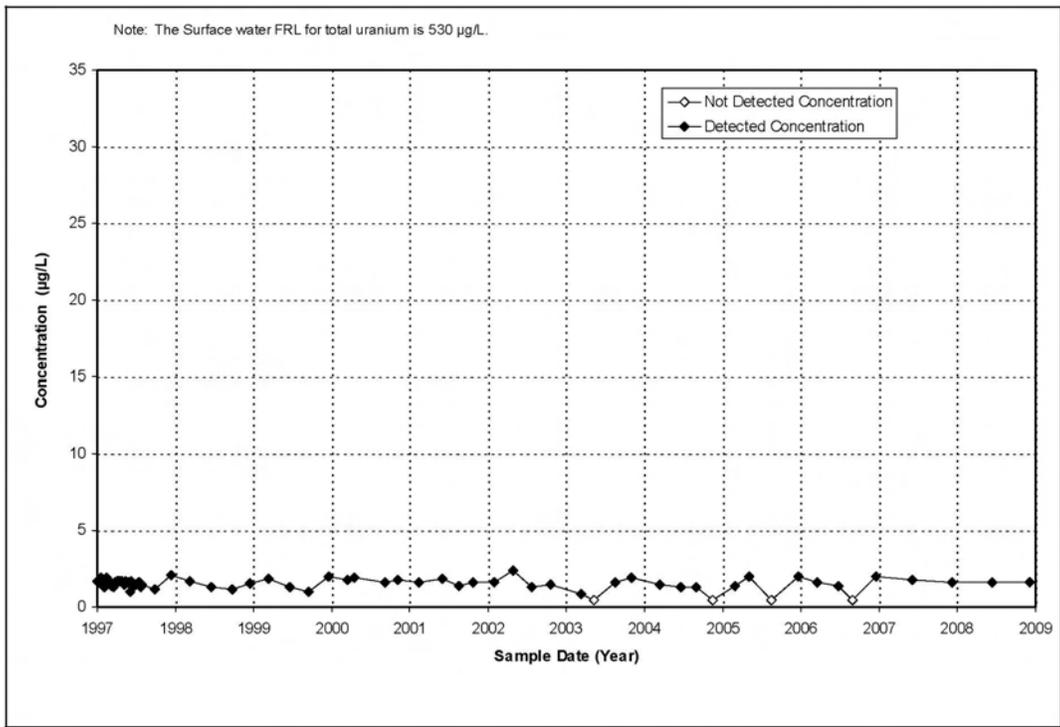


Figure B.1-5. Total Uranium Concentration versus Time Plot for Location SWR-01 (Great Miami River Background)

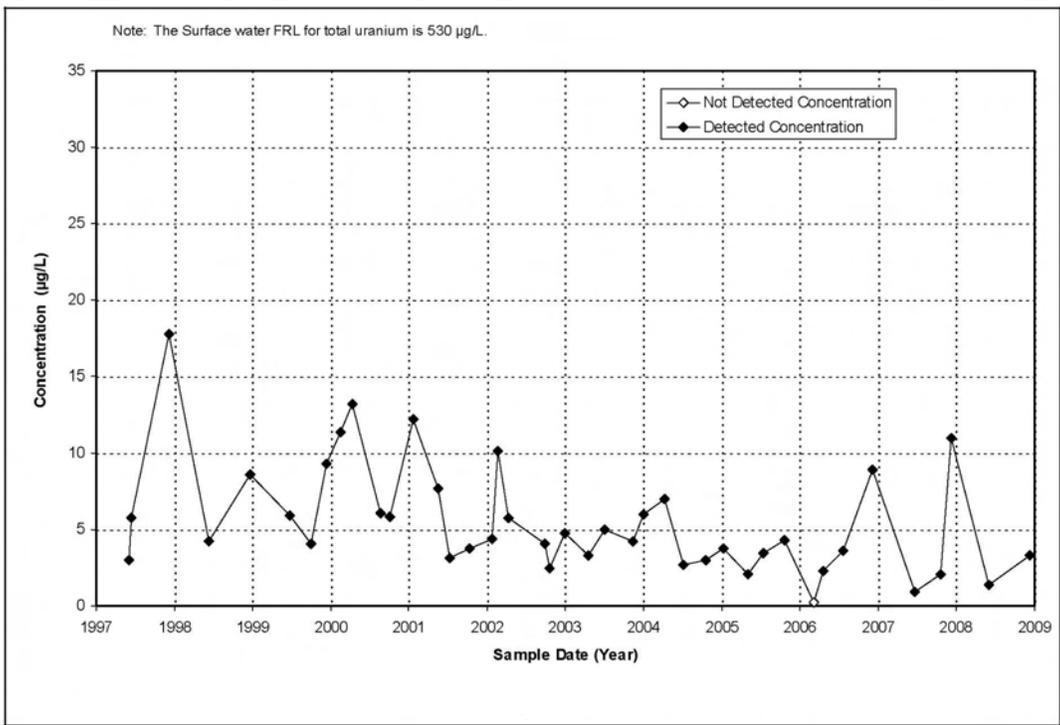


Figure B.1-6. Total Uranium Concentration versus Time Plot for Location STRM 4003 (Drainage to Paddys Run)

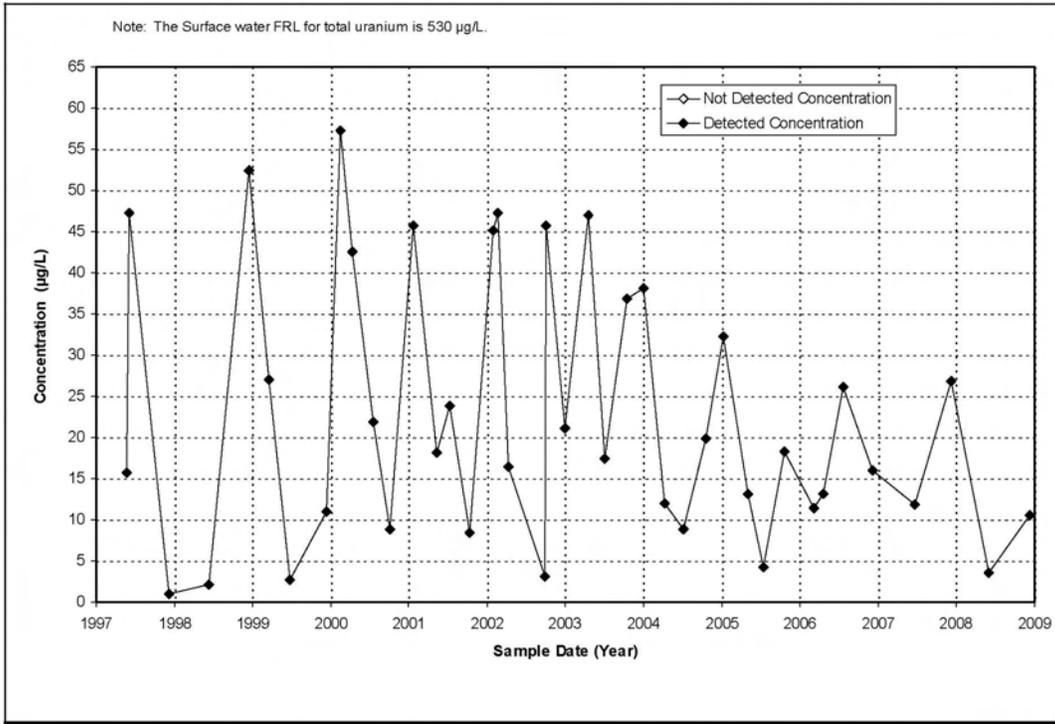


Figure B.1-7. Total Uranium Concentration versus Time Plot for Location STRM 4006 (Drainage to Paddys Run)

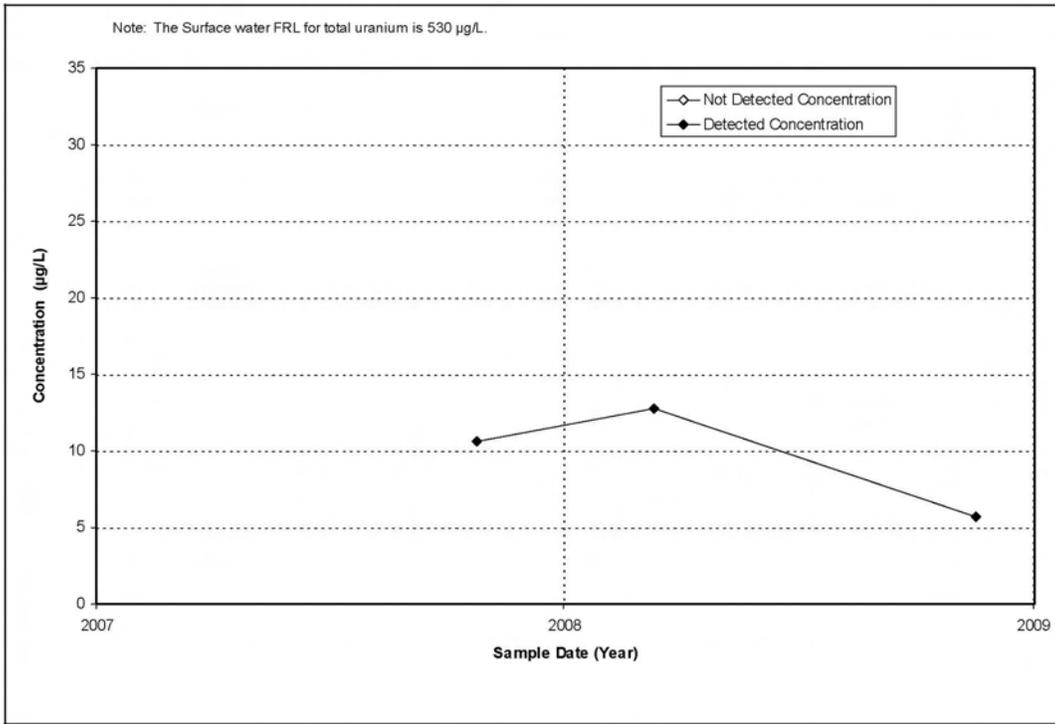


Figure B.1-8. Total Uranium Concentration versus Time Plot for Location SWD-06 (Former Pilot Plant)

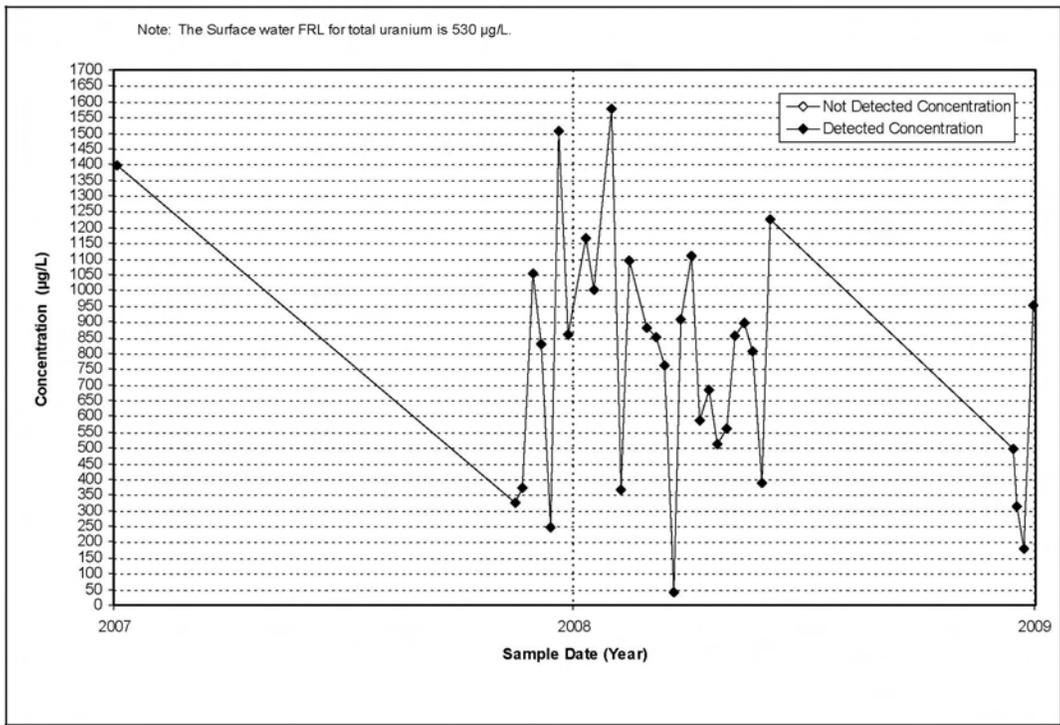


Figure B.1-9. Total Uranium Concentration versus Time Plot for Location SWD-09 (Former Waste Storage Area)

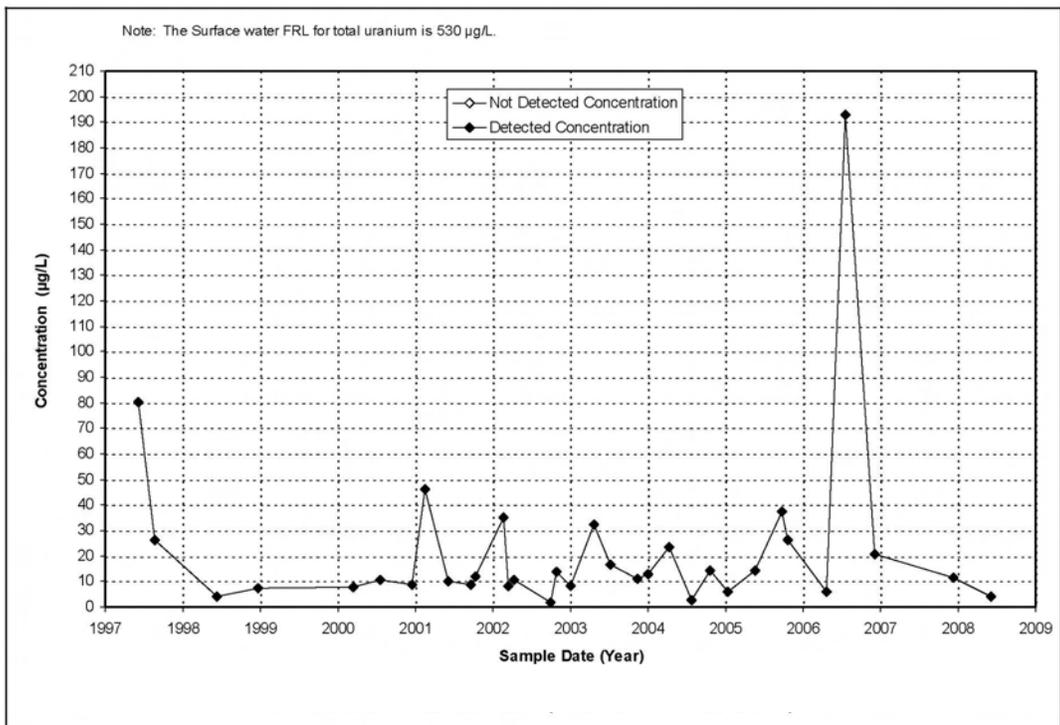


Figure B.1-10. Total Uranium Concentration versus Time Plot for Location STRM 4004/4004A (Drainage to Paddys Run)

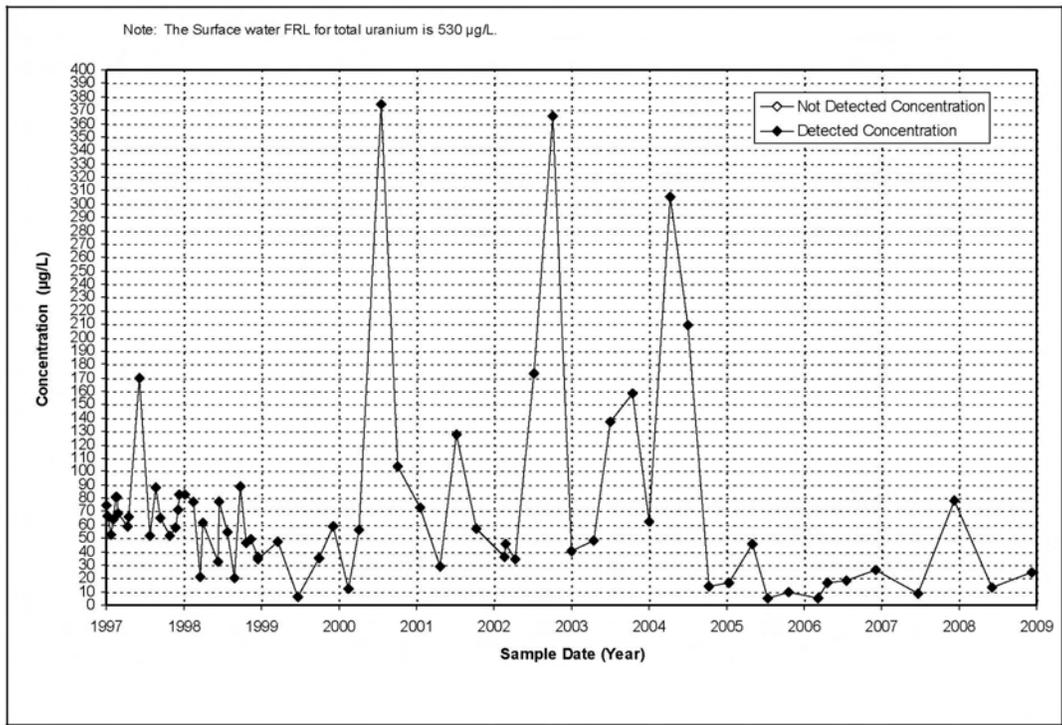


Figure B.1-11. Total Uranium Concentration versus Time Plot for Location STRM 4005 (Drainage to Paddys Run) for Cross-Media Impact Evaluation

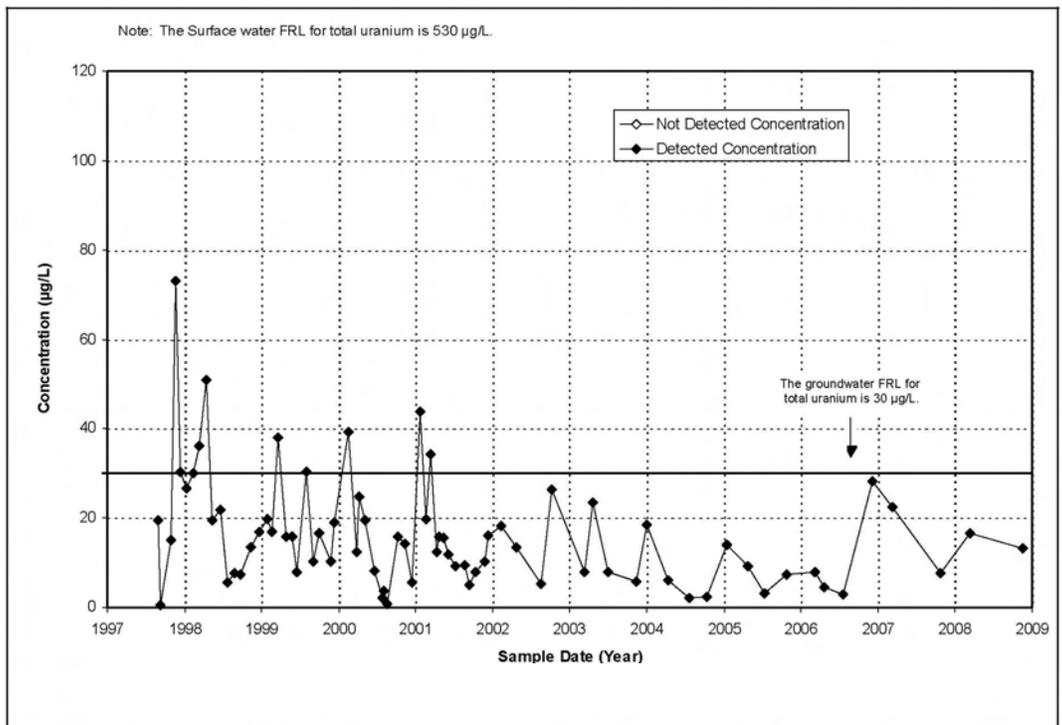


Figure B.1-12. Total Uranium Concentration versus Time Plot for Location SWD-02 (Storm Sewer Outfall Ditch) for Cross-Media Impact Evaluation

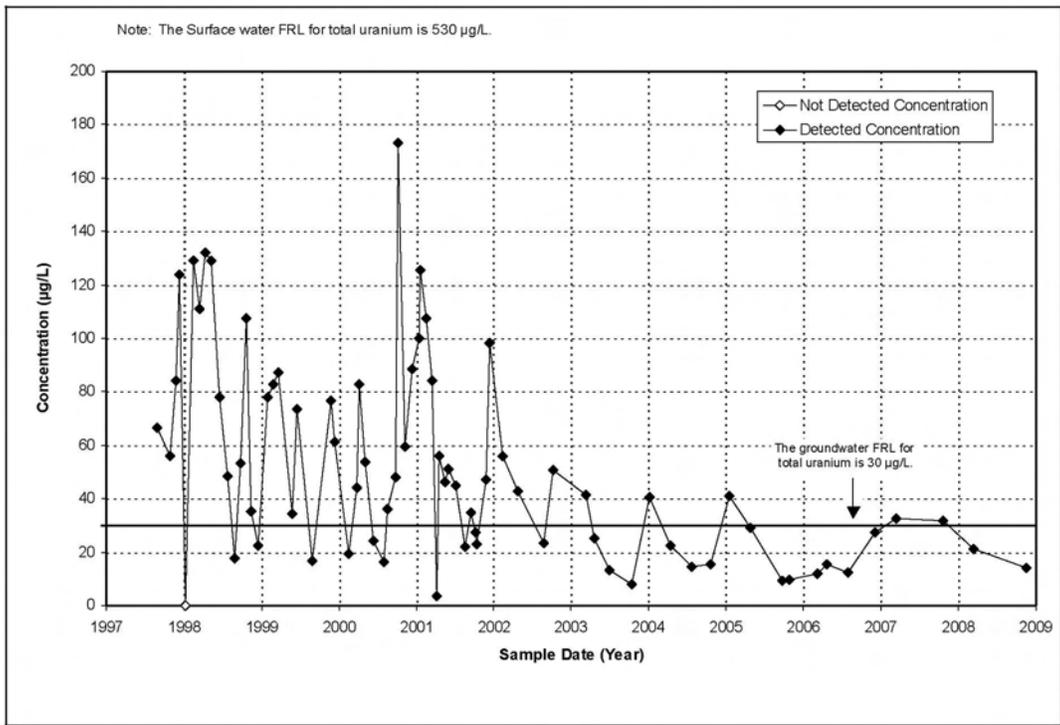


Figure B.1-13. Total Uranium Concentration versus Time Plot for Location SWD-03 (Waste Storage Area) for Cross-Media Impact Evaluation

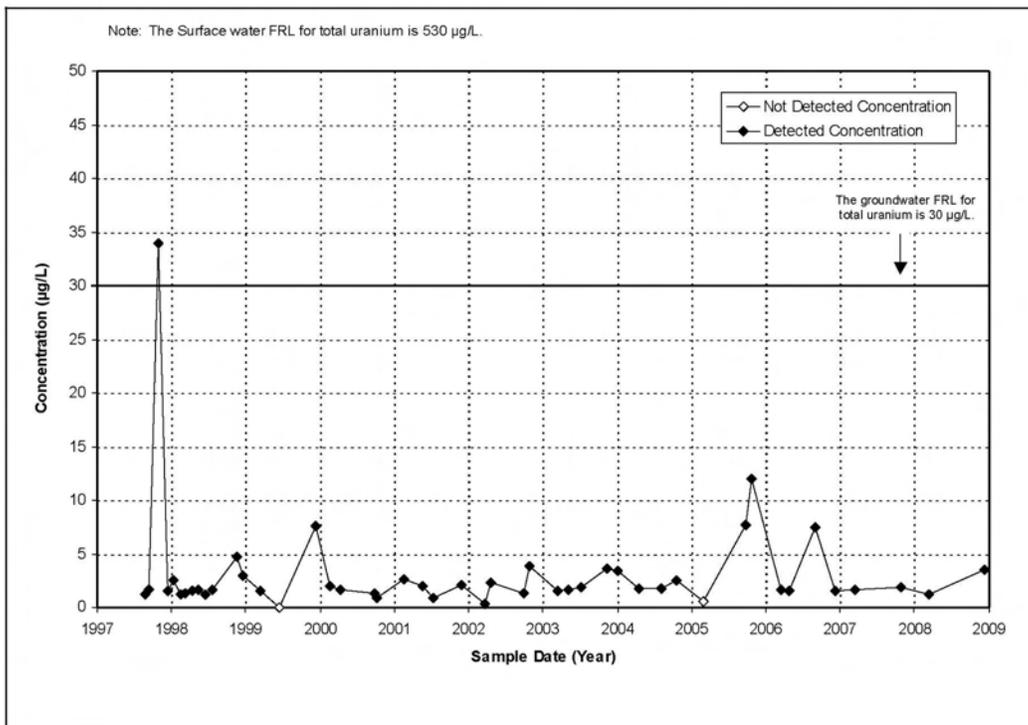


Figure B.1-14. Total Uranium Concentration versus Time Plot for Location SWP-02 (Paddys Run) for Cross-Media Impact Evaluation

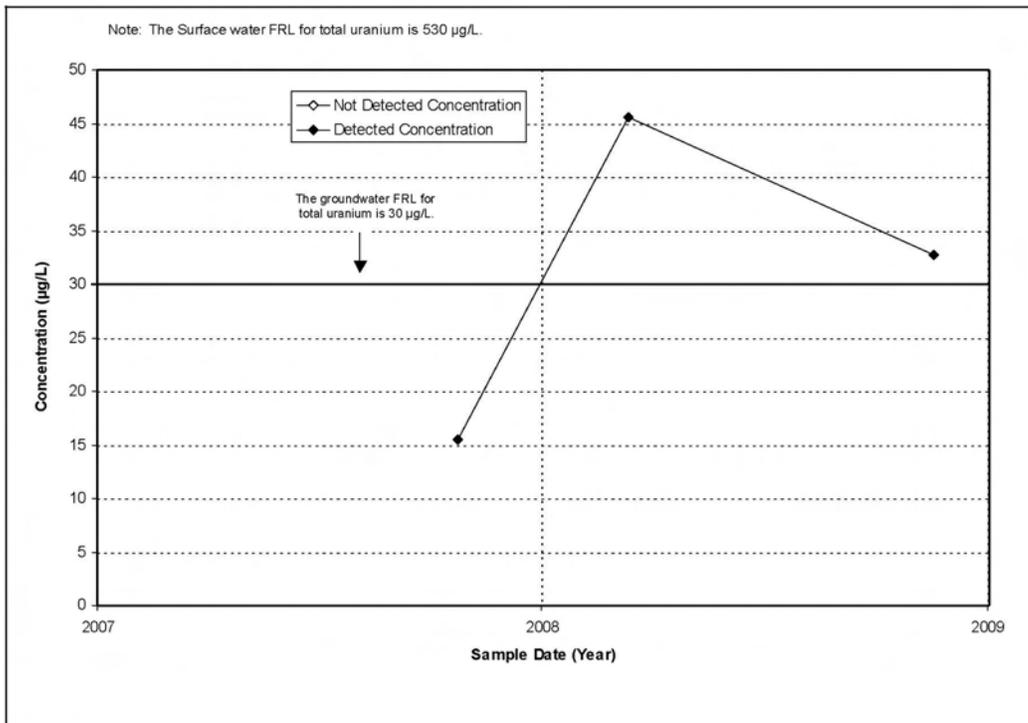


Figure B.1-15. Total Uranium Concentration versus Time Plot for Location SWD-04 (Former Waste Pit 3) for Cross-Media Impact Evaluation

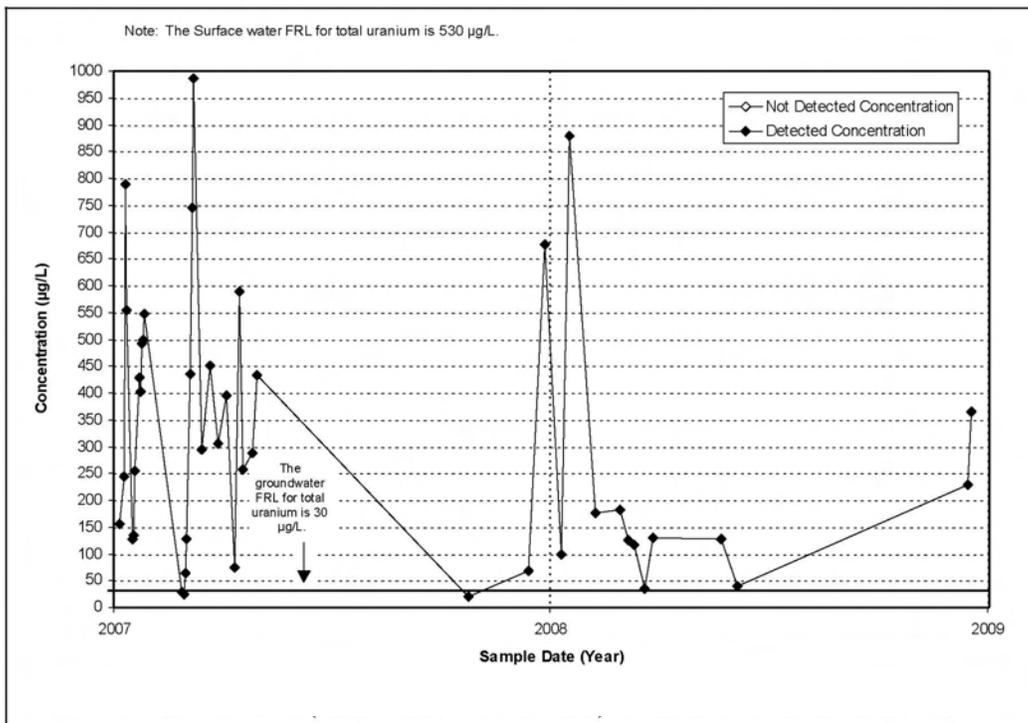


Figure B.1-16. Total Uranium Concentration versus Time Plot for Location SWD-05 (Former Waste Storage Area) for Cross-Media Impact Evaluation

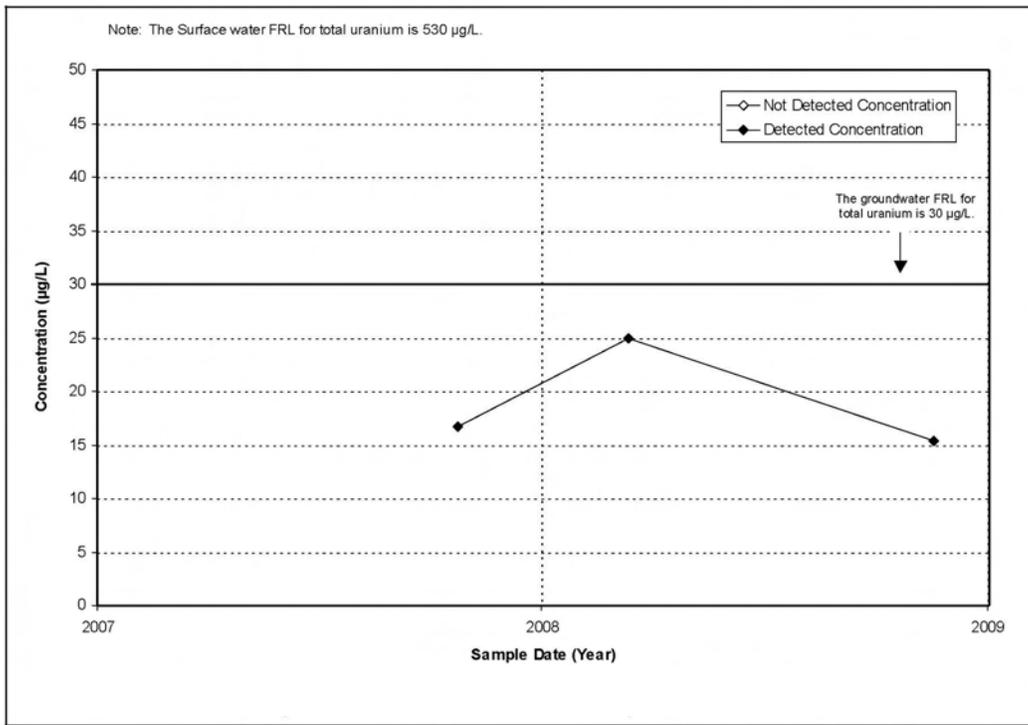


Figure B.1-17. Total Uranium Concentration versus Time Plot for Location SWD-07 (Former Production Area Drainage) for Cross-Media Impact Evaluation

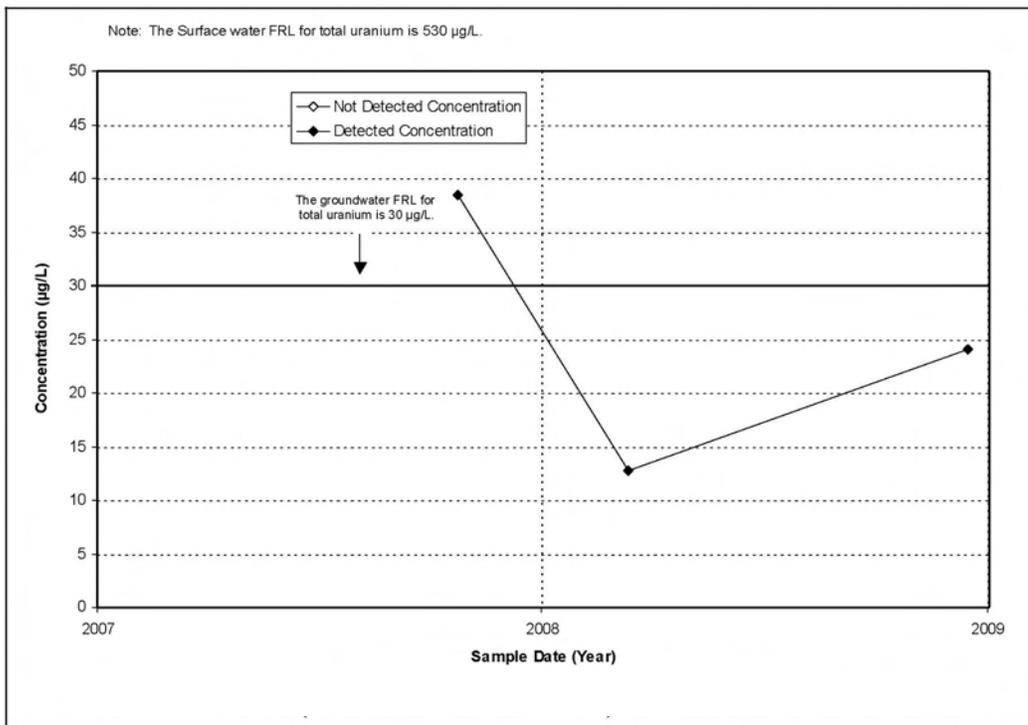


Figure B.1-18. Total Uranium Concentration versus Time Plot for Location SWD-08 (Former Southern Waste Units) for Cross-Media Impact Evaluation

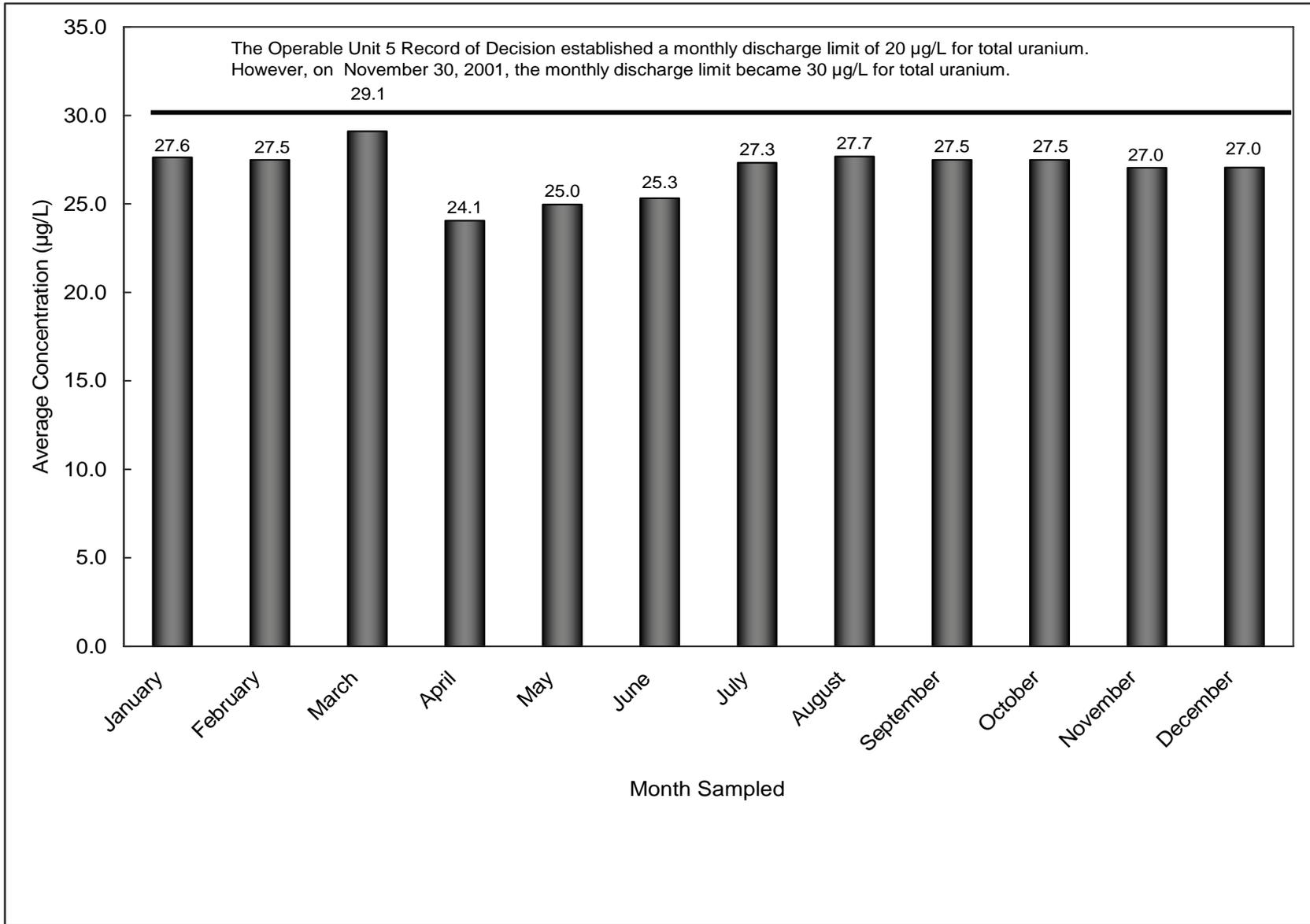


Figure B.1-19. 2008 Monthly Average Total Uranium Concentration in Water Discharged from the Parshall Flume (PF 4001) to the Great Miami River

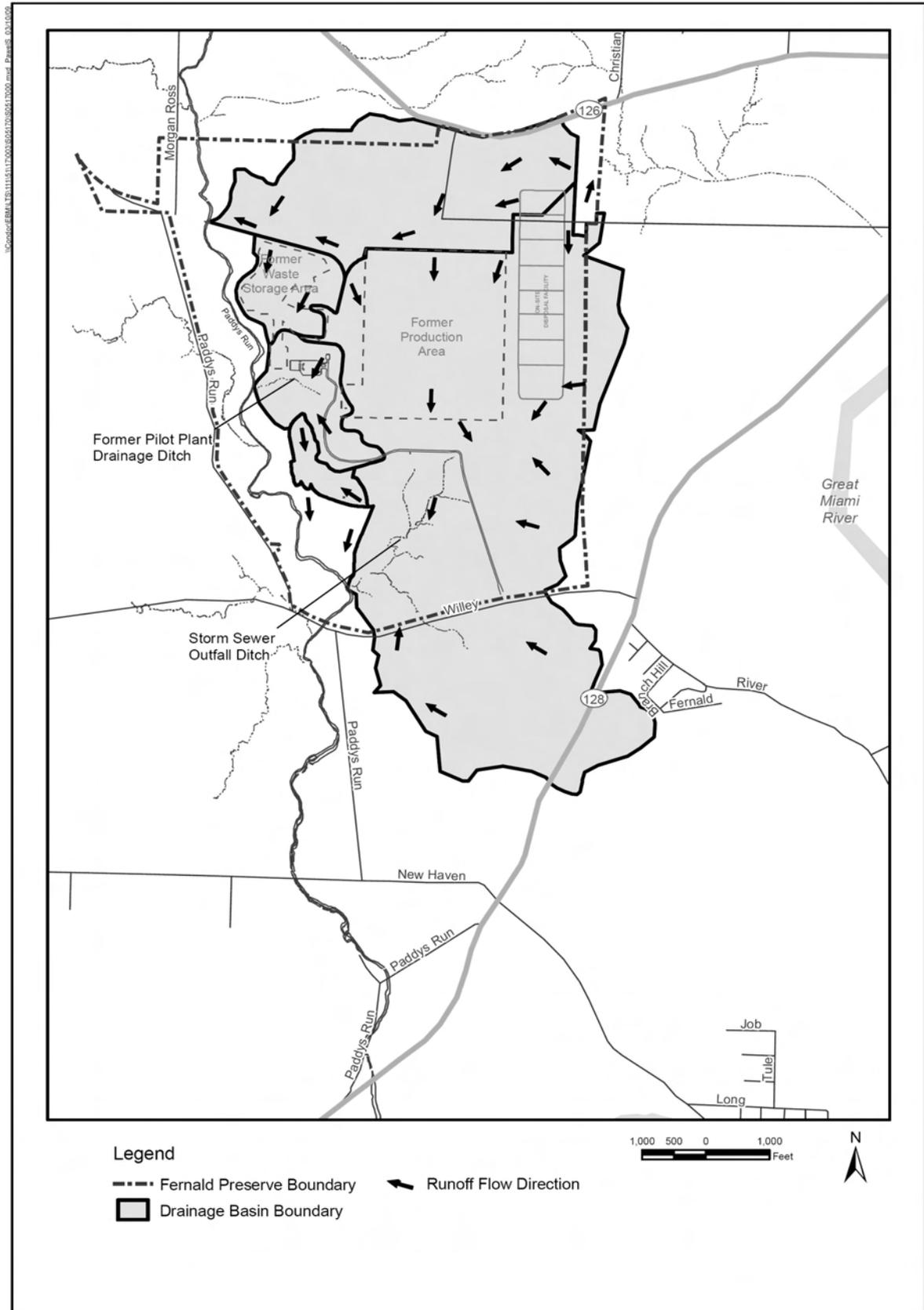


Figure B.1-20. Controlled Surface Water Areas and Uncontrolled Runoff Flow Directions

This page intentionally left blank

Attachment B.2

This page intentionally left blank

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 2008, sediment was collected at strategic locations in the Great Miami River (i.e., upgradient and downgradient of the effluent line). The year 2008 marks the tenth year that sediment was collected under the IEMP.

Sediment samples in the Great Miami River were collected in August of 2008 at two locations (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 identify the 2008 uranium results and historical uranium results from the Great Miami River. Uranium results from the river were less than 2 milligrams per kilogram (mg/kg), which are comparable to historical results. Note the sediment FRL for uranium is 200 mg/kg.

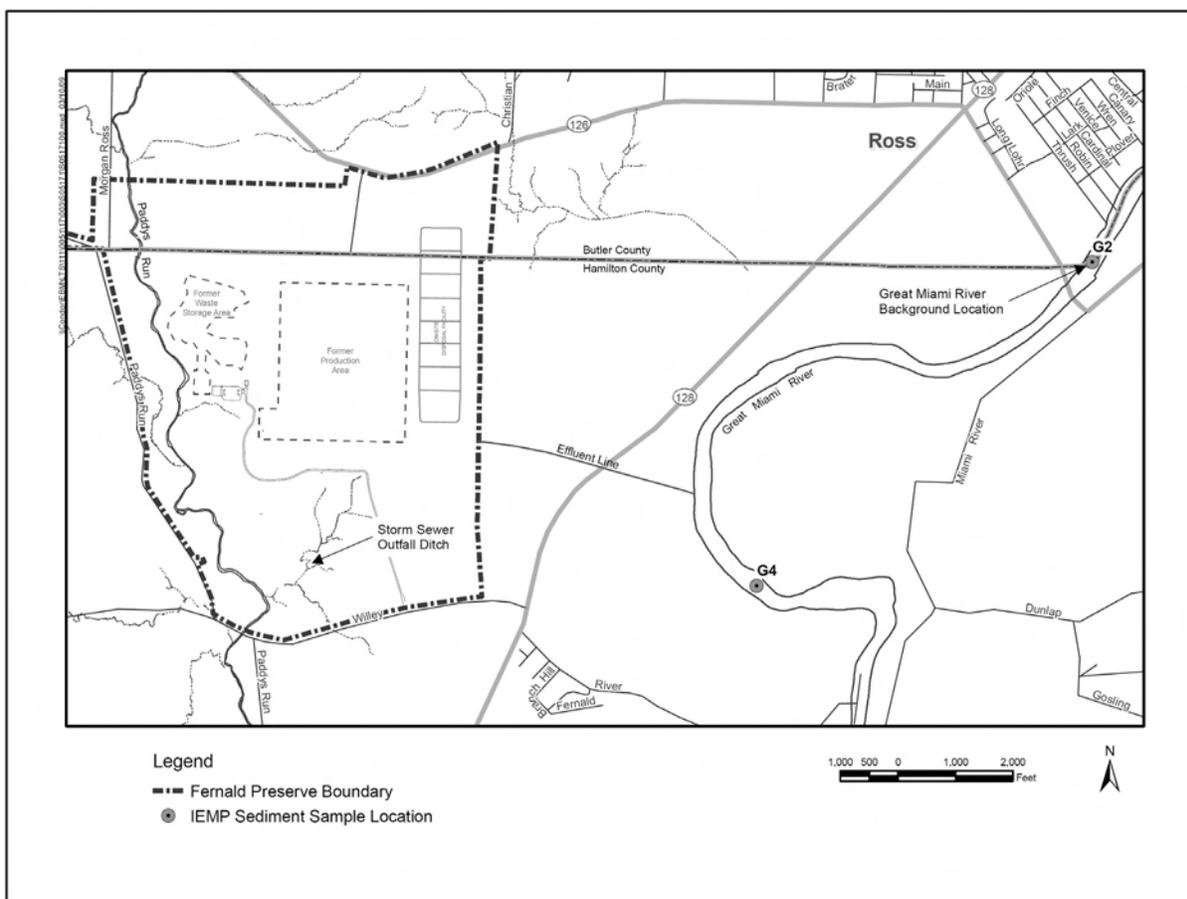


Figure B.2-1. 2008 Sediment Sample Locations

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

Radionuclide	No. of Samples	2008 Results – Concentration (mg/kg)	No. of Samples	2007 Results – Concentration (mg/kg)
Great Miami River, North of the Effluent Line (G2)				
Uranium, Total	1	1.1	1	0.55
Great Miami River, South of The Effluent Line (G4)				
Uranium, Total	1	0.68	1	0.75

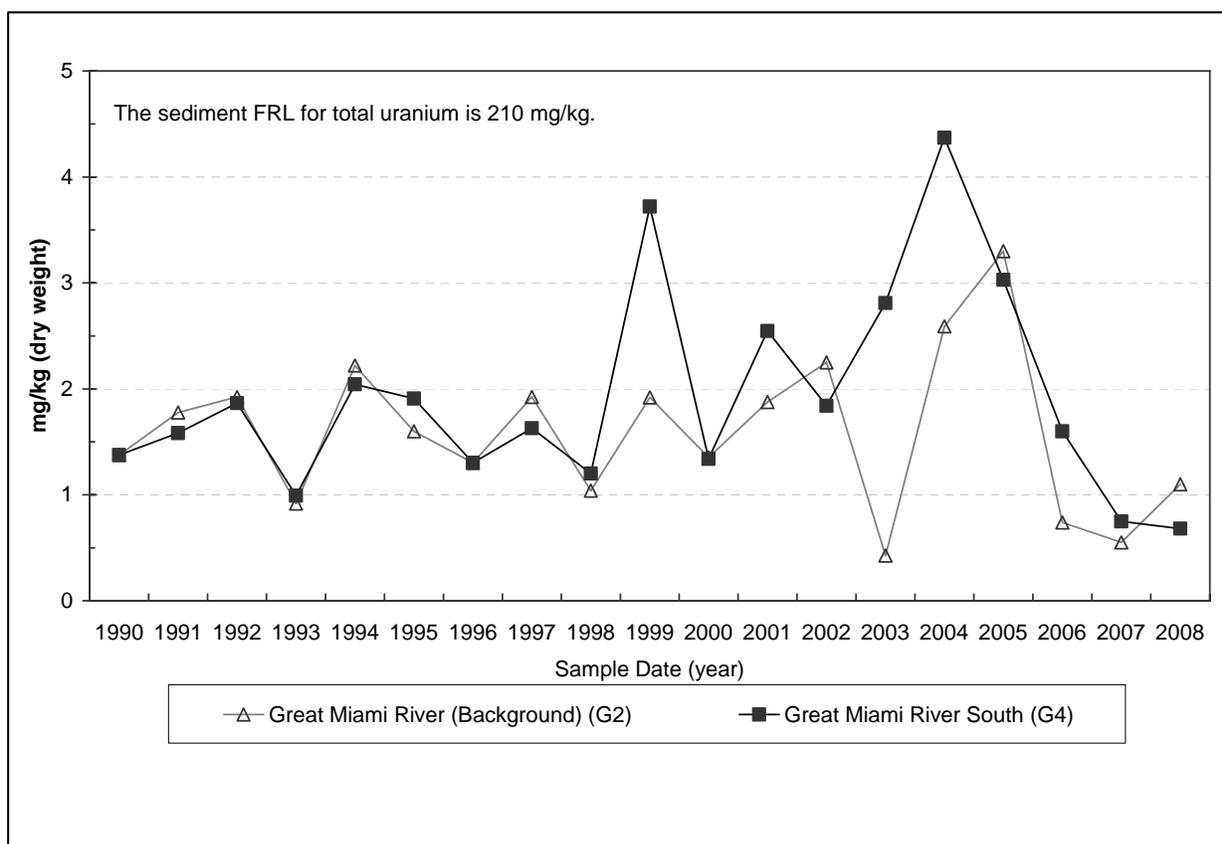


Figure B.2-2. Average Total Uranium Concentration versus Time Plot for Sediment