

Appendix B

Supplemental Surface Water and Treated Effluent Information

This page intentionally left blank

Contents

Abbreviations.....	iii
Measurement Abbreviations.....	iii
References.....	v
B.1.0 Surface Water and Treated Effluent.....	1
B.1.1 Surveillance Monitoring.....	1
B.1.1.1 Evaluation of Constituents above FRLs for 2011.....	2
B.1.1.2 Evaluation of Cross-Media Impacts for 2011.....	2
B.1.2 FFCA/OU5 ROD Compliance.....	6
B.1.3 Controlled and Uncontrolled Storm Water Runoff Areas.....	6

This page intentionally left blank

Abbreviations

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/L	milligrams per liter
pCi/L	picocuries per liter
µg/L	micrograms per liter

This page intentionally left blank

References

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, 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), 2010. *Comprehensive Legacy Management and Institutional Controls Plan*, LMS/FER/S03496, Revision 4, prepared by S.M. Stoller Corporation for DOE, Fernald Area Office, Cincinnati, Ohio, April.

This page intentionally left blank

B.1.0 Surface Water and Treated Effluent

This appendix presents additional surface water and treated effluent data in support of Section 4 of this *Fernald Preserve 2011 Site Environmental Report*. This appendix provides an evaluation of the final remediation level (FRL) exceedances for surface water and treated effluent, including an assessment of potential cross-media impacts to the groundwater pathway. Surface water data are available through the Department of Energy Office of Legacy Management's Geospatial Environmental Mapping System (<http://www.lm.doe.gov/Fernald/Sites.aspx>).

Surface water and treated effluent samples are collected as required by the Integrated Environmental Monitoring Plan (IEMP), which is Attachment D of the *Comprehensive Legacy Management and Institutional Controls Plan* (LMICP) (DOE 2010). 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 because it is discussed in detail in Section 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 FRLs 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 2011 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 FRLs, 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) micrograms per liter ($\mu\text{g/L}$), 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 2010 LMICP, pCi/L, $\mu\text{g/L}$, or mg/L (zero was used when no background concentration was available)
- Q_{PF} = Daily flow at PF 4001, cfs
- C_{PF} = Daily concentration at PF 4001, pCi/L, $\mu\text{g/L}$, 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 2011 was 662 cfs, which occurred on September 3. 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 2011

As shown in Table B.1–1, there were 27 exceedances in 2011 of surface water FRLs. The following are general observations:

- No FRL exceedances occurred at PF 4001, thus there was no need to run the mixing equation to determine the concentration in the Great Miami River.
- Twenty-seven results from sampling location SWD-09 exceeded the surface water FRL for total uranium (530 $\mu\text{g/L}$). Figure B.1–3 is a plot of the total uranium concentration versus time for sampling location SWD-09. Figures B.1–4 through B.1–22 are plots of the total uranium concentration versus time for all of the surface water sampling locations.

As discussed in Section 4, surface water monitoring currently conducted in a small area west of the former waste pits continues to show elevated but slowly diminishing uranium concentrations. After a limited maintenance activity was completed in the fall of 2007, DOE committed to continued monitoring of the area. Two monitoring points (SWD-05 and SWD-09) were added to the surface water program to fulfill this monitoring commitment. These two locations are sampled weekly, when water is present. As shown in Table B.1-1, SWD-09 has been sampled 131 times between January 2007 and December 2012. One-hundred and one of the 131 sampling events have exceeded the surface water FRL. SWD-05 has been sampled 90 times and SWD-09 has been sampled 131 times.

B.1.1.2 Evaluation of Cross-Media Impacts for 2011

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, sampling 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 sampling locations associated with these areas of direct infiltration are SWD-02, SWD-03, SWD-04, SWD-05, SWD-07, SWD-08, STRM 4005, and SWP-02 (Figures B.1–4 through B.1–11).

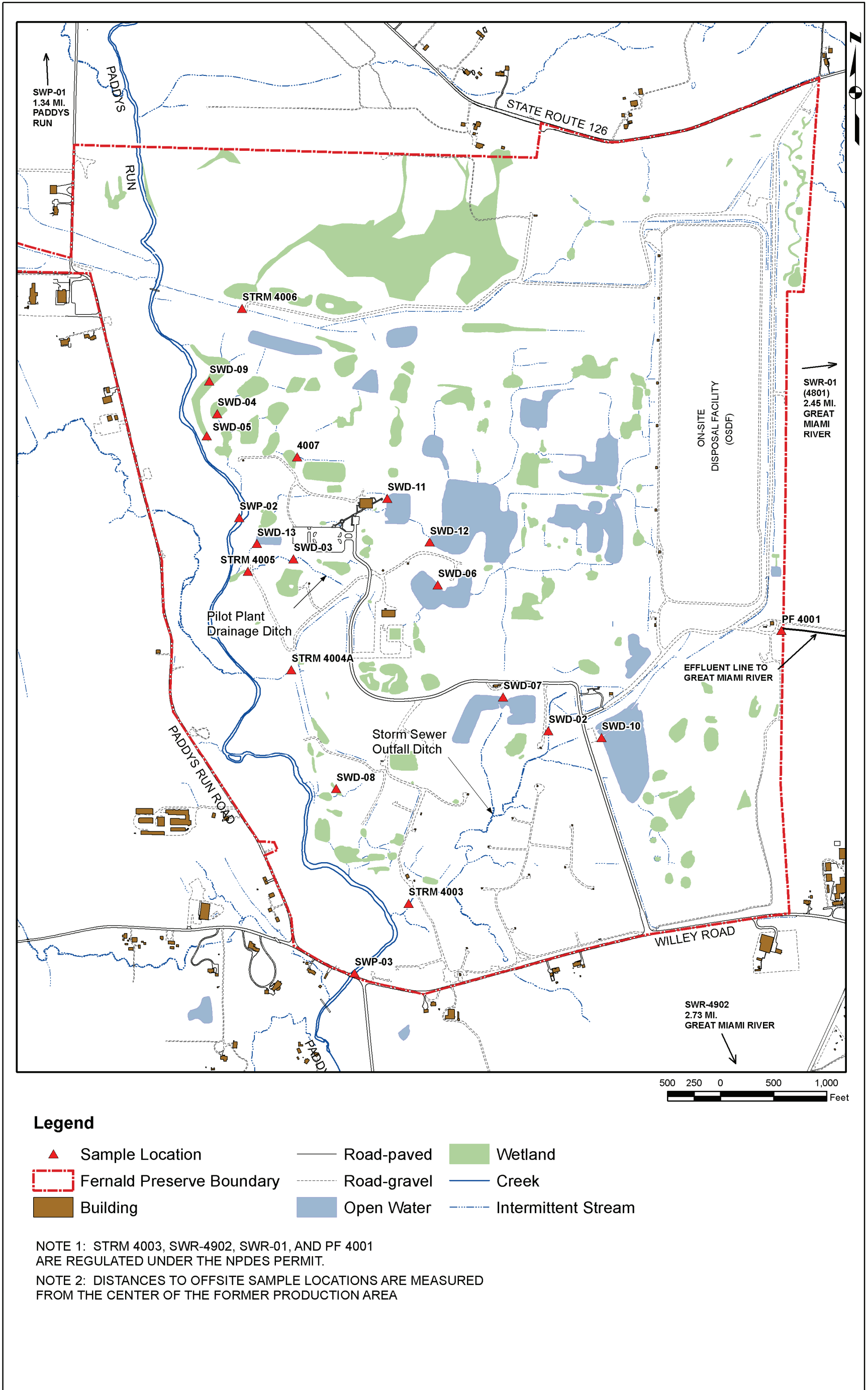


Figure B.1-1. IEMP/NPDES Surface Water and Treated Effluent Sample Locations

This page intentionally left blank

accounted for this potential contaminant pathway by installing extraction wells downgradient of these areas where direct infiltration can occur.

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 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 2011, the total uranium concentrations were monitored daily at PF 4001 to demonstrate compliance with these limitations. The Fernald Preserve was in compliance with the total mass limitation, as uranium discharges totaled 565 pounds, which is below the 600-pound limit. The Fernald Preserve was in compliance with the monthly flow-weighted concentration limit every month in 2011, as identified on Figure B.1–23.

B.1.3 Controlled and Uncontrolled Storm Water Runoff Areas

In 2011, there were no previously uncontrolled areas that were added to the Fernald Preserve controlled storm water system (refer to Figure B.1–24). 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 2011 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 2011 ^{c,d}	FRL ^e (µg/L)	Min. ^{b,c,d,f,g} (µg/L)	Max. ^{b,c,d,f,g} (µg/L)	Avg. ^{b,c,d,f,g} (µg/L)	SD ^{b,c,d,f,g} (µg/L)	Trend ^{b,c,d,f,g} (µg/L)
SWD-09 (Waste Storage Area)	Uranium	131	101	27	530	40.8	1,710	810	350	Down, Significant

^aRefer to Figure B.1-1.

^bBased on samples collected from January 3, 2007, through December 31, 2011.

^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 method 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.

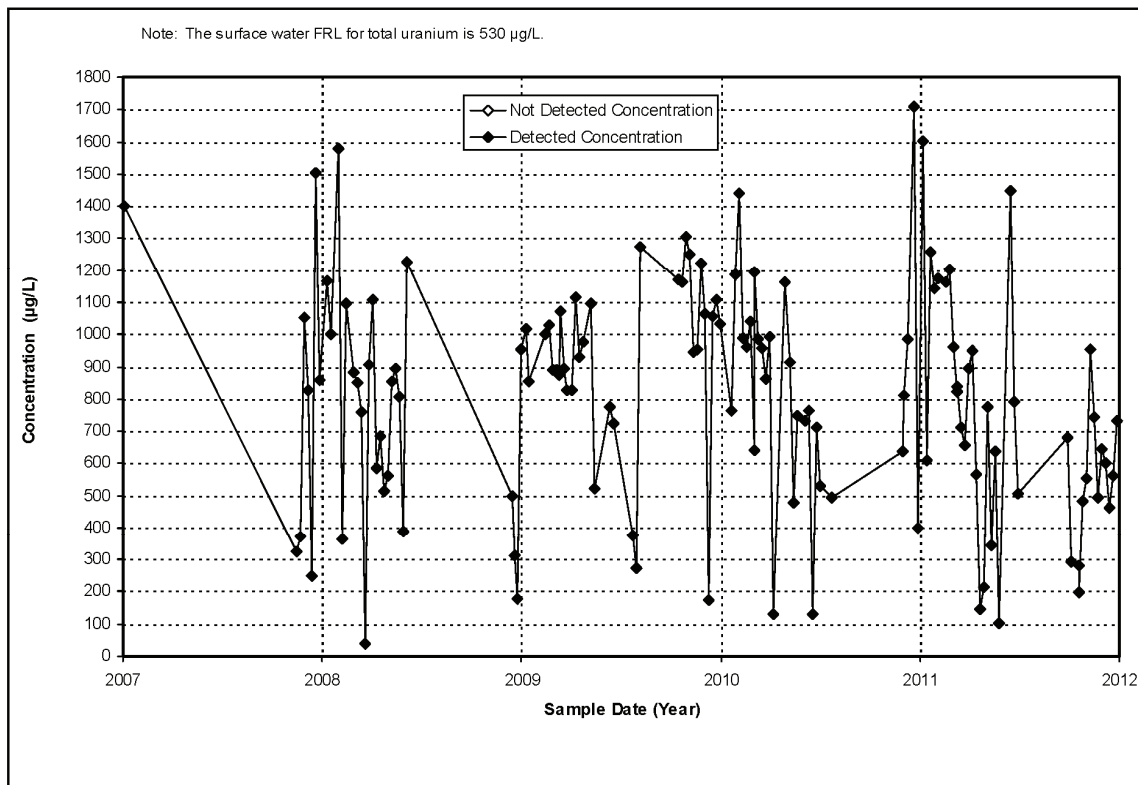


Figure B.1-3. Plot of Total Uranium Concentration versus Time for Location SWD-09 (Former Waste Storage Area)

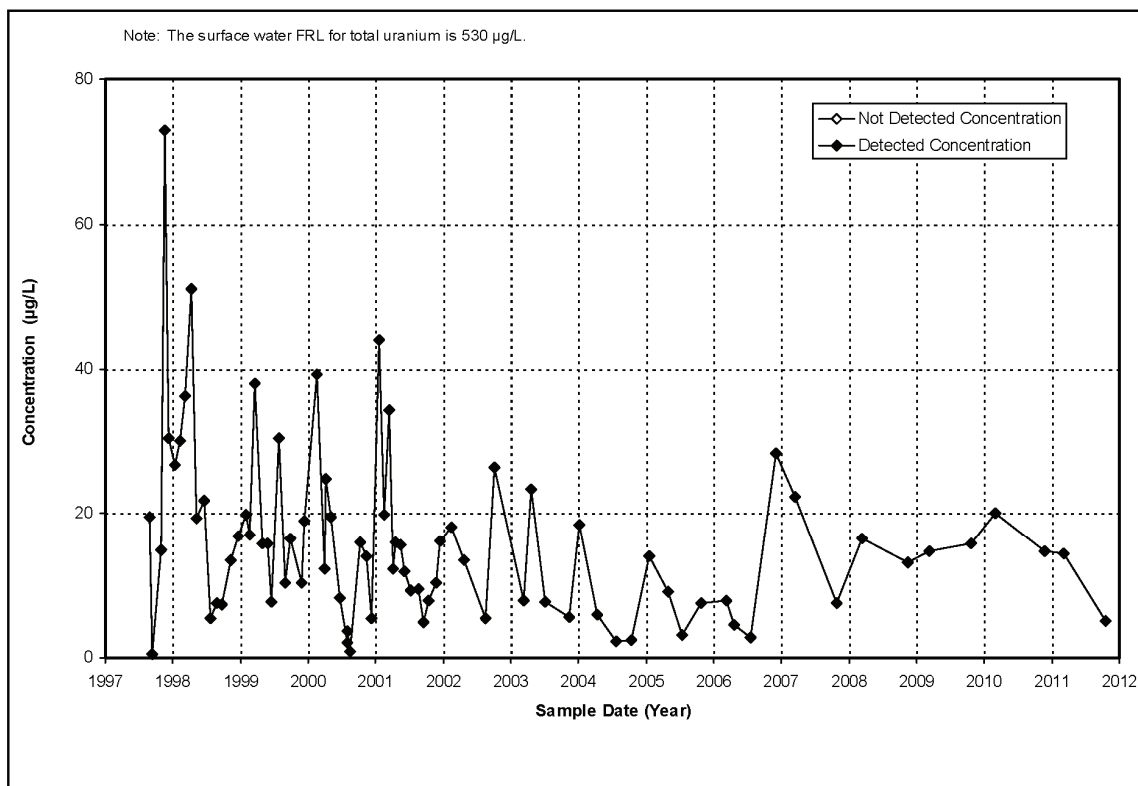


Figure B.1-4. Total Uranium Concentration vs. Time Plot for Location SWD-02 (Storm Sewer Outfall Ditch) for Cross-Media Impact Evaluation

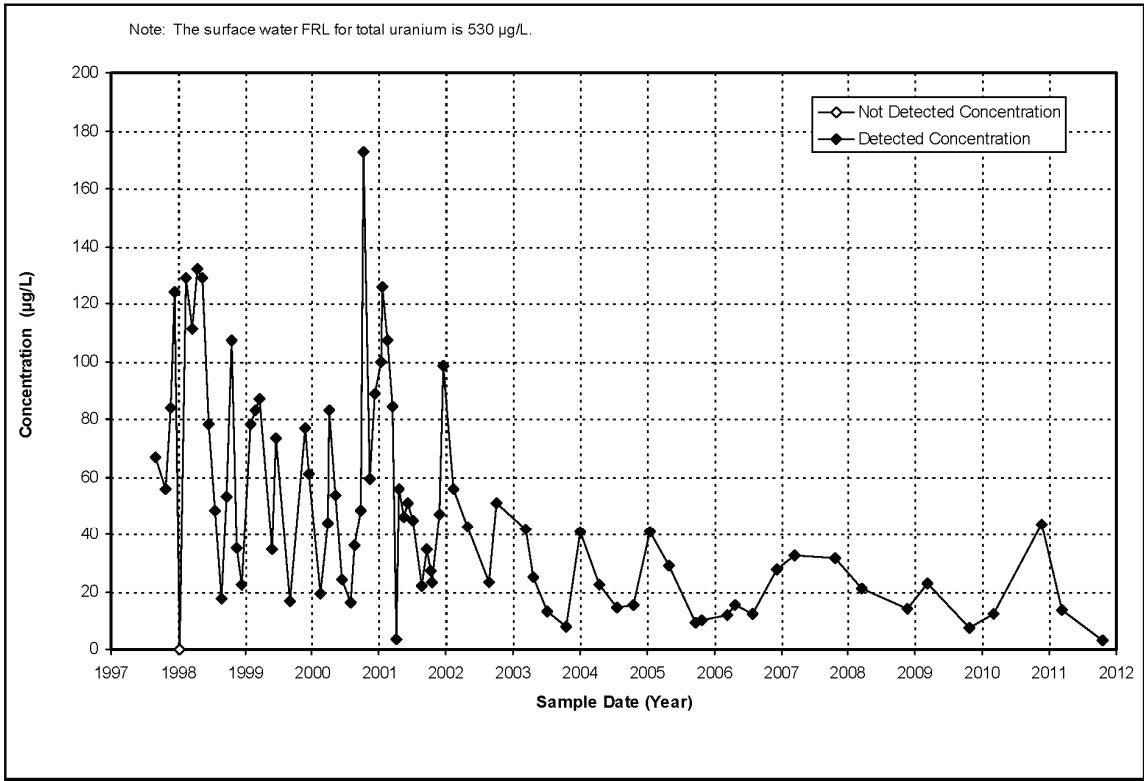


Figure B.1-5. Plot of Total Uranium Concentration versus Time for Location SWD-03 (Former Pilot Plant Drainage Ditch) for Cross-Media Impact Evaluation

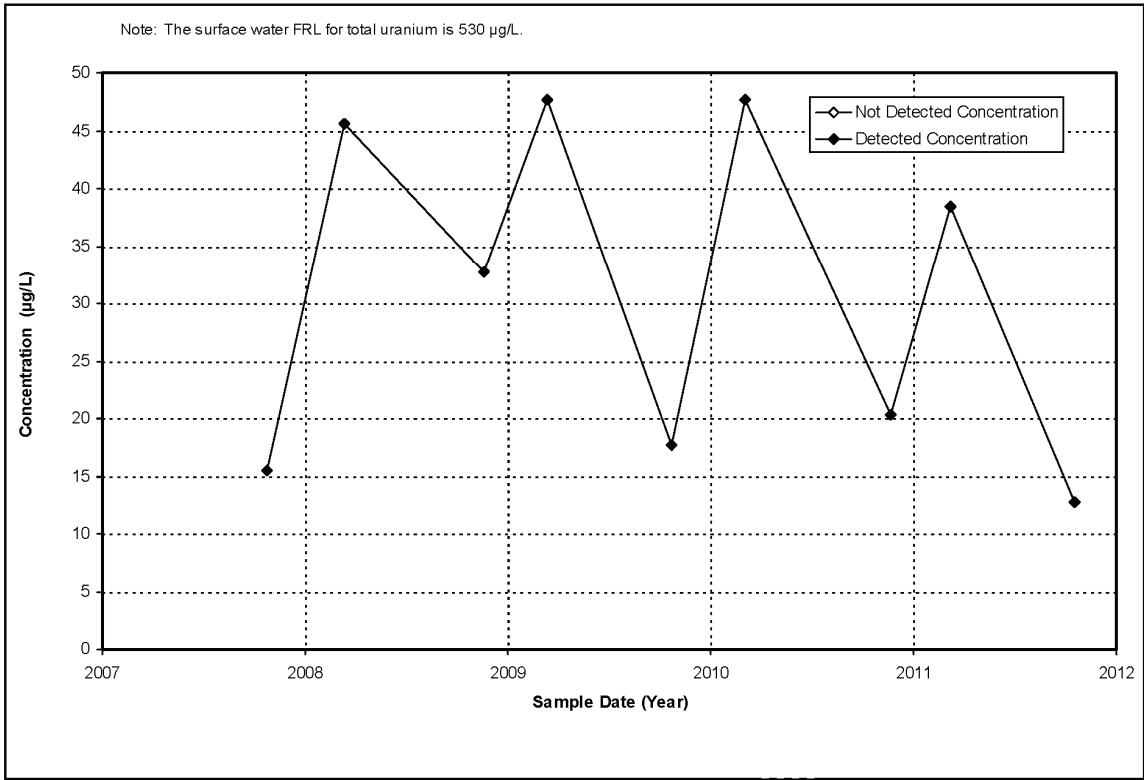


Figure B.1-6. Plot of Total Uranium Concentration versus Time for Location SWD-04 (Former Waste Pit 3) for Cross-Media Impact Evaluation

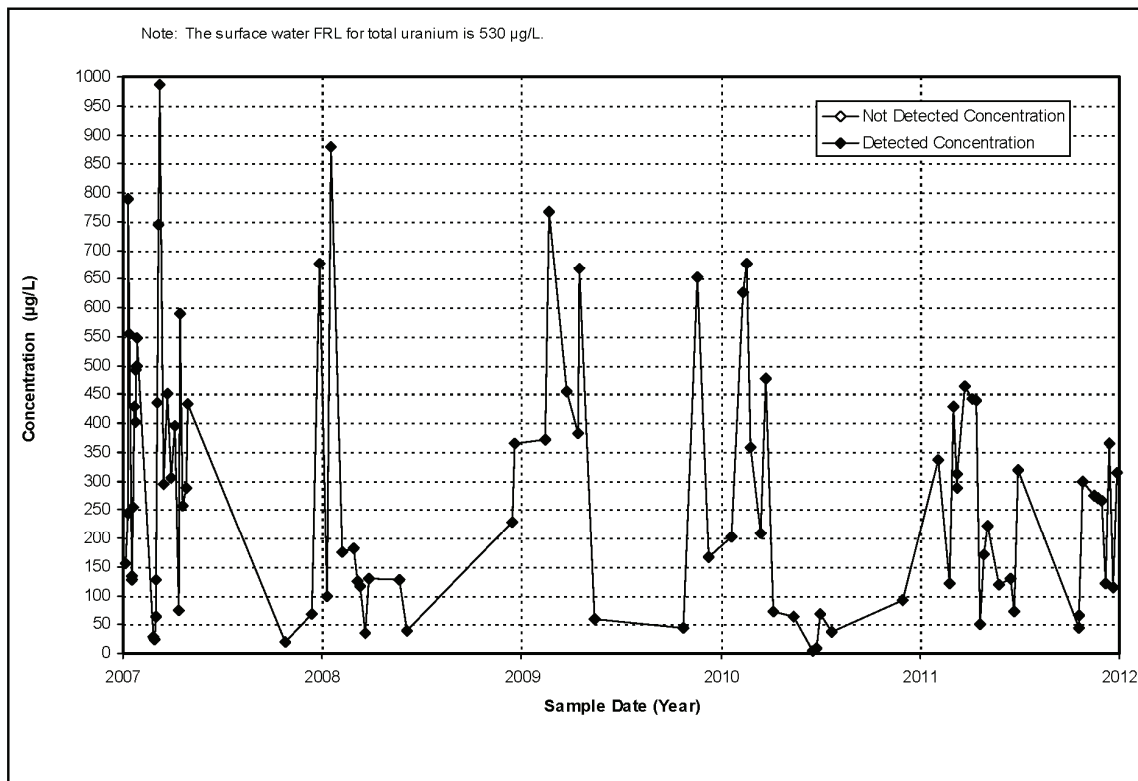


Figure B.1-7. Plot of Total Uranium Concentration versus Time for Location SWD-05 (Former Waste Storage Area) for Cross-Media Impact Evaluation

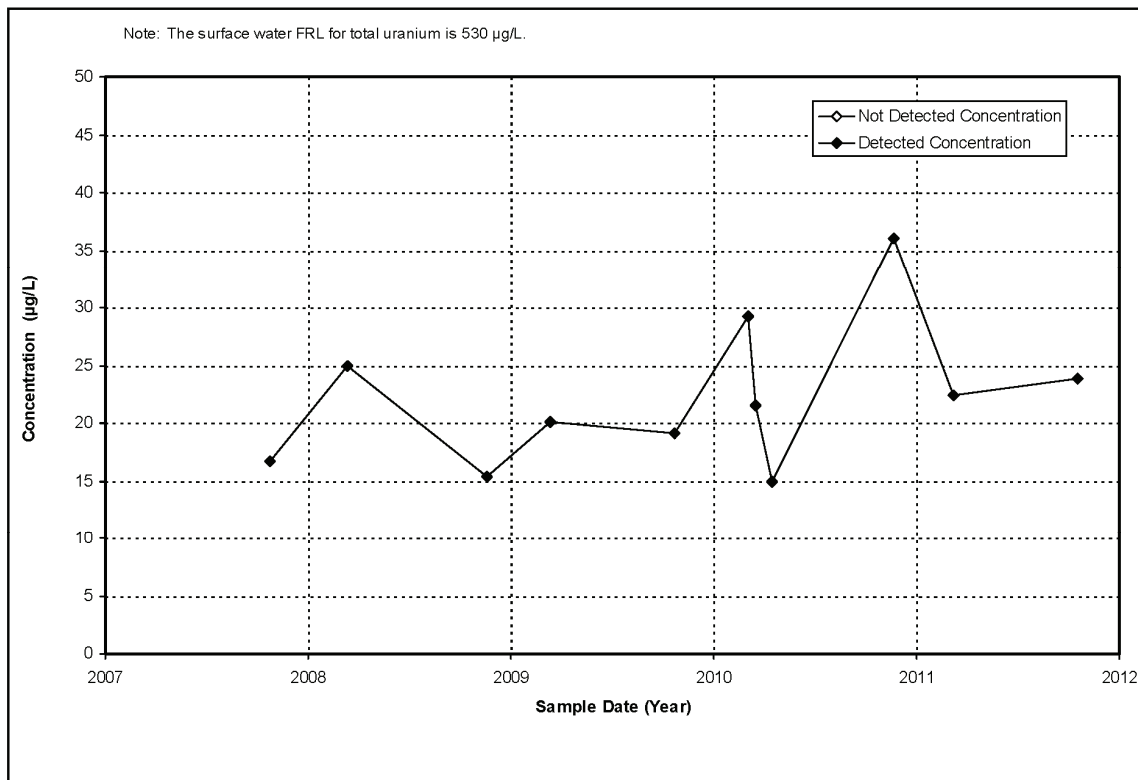


Figure B.1-8. Plot of Total Uranium Concentration versus Time for Location SWD-07 (Former Production Area Drainage) for Cross-Media Impact Evaluation

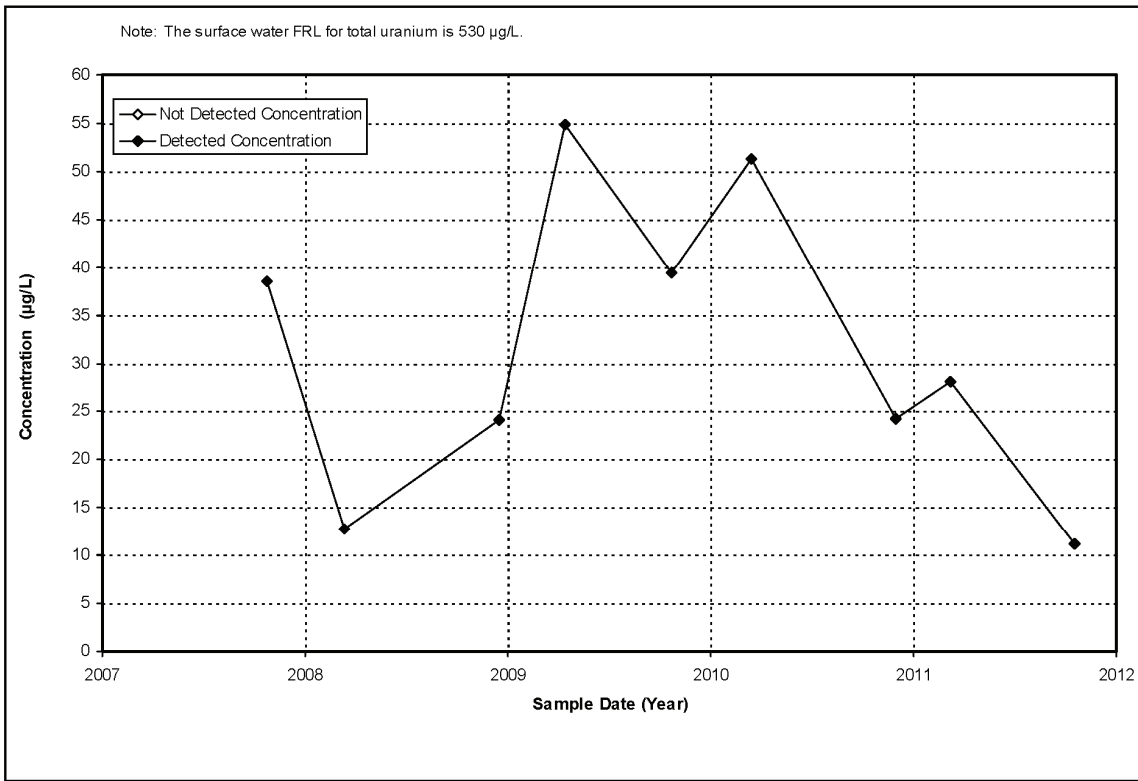


Figure B.1-9. Plot of Total Uranium Concentration versus Time for Location SWD-08 (Former Southern Waste Units) for Cross-Media Impact Evaluation

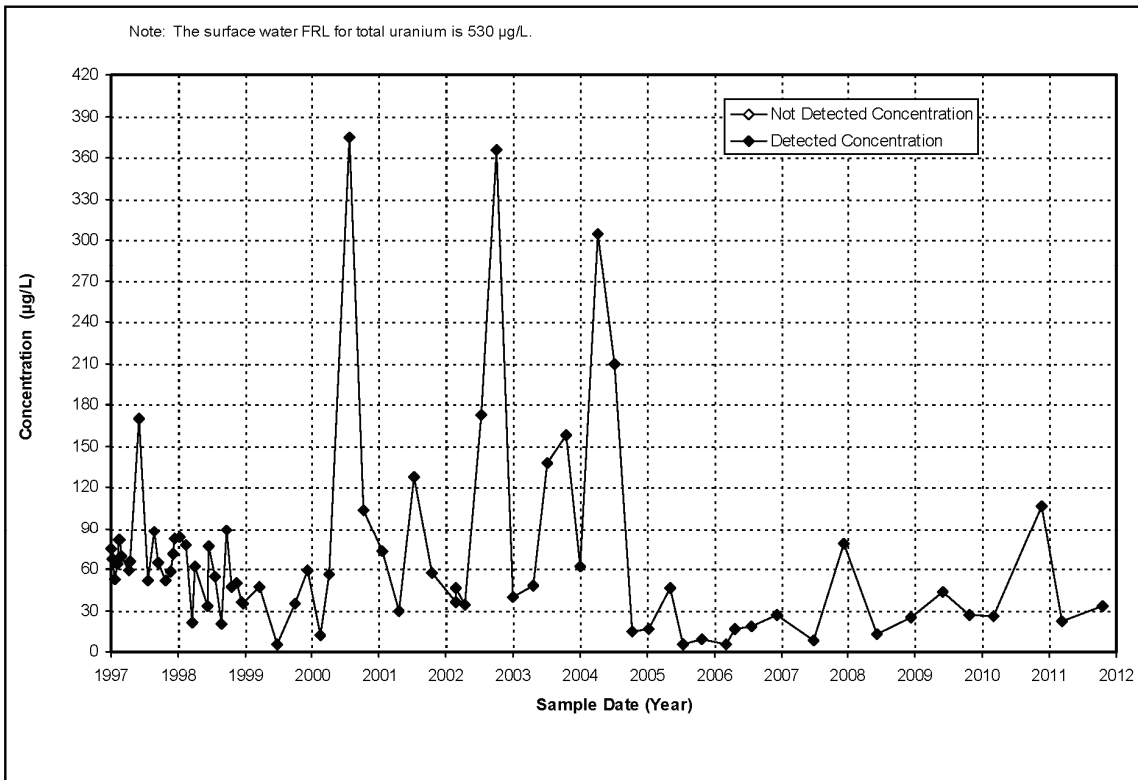


Figure B.1-10. Plot of Total Uranium Concentration versus Time for Location STRM 4005 (Drainage to Paddys Run) for Cross-Media Impact Evaluation

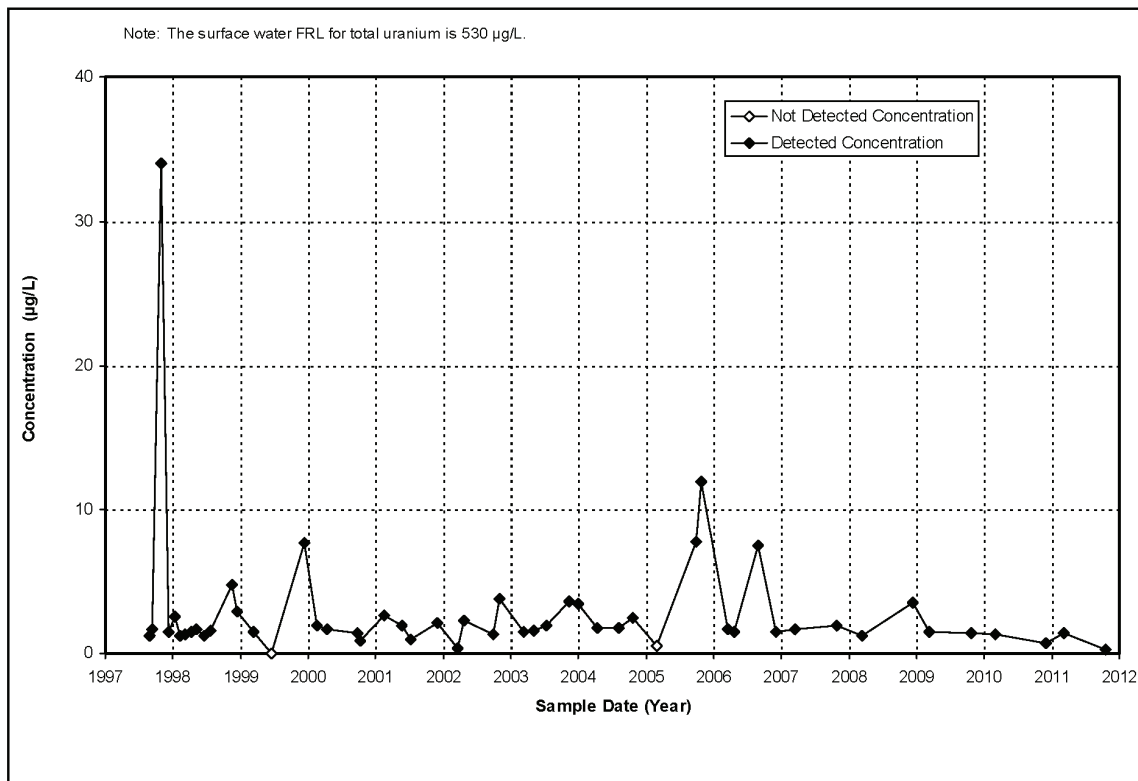


Figure B.1-11. Total Uranium Concentration vs. Time Plot for Location SWP-02 (Paddys Run) for Cross-Media Impact Evaluation

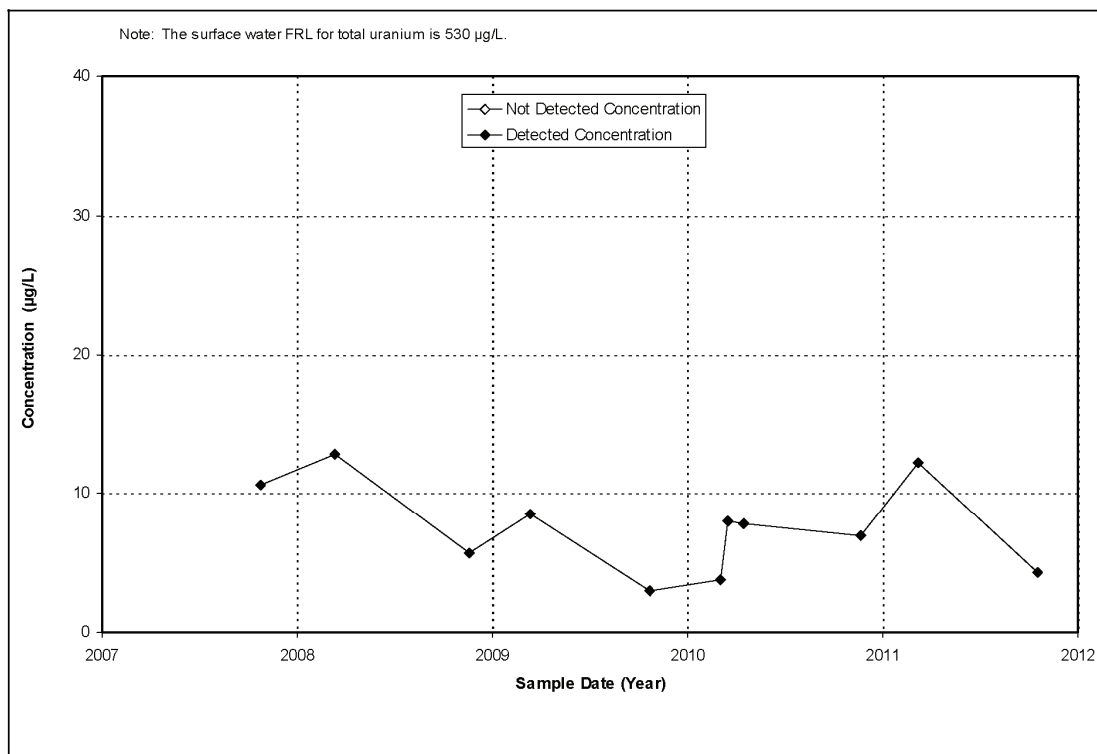


Figure B.1-12. Plot of Total Uranium Concentration versus Time for Location SWD-06 (Former Pilot Plant)

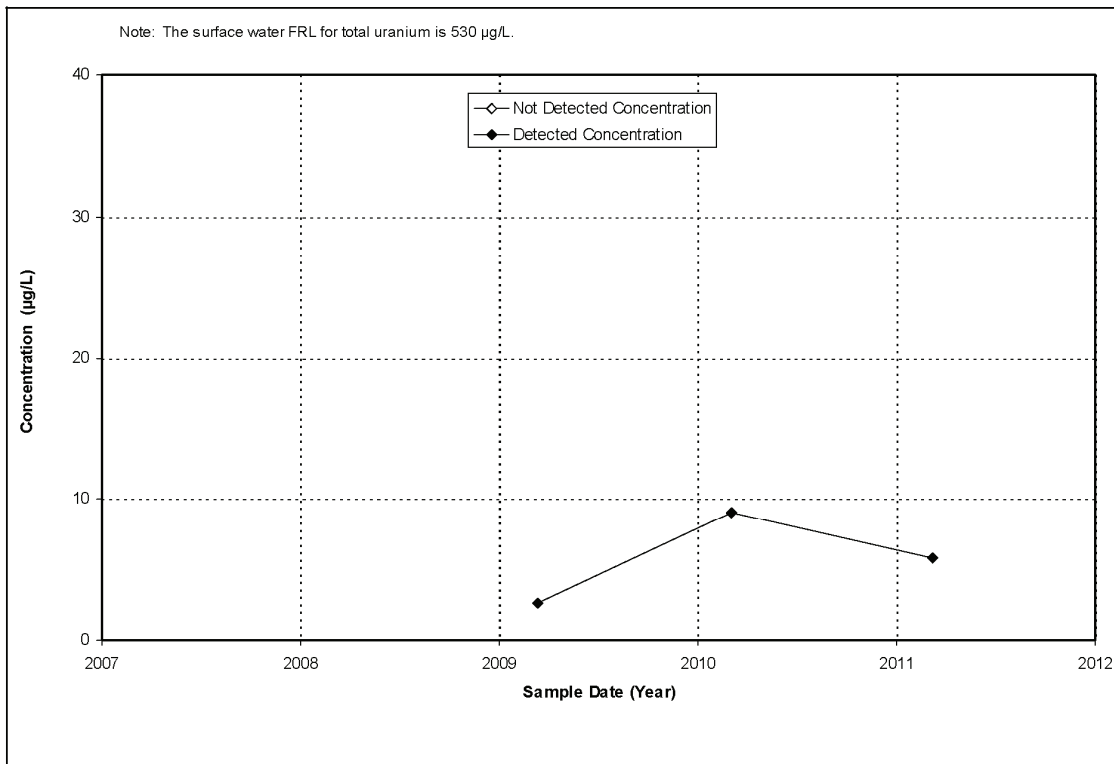


Figure B.1-13. Total Uranium Concentration vs. Time Plot for Location SWD-10 (Lodge Pond)

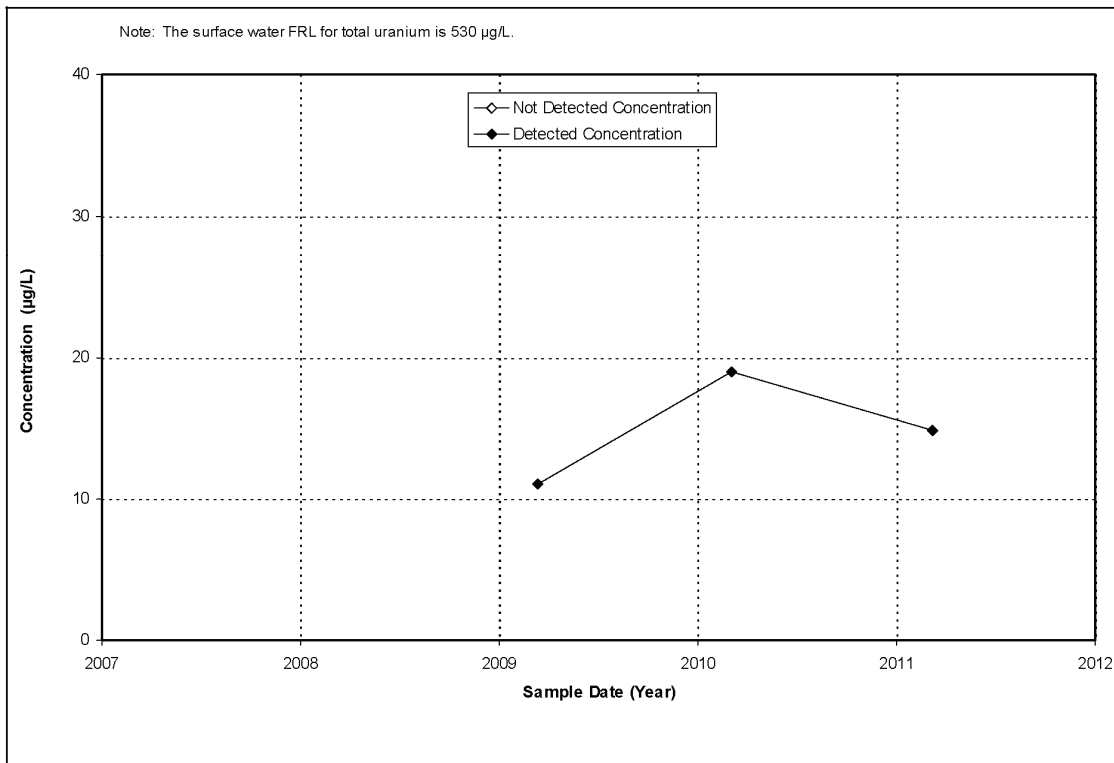


Figure B.1-14. Total Uranium Concentration vs. Time Plot for Location SWD-11 (Former Lime Sludge Pond)

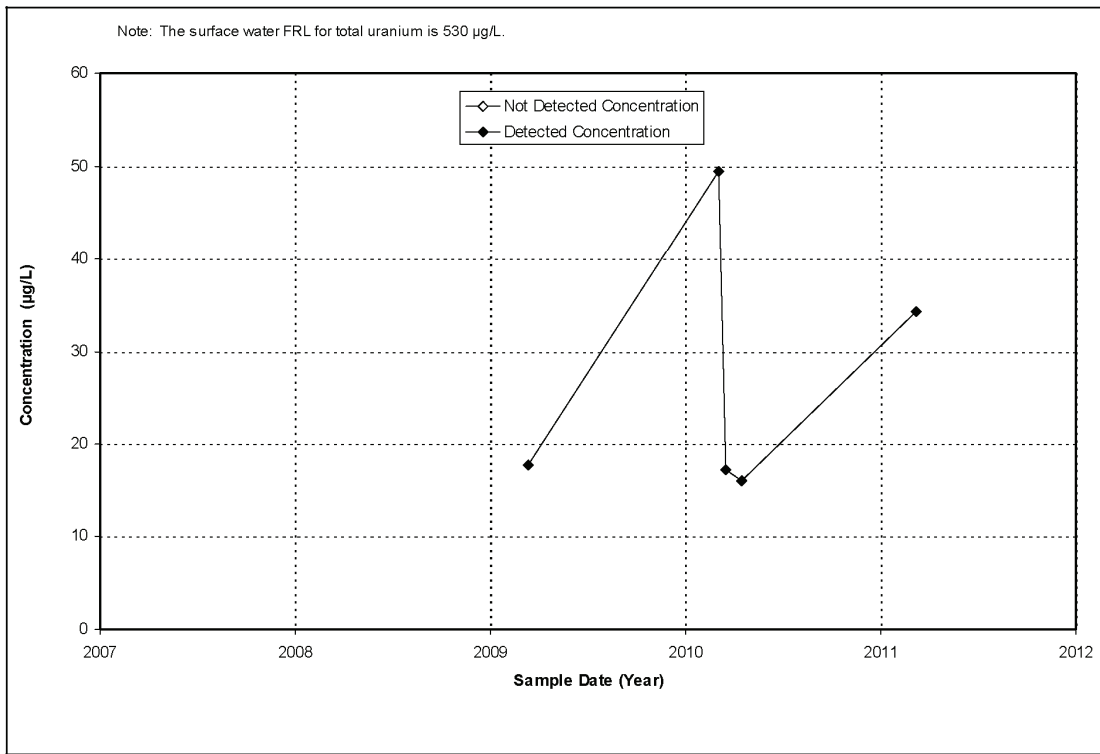


Figure B.1-15. Total Uranium Concentration vs. Time Plot for Location SWD-12 (Former Area 4B)

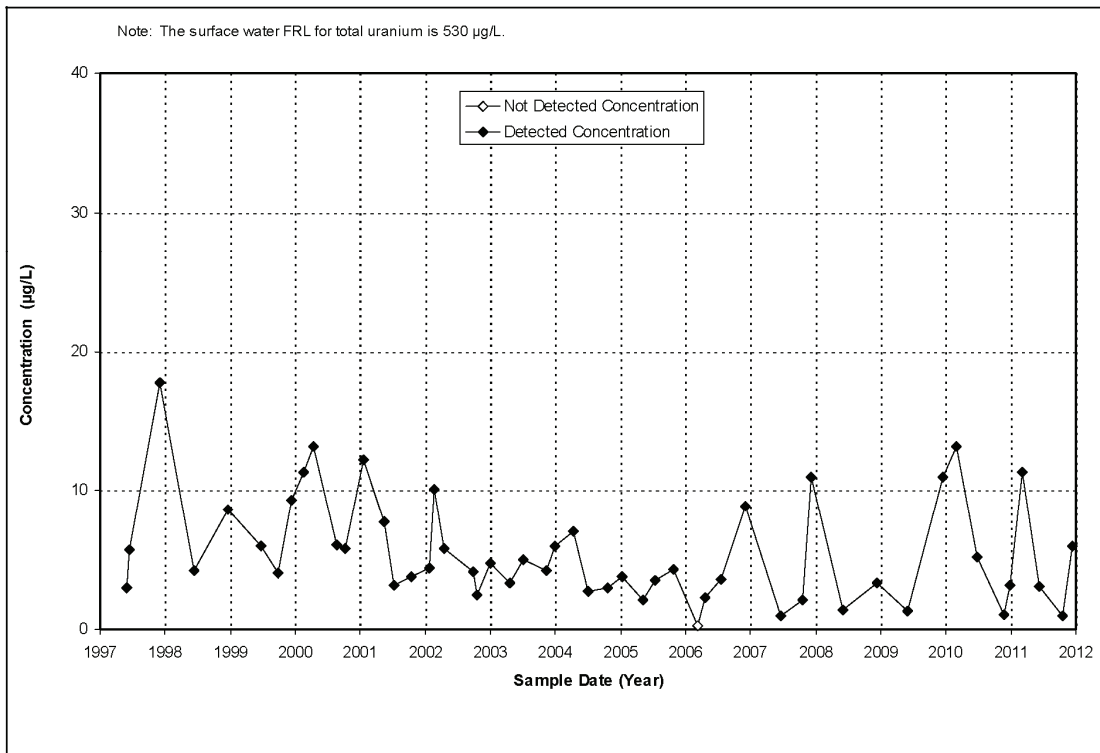


Figure B.1-16. Total Uranium Concentration vs. Time Plot for Location STRM 4004/4004A (Drainage to Paddys Run)

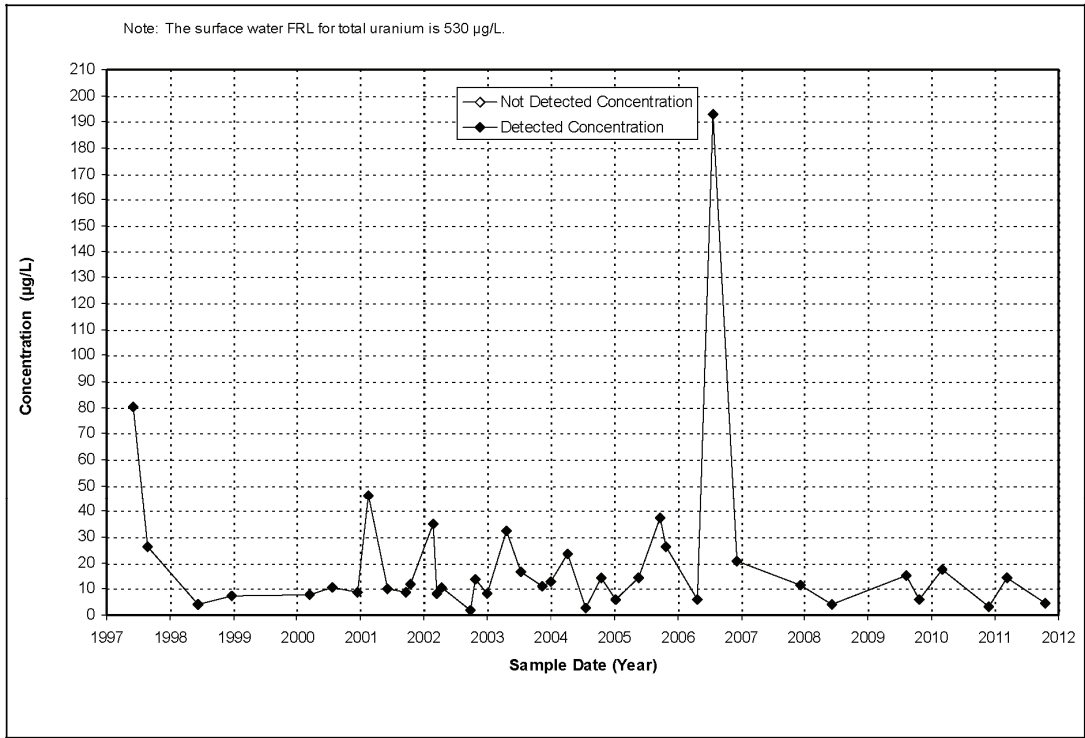


Figure B.1-17. Total Uranium Concentration vs. Time Plot for Location STRM 4006 (Drainage to Paddys Run)

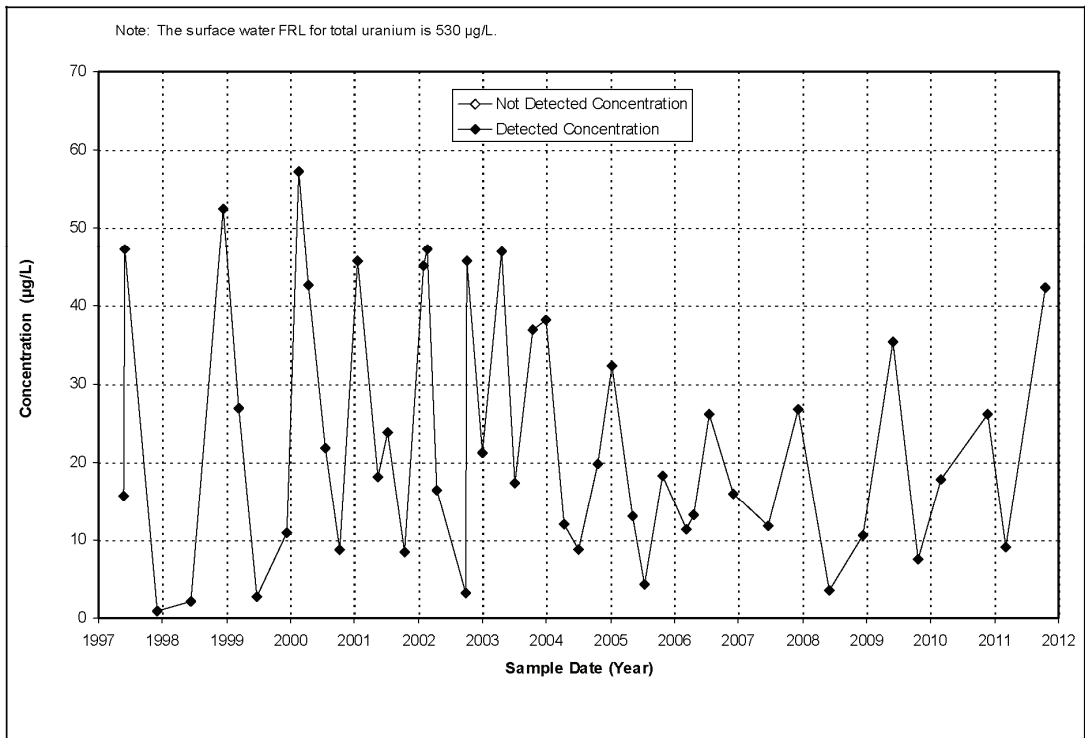


Figure B.1-18. Plot of Total Uranium Concentration versus Time for Location SWD-13 (Former Silos Area)

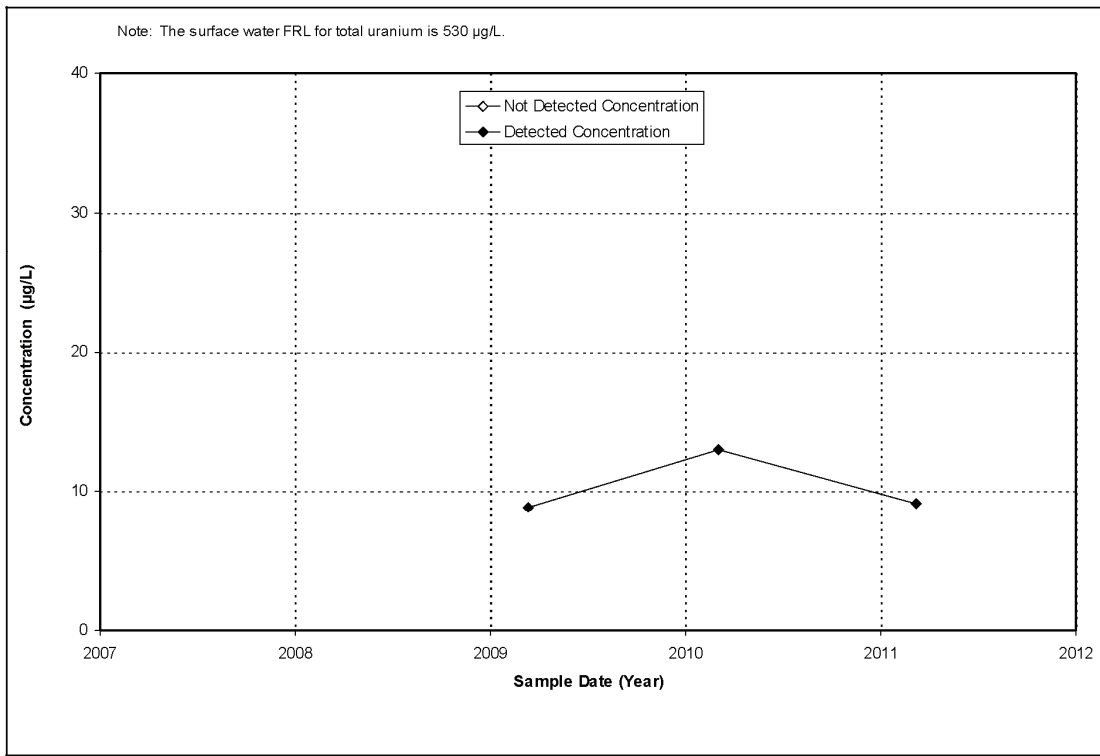


Figure B.1-19. Total Uranium Concentration vs. Time Plot for Location STRM 4003 (Drainage to Paddys Run)

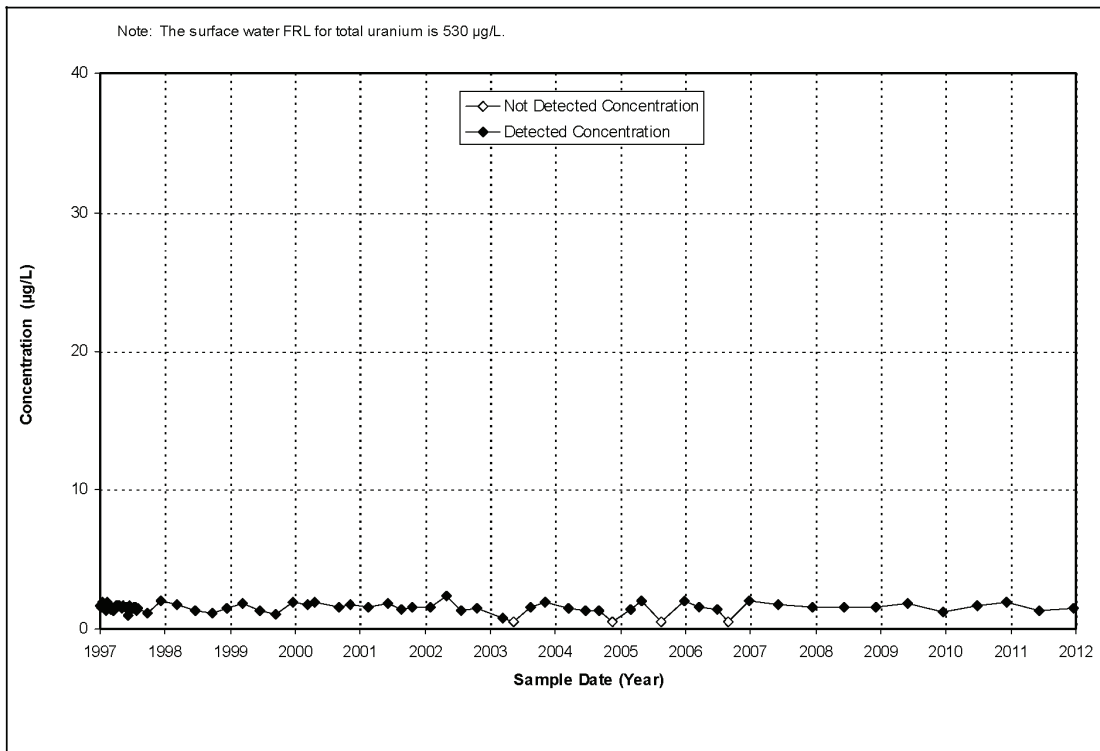


Figure B.1-20. Total Uranium Concentration vs. Time Plot for Location SWR-01 (Great Miami River Background)

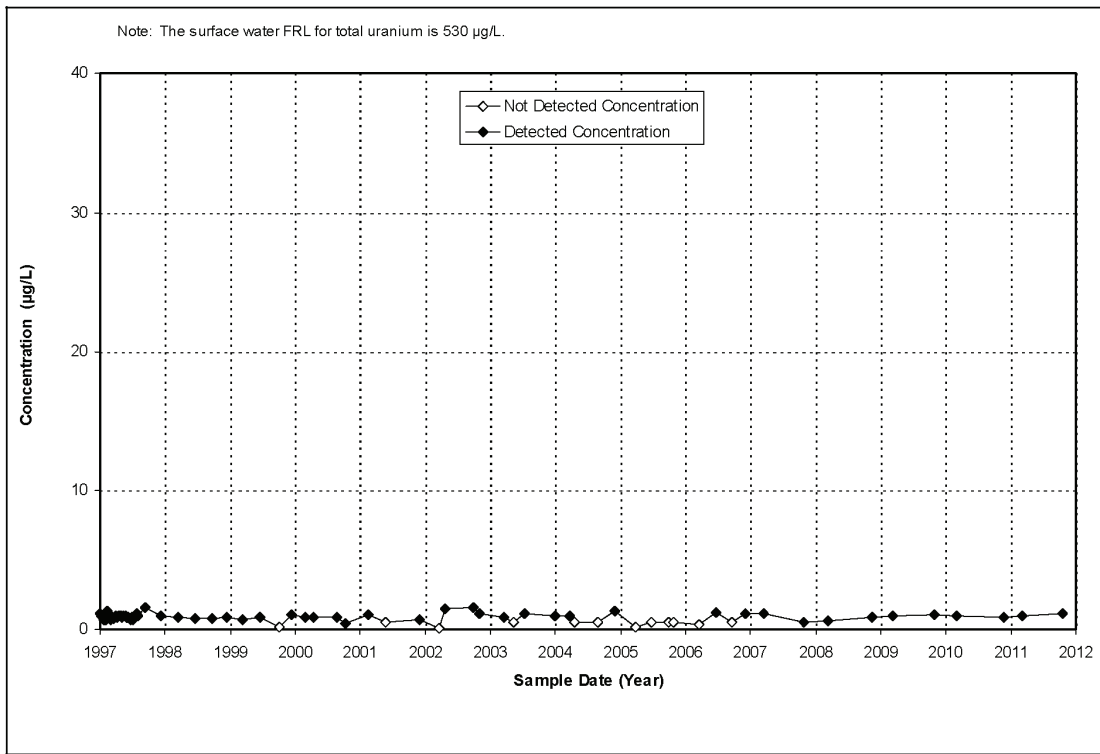


Figure B.1-21. Total Uranium Concentration vs. Time Plot for Location SWP-01 (Paddys Run Background)

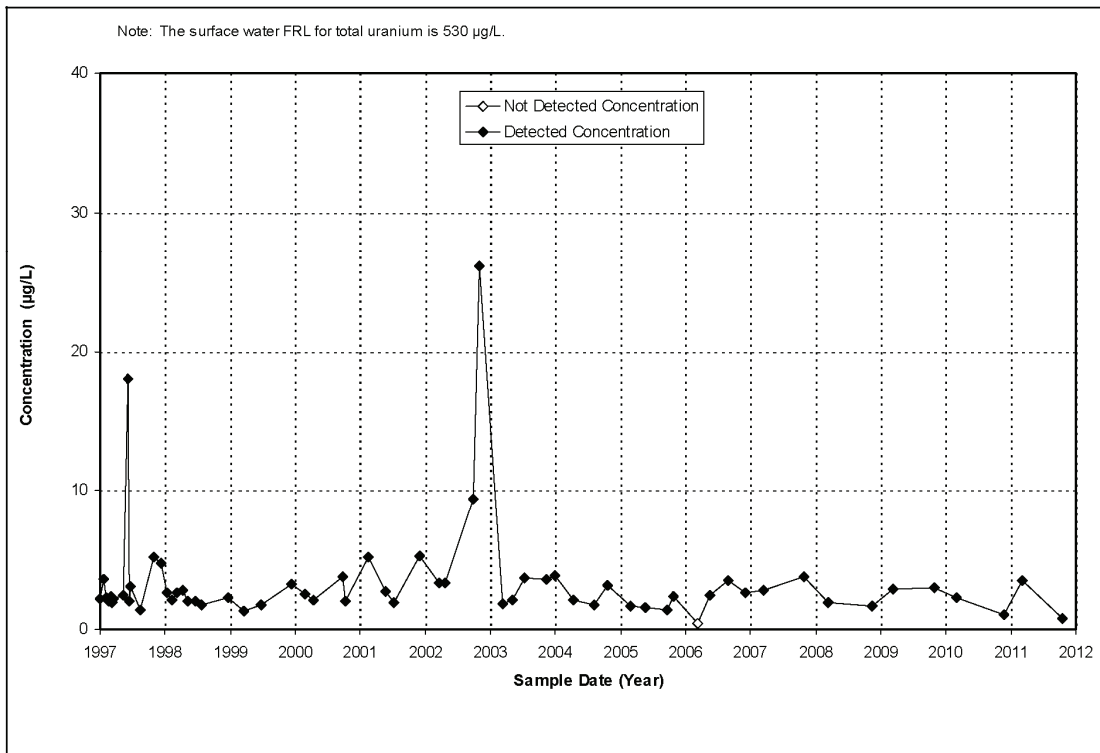


Figure B.1-22. Total Uranium Concentration vs. Time Plot for Location SWP-03 (Paddys Run at Downstream Property Boundary)

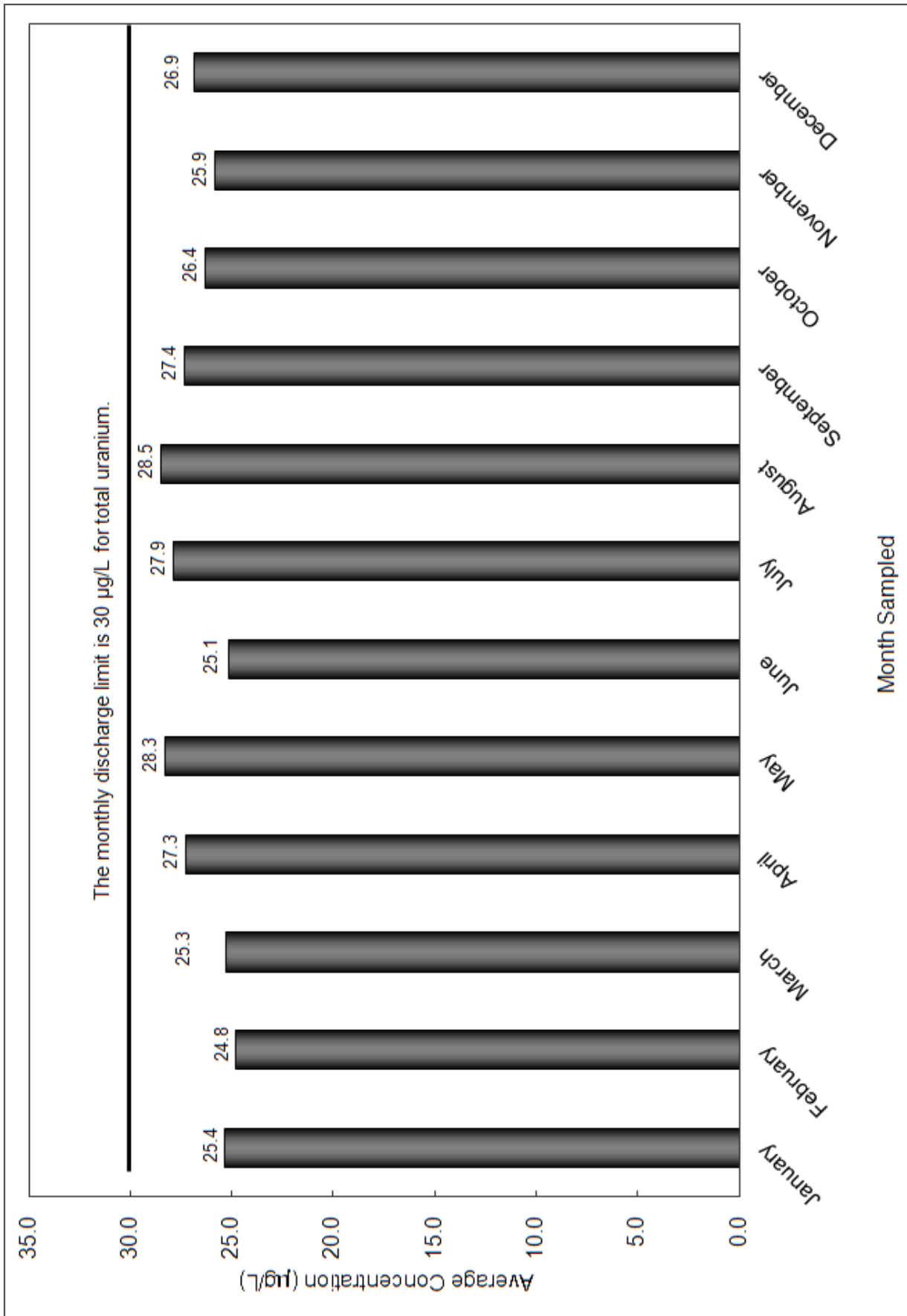


Figure B.1-23. 2011 Monthly Average Total Uranium Concentration in Water Discharged from PF 4001 to the Great Miami River

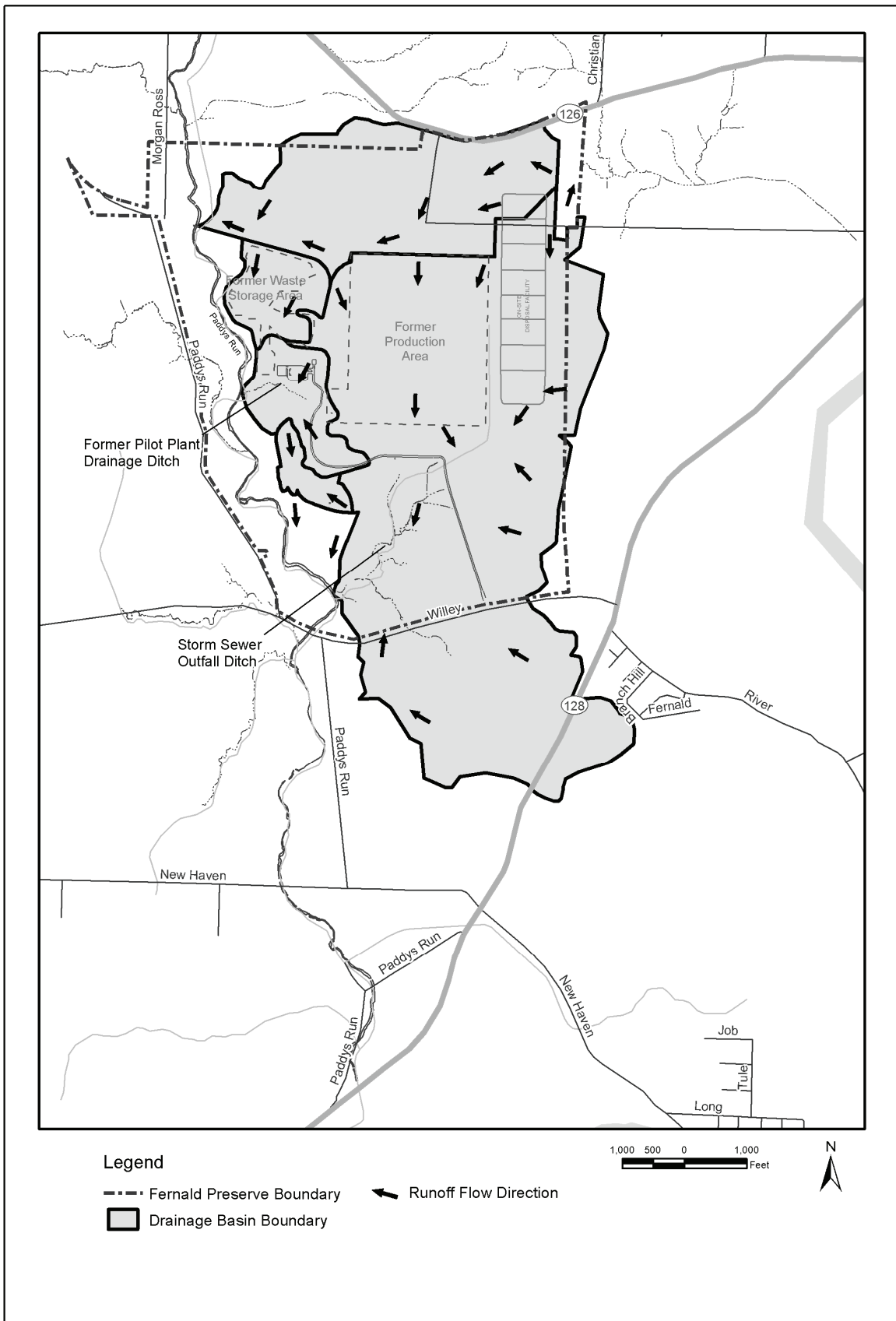


Figure B.1-24. Controlled Surface Water Areas and Uncontrolled Runoff Flow Directions

This page intentionally left blank