4.0 Surface Water and Treated Effluent Pathway

Results in Brief: 2002 Surface Water and Treated Effluent Pathway

Surveillance Monitoring - No surface water or treated effluent analytical results from samples collected in 2002 exceeded the surface water FRL for total uranium, the primary site contaminant. FRL exceedances that may be attributable to the Fernald site were limited to four constituents and three locations, while BTV exceedances that may be attributable to the Fernald site were limited to one constituent at one location. Occasional, sporadic FRL and BTV exceedances are to be expected until site remediation is complete.

Uranium Discharges - In 2002, 524 pounds (238 kg) of uranium were discharged in treated effluent to the Great Miami River. Approximately 127 pounds (58 kg) of uranium were released to the environment through uncontrolled storm water runoff. The estimated total pounds of uranium released through the surface water and treated effluent pathway (approximately 653 pounds [296 kg]) increased 38 percent from the 2001 estimate.

Sediment - The 2002 sediment results are within the range of historical concentrations. In addition, there were no FRL exceedances for any sediment result in 2002.

This chapter presents the 2002 monitoring activities and results for surface water, treated effluent, and sediment to determine the effects of remediation activities on the surface water pathway.

In general, low levels of contaminants enter the surface water pathway at the Fernald site by two primary mechanisms: treated effluent that is monitored as it is discharged to the Great Miami River, and uncontrolled runoff entering the site's drainages from areas with low levels of soil contamination. Because these discharges will continue throughout remediation, the surface water and sediment pathways will continue to be monitored. Effective use of the site's wastewater treatment capabilities, and implementation of runoff and sediment controls, minimize the site's impact on the surface water pathway.

4.1 Summary of Surface Water and Treated Effluent Pathway

To assist in the understanding of this chapter, the following key definitions are provided:

- **Controlled runoff** is contaminated storm water that is collected and, under normal circumstances, treated and discharged to the Great Miami River as treated effluent.
- **Uncontrolled runoff** is storm water that is not collected for treatment, but enters the site's natural drainages.
- **Treated effluent** is water from numerous sources at the site, which is treated through one of the site's wastewater treatment facilities, then discharged to the Great Miami River.
- **Surface water** is water that flows within natural drainage features.

The treated effluent pathway is comprised of those flows discharged to the Great Miami River via the Parshall Flume (PF 4001). Discharges through this point are considered under the control of wastewater operations. Under normal operation this combined flow is comprised of:

- Storm water runoff collected from the former production area and the waste pit area.
- Treated and untreated groundwater from the South Plume, South Field (Phase I), and Waste Storage Area Aquifer Restoration Modules.
- Treated remediation wastewater, such as on-site disposal facility leachate, decontamination rinse water generated during building decontamination and dismantling activities, and wastewater generated from pit dewatering and the operation of the Waste Pits Remedial Action Project dryer facility.
- Treated sanitary wastewater from the sewage treatment plant.

During periods of heavy and/or sequential rainfall events when the Storm Water Retention Basin is close to overflowing, untreated storm water is bypassed directly to the Great Miami River in order to minimize or prevent the Storm Water Retention Basin from overflowing into Paddys Run.

The volume and flow rate of uncontrolled runoff depends on the amount of precipitation within any given period of time. Figure 1-10 in Chapter 1 shows monthly precipitation totals for 2002. Figure 4-1 shows the site's natural drainage features and defines the areas from which runoff is either controlled or uncontrolled. The site's natural surface water drainages include several tributaries to Paddys Run (e.g., Pilot Plant Drainage Ditch and Storm Sewer Outfall Ditch) as well as the northeast drainage that flows to the Great Miami River. The arrows on Figure 4-1 indicate the general flow direction of uncontrolled runoff that is determined from the topography. Uncontrolled runoff from the Fernald site leaves the property via two drainage pathways, Paddys Run and the northeast drainage.

4.2 Remediation Activities Affecting Surface Water Pathway

Major remediation activities in 2002 that affected (or had the potential to affect) the surface water pathway include:

- Construction activities associated with the on-site disposal facility including excavation, screening, and hauling activities in the on-site disposal facility borrow area.
- Waste hauling and placement activities associated with the on-site disposal facility.
- Soil excavation activities conducted by the Soil and Disposal Facility Project (refer to Chapter 2).
- Activities associated with the Waste Pits Remedial Action Project including dryer operation, pit excavation and waste material handling, and railcar loading.
- Construction activities associated with the Accelerated Waste Retrieval; Radon Control System; and Silos 1 and 2, and Silo 3 Projects.

To minimize the effects of remediation on the environment, engineered and administrative controls are used at the Fernald site to reduce the amount of sediment entering the surface water drainages during rainfall events. As water flows over soil, contaminants typically move with the water either by being adsorbed to sediment eroded from the land surface or dissolved in the water itself. The chosen sediment control method varies based on the contaminants expected during excavation, the topography of the area, and the size and duration of the excavation.

Engineered sediment controls can include the construction of sedimentation basins (lined or unlined), silt fences, check dams, and permanent or temporary seeding. Diversion ditches are also constructed as an engineered control to divert clean water from upgradient areas away from areas of remediation. Ditches are sometimes lined with riprap (large rocks) and/or synthetic liners to control erosion. Administrative controls include limiting the duration of open excavations, as well as routinely inspecting each of the engineered controls used.

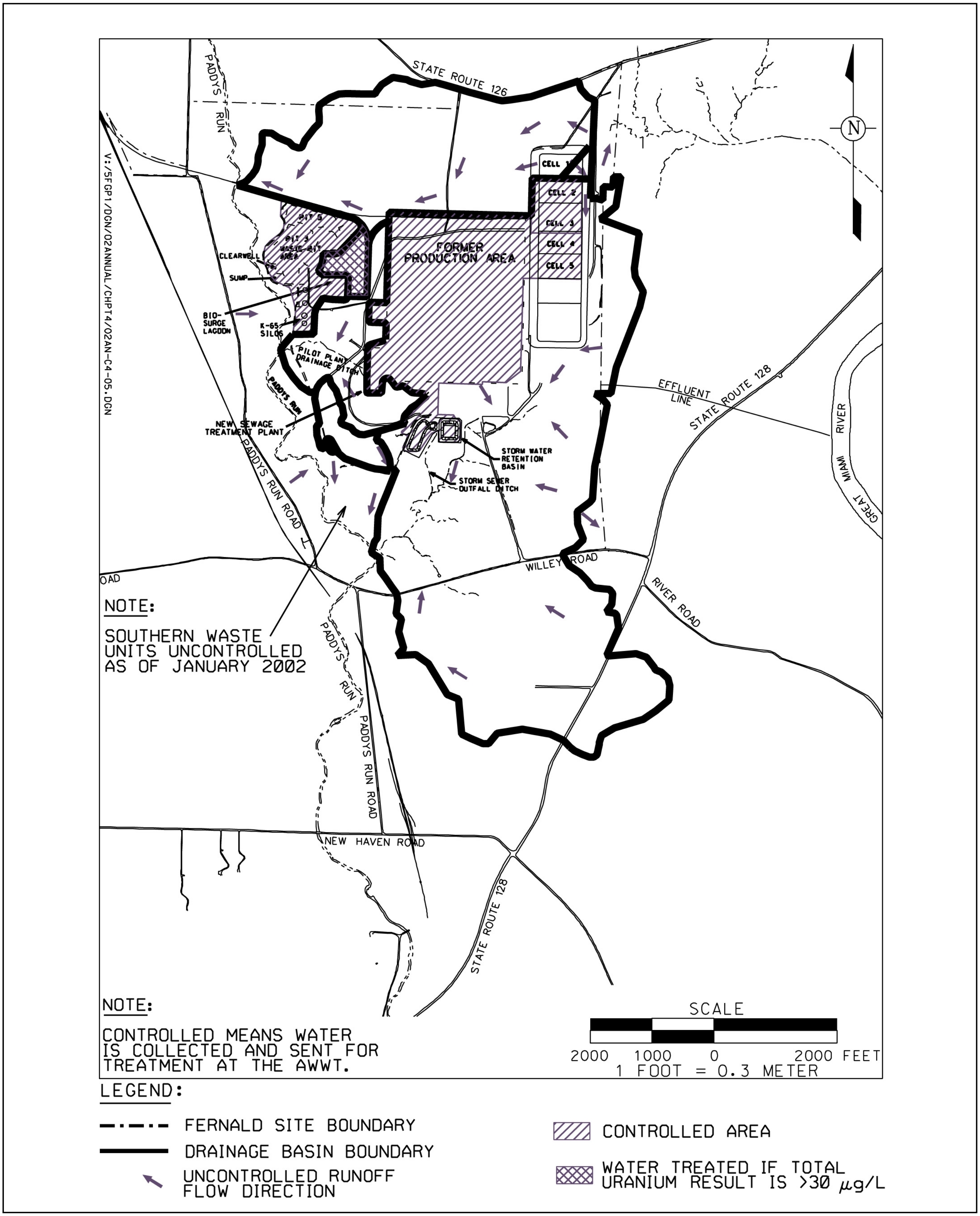

Figure 4-1. Controlled Surface Water Areas and Uncontrolled Runoff Flow Directions

Each remediation project is responsible for constructing and maintaining the engineered control structures required under their remedial design. All engineered sediment and surface water controls are inspected at least once a week, and within 24 hours of any rain event measuring greater than 0.5 inch (1.3 cm) of rain in a 24-hour period. Discharge points for uncontrolled runoff to Paddys Run are also inspected periodically to assess the effectiveness of upgradient controls in preventing significant impacts to Paddys Run. Minor maintenance activities (e.g., silt fencing repairs and reseeding of eroded areas) were performed in 2002 as a result of these inspections. Though no new storm water controls were installed in 2002, many engineered controls installed during previous years were still used and maintained.

4.3 Surface Water, Treated Effluent, and Sediment Monitoring Program for 2002

Surface water, treated effluent, and sediment are sampled to determine the effect of the Fernald site's remediation activities on the environment. Surface water is sampled at several locations in the site's drainages and analyzed for various radiological and non-radiological constituents. Treated effluent is sampled prior to discharge into the Great Miami River. Sediment is sampled for radiological constituents in the major site drainages (i.e., Paddys Run and Storm Sewer Outfall Ditch), and in the Great Miami River.

Following is a description of the key elements of the surface water and treated effluent program design:

- **Sampling** – Sample locations, frequency, and constituents were selected to address the requirements of the NPDES Permit, FFCA, and the Operable Unit 5 Record of Decision, and to provide a comprehensive assessment of surface water quality at 16 key locations including two background locations (refer to Figures 4-2 and 4-3). Surface water is monitored for up to 55 FRL constituents (refer to Table 2-2 in Chapter 2) and three BTV constituents (barium, cadmium, and silver).

- **Data Evaluation** – The integrated data evaluation process focuses on tracking and evaluating data compared with background and historical ranges, FRLs, BTVs, and NPDES limits. This information is used to assess impacts on surface water due to site remediation activities affecting uncontrolled runoff or treated effluent. The assessment also includes identifying the potential for impacts from surface water to the groundwater in the underlying Great Miami Aquifer. The ongoing data evaluation is designed to support remedial action decision-making by providing timely feedback to the remediation project organizations on the effectiveness of storm water runoff controls and treatment processes.

- **Reporting** – Surface water and treated effluent data are reported under the IEMP program and annual site environmental reports. Monthly discharge monitoring reports required by the NPDES Permit are submitted to OEPA.

The IEMP sediment monitoring program includes an annual sampling program with data reported through annual site environmental reports.

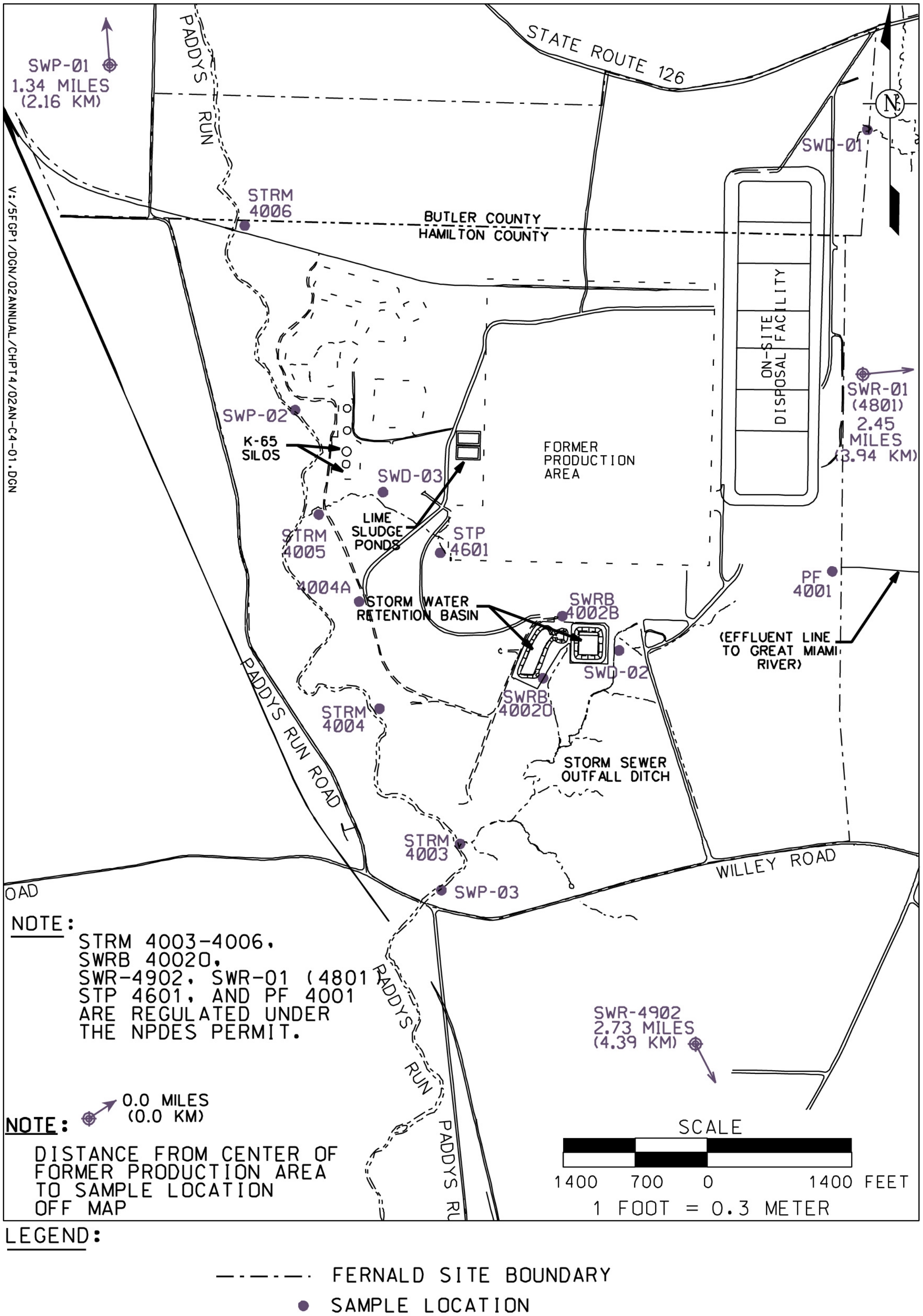

Figure 4-2. IEMP/NPDES Surface Water and Treated Effluent Sample Locations

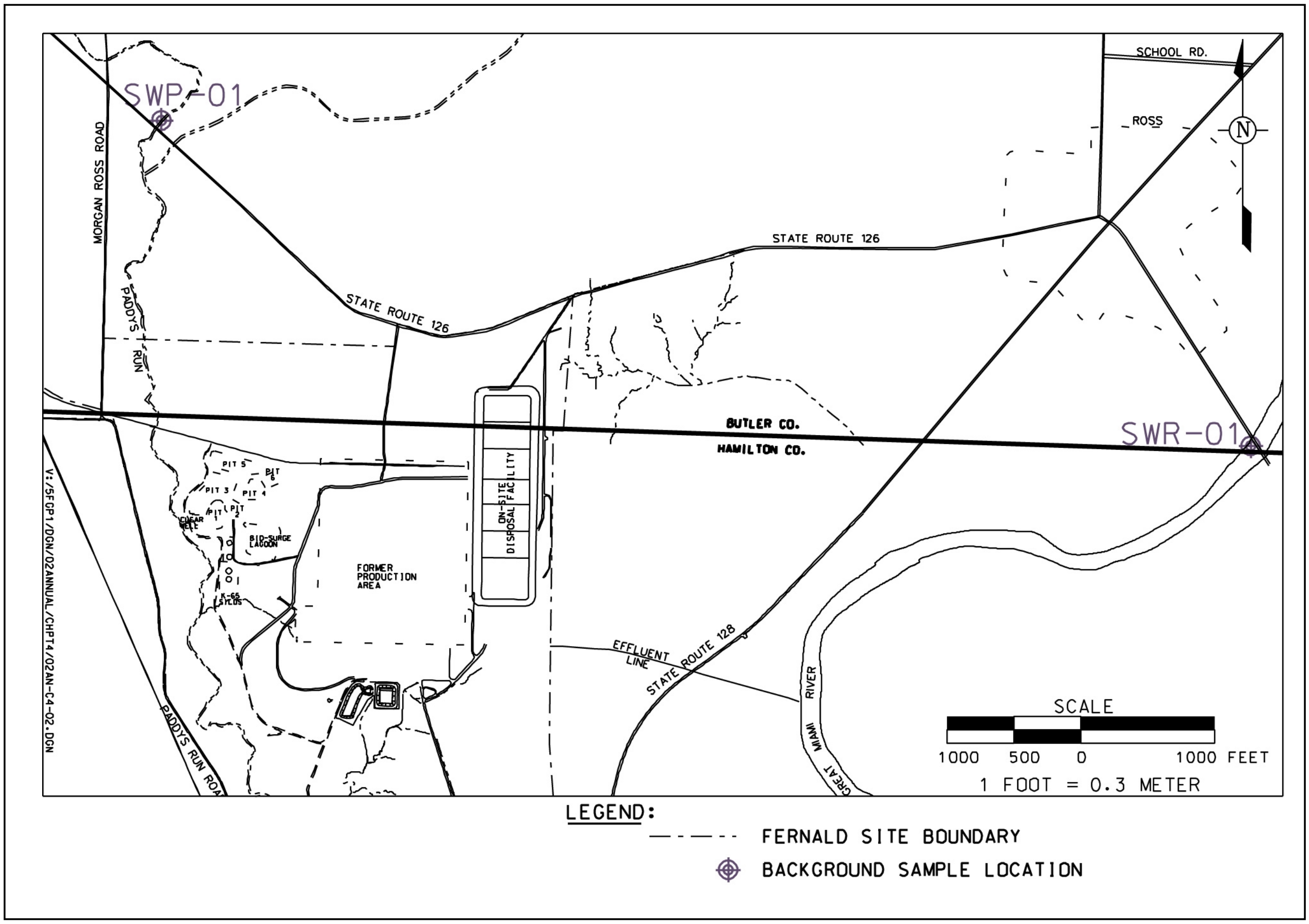

Figure 4-3. IEMP Background Surface Water Sample Locations

Data from samples collected under the IEMP are used to fulfill both surveillance and compliance monitoring functions. Surveillance monitoring results of the IEMP surface water and treated effluent program are used to assess the collective effectiveness of site storm water controls and wastewater treatment processes in preventing unacceptable impacts to the surface water and groundwater pathways. Compliance monitoring includes sampling at storm water and treated effluent discharge points into the surface water, and is conducted to comply with provisions in the NPDES Permit, the FFCA, and the Operable Unit 5 Record of Decision. The data are routinely evaluated to identify any unacceptable trends and to trigger corrective actions when needed to ensure protection of these critical environmental pathways. Figure 4-2 depicts IEMP/NPDES surface water and treated effluent sample locations, while Figure 4-3 shows IEMP background sample locations.

Treated effluent is discharged to the Great Miami River through the effluent line identified on Figure 4-1. Samples of the treated effluent are collected at the Parshall Flume (PF 4001). The resulting data are used to calculate the concentration of each FRL constituent after the effluent water mixes with the water in the Great Miami River.

4.3.1 Surveillance Monitoring

Data resulting from 2002 sampling efforts were evaluated to provide surveillance monitoring of remediation activities. This evaluation showed that during 2002, there were no exceedances of the surface water total uranium FRL (530 µg/L) detected in any of the surface water and treated effluent samples. There were four non-uranium constituents with FRL exceedances, and one constituent with a BTV exceedance. Table 4-1 summarizes these exceedances and Figure 4-4 identifies the locations of these exceedances.

There were two FRL exceedances in 2002 at location SWR-01, one for chromium and one for copper. There were no BTV exceedances at this location. In addition, there was one FRL exceedance at location SWP-01 for chromium. There were no BTV exceedances at this location. Locations SWR-01 and SWP-01 are background monitoring locations, and are situated upstream and outside the influence of Fernald site discharges. The background data are used to distinguish impacts from site activities against upstream water quality conditions. Therefore, concentrations at the background locations (Great Miami River [SWR-01] and Paddys Run [SWP-01]) are not attributable to the Fernald site.

TABLE 4-1
CONSTITUENTS WITH RESULTS ABOVE SURFACE WATER FRLs OR BTVs DURING 2002

Constituent	Number of Locations Exceeding FRL	Number of Locations Exceeding BTV[a]	Surface Water FRL	Surface Water BTV[a]	Range of 2002 Data above FRL[a]	Range of 2002 Data above BTV[a]
Inorganics			(mg/L)	(mg/L)	(mg/L)	(mg/L)
Cadmium	0	1	0.0098	0.0035	NA	0.0039[b]
Chromium	3	NA	0.010[c]	NA	0.0134 to 0.0267	NA
Copper	3	NA	0.012	NA	0.0134 to 0.0426	NA
Lead	1	NA	0.010	NA	0.0137	NA
Zinc	1	NA	0.11	NA	0.124	NA

[a]NA = not applicable
[b]The cadmium BTV exceedances in the Great Miami River for the Parshall Flume (PF 4001) occurred because the mixing equation uses the background number of 0.0098 mg/L, which is above the associated BTV.
[c]FRL based on hexavalent chromium, from Operable Unit 5 Record of Decision, Table 9-5; however, due to holding time considerations, total chromium is analyzed which is acceptable because total chromium provides a more conservative result.

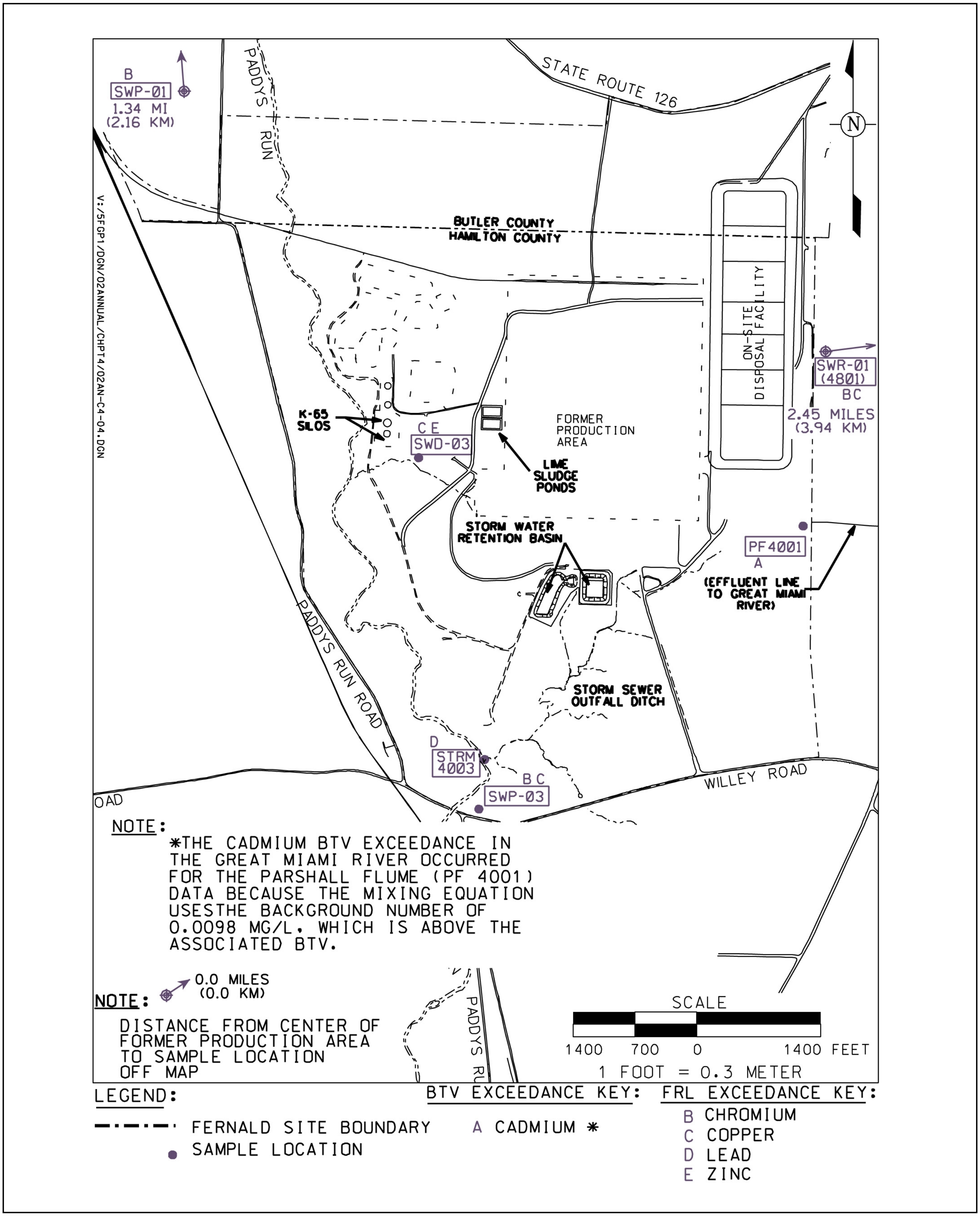

Figure 4-4. Constituents with 2002 Results Above FRLs or BTVs

The remaining FRL and BTV exceedances, which may be attributable to Fernald site activities, were sporadic in nature and do not indicate any significant impacts to the environment or operational problems with the Fernald site's storm water and sediment control systems. There were two FRL exceedances at location SWD-03, one for copper and one for zinc. There were also two FRL exceedances at location SWP-03, one for copper and one for chromium. There was one FRL exceedance for lead at STRM-4003. Finally, there was one exceedance of the cadmium BTV at the Parshall Flume (PF 4001), as discussed later in this chapter.

Even with the Fernald site's implementation of storm water and sediment controls, sporadic FRL and BTV exceedances can be expected to occur until final remediation of contaminated source areas (soils and sediments) are complete. A Mann-Kendall statistical test for trend was run for each 2002 FRL exceedance at each location where the exceedance occurred. No statistically significant trends were identified with the exception of chromium at location SWP-03 which has been determined to be "up significantly." The FRL and BTV exceedances will continue to be evaluated for persistence and increasing trends through the IEMP sampling program throughout remediation. This information will be used to provide feedback to the remediation projects on the collective effectiveness of their storm water and sediment controls. Additional details of the FRL and BTV exceedances are presented in Appendix B, Attachment 1, of this report.

The following two key sample locations represent points where surface water or treated effluent leaves the site:

- Paddys Run at the Willey Road property boundary (sample location SWP-03).

- Parshall Flume (PF 4001) located at the entry point of the effluent line leading to the Great Miami River.

Evaluation of the data from these locations is especially important because the locations represent points beyond which direct exposure to the public is possible.

There were two FRL exceedances at location SWP-03, one for copper and one for chromium. The SWP-03 sampling location measures the cumulative drainage from the several drainage basins from Fernald site property as well as drainage from areas north of the Fernald site. No specific activity has been identified as a causal event. However, it should be noted that the concentrations for these parameters at the background location were also elevated on the days the samples at SWP-03 were collected.

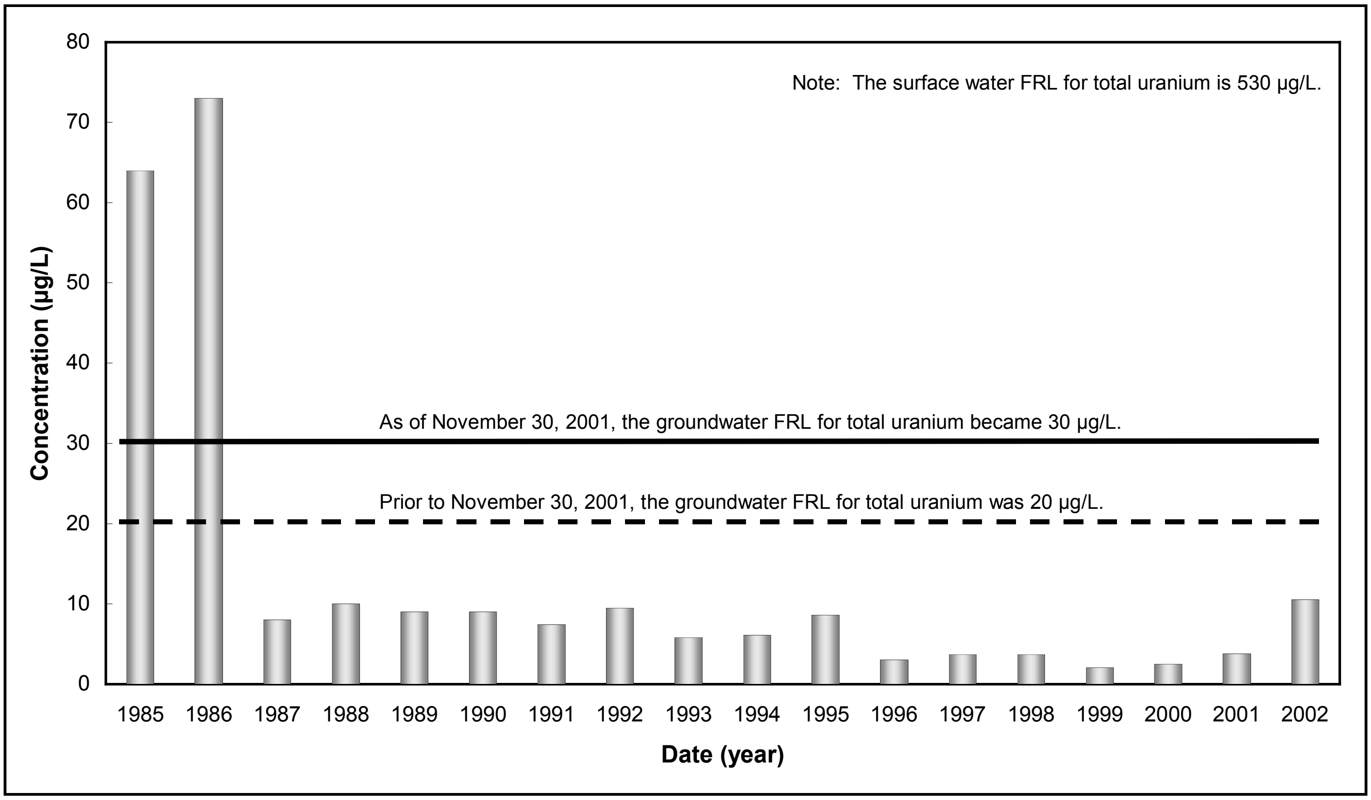

Figure 4-5. Annual Average Total Uranium Concentrations in Paddys Run at Willey Road (SWP-03) Sample Location, 1985-2002

The maximum total uranium concentration at SWP-03 during 2002 was 26.1 µg/L, which is below the surface water total uranium FRL of 530 µg/L. Figure 4-5 shows the annual average total uranium concentration in Paddys Run at Willey Road for the period 1985 through 2002. This figure illustrates the decrease of the total uranium concentration in Paddys Run from 1986 following completion of the Storm Water Retention Basin, which collects contaminated storm water from the former production area.

Samples collected at the Parshall Flume (PF 4001) are used in the surveillance evaluation because this is the last point where treated effluent is sampled prior to discharge to the Great Miami River. Data collected from this location cannot directly be compared to the surface water FRL without considering the effect of the effluent waters mixing with the Great Miami River. This is done through the use of a mixing equation. After applying the mixing equation, there were no FRL exceedances at the Parshall Flume (PF 4001) but there was one BTV exceedance, for cadmium, as mentioned above. The FRL for cadmium is based on the background number of 0.0098 mg/L (milligrams per liter), and the BTV is 0.0035 mg/L, which is lower than the FRL. The cadmium BTV exceedance in the Great Miami River occurred after using the mixing equation (from the Parshall Flume [PF 4001] data), but note that the mixing equation uses the background number which is above the associated BTV.

There were no surface water FRL exceedances for uranium in the Great Miami River outside the Fernald site mixing zone during 2002. The maximum daily total uranium concentration at the Parshall Flume (PF 4001) prior to discharge through the effluent line to the Great Miami River was 114.1 µg/L. After the water from the Parshall Flume (PF 4001) mixed with the water in the Great Miami River, the concentration would have been approximately 3.21µg/L. Both concentrations, those from the Parshall Flume (PF 4001) and after mixing with the Great Miami River, were well below the surface water total uranium FRL of 530 µg/L. Contaminant concentrations observed at the Parshall Flume (PF 4001) in 2002 are further discussed in the compliance monitoring section.

Evaluation of surface water data is also performed in order to provide an ongoing assessment of the potential for cross-media impacts from surface water to the underlying Great Miami Aquifer. In areas where there is no glacial overburden, a direct pathway exists for contaminants to reach the aquifer. This contaminant pathway to the aquifer was considered in the design of the groundwater remedy, and includes placing groundwater extraction wells downgradient of these areas where direct infiltration occurs in order to mitigate any potential cross-media impacts during surface remediation. To provide this assessment, sample locations were selected to evaluate contaminant concentrations in surface water just upstream of, or within, those areas where site drainages have eroded through the protective glacial overburden. This includes locations SWP-02, SWD-02, SWD-03, STRM 4005, and the Storm Water Retention Basin overflow (SWRB 4002O).

During 2002, three of the five surface water locations were evaluated (STRM 4005, SWRB-4002O, and SWD-03) had results that exceeded the total uranium groundwater FRL of 30 µg/L. Table 4-2 summarizes the total uranium cross-media exceedances. Of the locations evaluated, only SWD-03 had results that exceeded the groundwater FRL for a constituent other than uranium. The SWD-03 zinc results of 0.0297 and 0.124 mg/L exceeded the respective groundwater FRL of 0.021 mg/L.

TABLE 4-2
SURFACE WATER TOTAL URANIUM RESULTS EXCEEDING THE GROUNDWATER FRL AT CROSS-MEDIA IMPACT LOCATIONS DURING 2002

Location	Number of Surface Water Results Exceeding the Groundwater FRL for Total Uranium[a]	Total Number of Samples	Range of 2002 Data above FRL (µg/L)
STRM 4005	5	5	34 – 365.5
SWD-03	3	4	42.6 – 55.8
SWRB-4002O	1	1	291.4

[a]The surface water result is compared to the groundwater FRL of 30 µg/L for the purpose of evaluating potential cross-media impacts.

Under the IEMP, both surface water and groundwater data from monitoring wells will continue to be collected at these sensitive areas under the IEMP to address the cross-media concern. Additional details concerning the cross-media impacts are presented in Appendix B, Attachment 1, of this report.

4.3.2 Compliance Monitoring

4.3.2.1 FFCA and Operable Unit 5 Record of Decision Compliance

The FCP is required to monitor treated effluent discharges at the Parshall Flume (PF 4001) for total uranium mass discharges and total uranium concentrations. This requirement is identified in the July 1986 FFCA and the Operable Unit 5 Record of Decision. The Operable Unit 5 Record of Decision requires treatment of effluent so that the mass of total uranium discharged to the Great Miami River through the Parshall Flume (PF 4001) does not exceed 600 pounds (272 kg) per year. The Operable Unit 5 Record of Decision and subsequent approval of the Explanation of Significant Differences also require that the monthly average total uranium concentration in the effluent must be at or below 30 µg/L.

The Operable Unit 5 Record of Decision allows the Fernald site to discharge water from the Storm Water Retention Basin directly to the Great Miami River during periods of heavy precipitation. This is allowed in order to reduce the possibility of an overflow condition for the Storm Water Retention Basin. An overflow condition has the potential to generate cross-media impacts as described above. To comply with the monthly average total uranium concentration limit during these types of bypasses, the FCP is allowed to deduct these uranium concentrations from the monthly average total uranium calculation at the Parshall Flume (PF 4001) for up to 10 significant precipitation bypass days per year. However, the mass of total uranium discharged during these 10 days per year is still considered in the total discharge mass in order to ensure the 600 pound (272 kg) per year discharge limit is not exceeded.

In addition to significant precipitation-related bypasses, the site is also allowed to bypass water from the Storm Water Retention Basin during certain scheduled wastewater treatment plant maintenance activities. These maintenance bypasses must be pre-approved by the regulatory agencies. The total uranium concentration in the discharge related to maintenance activities may be deducted from the monthly average calculation demonstrating compliance with the total uranium monthly average concentration limit. However, the mass of total uranium discharged during these maintenance bypasses is still considered in the total discharge mass to ensure the discharge limit of 600 pounds (272 kg) per year is not exceeded.

During 2002 there were three bypass events as a result of significant precipitation, and one bypass event for maintenance activities. Table 4-3 summarizes these Storm Water Retention Basin treatment bypass events during 2002. Figure 4-6 shows that the cumulative mass of total uranium discharged to the Great Miami River during 2002 was 523.75 pounds (237.8 kg), which is below the 600 pound (272 kg) annual discharge limit. Figure 4-7 shows that the total uranium monthly average concentration limit was met every month during 2002. As indicated on Figure 4-7, during the fourth quarter of 2002 the monthly average uranium concentration in treated effluent approached the limit of 30 µg/L. A combination of above-normal precipitation and high concentrations of total dissolved solids in the influent to the advanced wastewater treatment facility (Phase II) system reduced the uranium removal efficiency of that system. This resulted in much higher than normal uranium concentrations in the effluent from the Phase II system. Pumping rates of groundwater restoration wells were reduced and shutdown of groundwater re-injection was required to compensate for the high uranium concentrations from the advanced wastewater treatment facility (Phase II) system. This compensation was required to maintain compliance with the 30 µg/L monthly average uranium discharge limit.

TABLE 4-3
2002 SIGNIFICANT PRECIPITATION AND TREATMENT PLANT MAINTENANCE BYPASS EVENTS

Event	Duration (hours)	Number of Bypass Days[a]	Cumulative Number of Bypass Days	Total Uranium Discharge (pounds)	Total Water Discharged (millions of gallons)
Significant Precipitation Bypasses				(to Great Miami River)	(to Great Miami River)
May 9	14.5	1	1	2.49	0.422
May 13 through May 15	57	2	3	14.86	3.126
September 27 through September 29	66.75	3	6	6.45	3.759
Treatment Plant Maintenance Bypasses[b]					
July 4 through July 7	96	4	4	7.68	23.589

[a]Days are counted according to the definition provided in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Project.
[b]Typically during planned maintenance outages, pumping and treatment systems are taken off-line in stages and returned to service in stages. There were portions of all four days where pumping and/or treatment systems were off-line due to a major electrical outage for the Silos Project in support of office trailer relocation and to allow relocation of a power pole in preparation for the Silos 1 and 2 rail upgrade (EPA and OEPA were notified in advance of this scheduled outage). The information is provided for these four days in total.

Appendix B, Attachment 1, of this report provides more detail on the bypass days deleted from the monthly average calculation to determine compliance with the monthly average total uranium concentration limit.

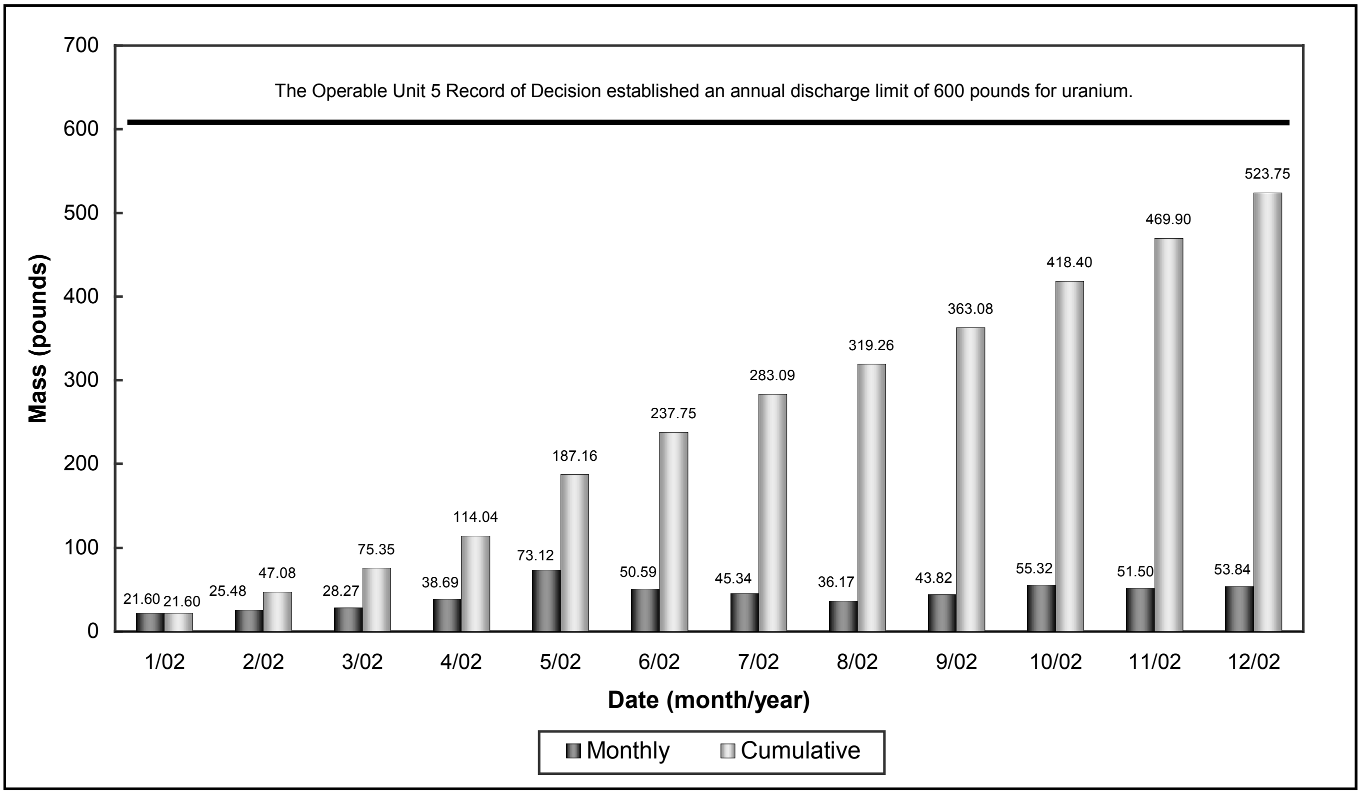

Figure 4-6. Pounds of Uranium Discharged to the Great Miami River from the Parshall Flume (PF 4001) in 2002

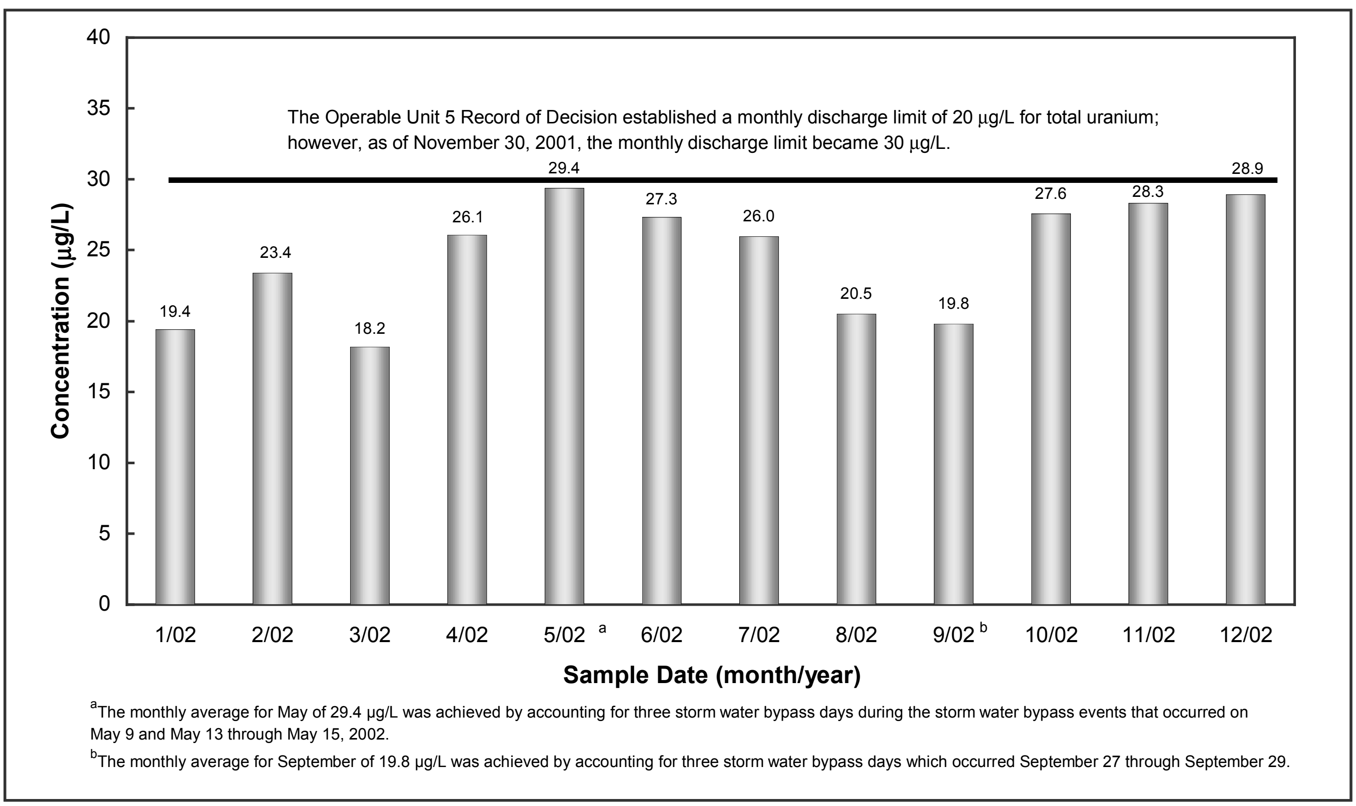

Figure 4-7. 2002 Monthly Average Total Uranium Concentration in Water Discharged from the Parshall Flume (PF 4001) to the Great Miami River

4.3.2.2 NPDES Permit Compliance

Compliance sampling, consisting of sampling for non-radiological pollutants from uncontrolled runoff and treated effluent discharges from the Fernald site, is regulated under the state-administrated NPDES program. The current permit became effective on March 1, 2000, and expired on October 31, 2002. An NPDES Permit Renewal Application was submitted to OEPA on April 30, 2002, which allows the FCP to continue to discharge under the expired permit until a new permit is issued. The permit specifies discharge and sample requirements, as well as discharge limits for several constituents. Figure 4-2 identifies NPDES sample locations.

During 2002 wastewater and uncontrolled runoff discharges from the Fernald site were in compliance with the NPDES Permit requirements in well over 99 percent of the samples collected. A total of three noncompliances were reported to OEPA pursuant to the terms of the NPDES Permit, as summarized in Table 4-4.

TABLE 4-4

EXCEEDANCES OF THE NPDES PERMIT DURING 2002

Date/ Month	Location	Parameter	Permit Limit	Actual Result	Possible Cause	Corrective Action
5/6	PF 4001 (Parshall Flume Treated Effluent)	Oil and Grease	105 kg/d	142.2 kg/d	Unknown	None. Continue to monitor and observe.
9/27	PF 4001 (Parshall Flume Treated Effluent)	Total Suspended Solids	473 kg/d	549.7 kg/d	Storm Water Bypass	None. Continue to monitor and observe.
9/27	SWRB 4002O (Storm Water Retention Basin Overflow)	Total Suspended Solids	50 mg/L	139.6 mg/L	Storm Water Bypass	None. Continue to monitor and observe.

4.3.3 Uranium Discharges in Surface Water and Treated Effluent

As identified in Figure 4-6, 523.75 pounds (237.8 kg) of uranium in treated effluent were discharged to the Great Miami River through the Parshall Flume (PF 4001) in 2002. In addition to the treated effluent, uncontrolled runoff is also contributing to the amount of uranium entering the environment. Figure 4-8 presents the pounds of uranium from the uncontrolled runoff and controlled discharges from 1993 through 2002.

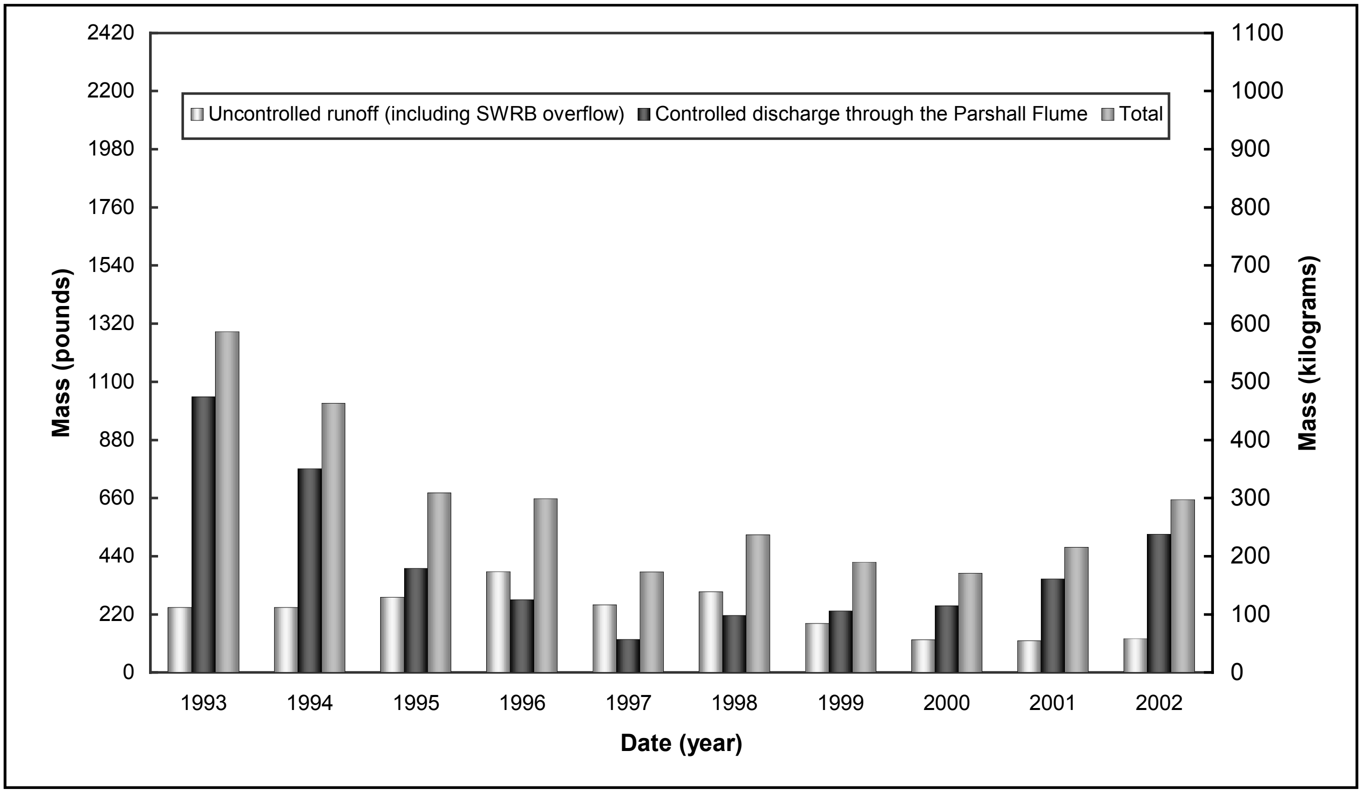

Figure 4-8. Uranium Discharged Via the Surface Water Pathway, 1993-2002

Beginning in 1999, estimates of uncontrolled runoff have been calculated using a loading term of 2.6 pounds (1.2 kg) of uranium discharged to Paddys Run for every inch (2.54 cm) of rainfall. This term was revised in 1999 based on analytical data reflecting the decreasing total uranium concentrations measured at points discharging to Paddys Run. Total uranium concentrations have been decreasing due to significant improvements in the capture of contaminated storm water by the Pilot Plant Drainage Sump, southern waste unit source removal, and excavation and placement of contaminated soils into the on-site disposal facility.

During 2002, 48.96 inches (124.4 cm) of precipitation fell at the Fernald site; therefore, an estimated 127.3 pounds (57.8 kg) of uranium entered the environment through uncontrolled runoff.

The estimated total amount of uranium discharged to the surface water pathway for the year, including both controlled treated effluent discharges and uncontrolled runoff, was approximately 653.29 pounds (296.6 kg).

4.4 Sediment Monitoring

Sediment is a secondary exposure pathway and is monitored annually to assess the impact of remediation activities on sediments deposited along surface water drainages. Sediment is collected at strategic locations to ensure that the most recently deposited sediment is collected.

Sediment samples were collected in August 2002 at 16 locations along Paddys Run, the Storm Sewer Outfall Ditch, and the Great Miami River (refer to Figure 4-9). All of these samples were analyzed for total uranium. Samples collected from the Storm Sewer Outfall Ditch, Paddys Run (north and south of the outfall ditch), the Storm Sewer Outfall Ditch south of the outfall ditch (one sample point at PS-1), and the Paddys Run background location, were also analyzed for radium-226, radium-228, thorium-228, thorium-230, and thorium-232.

Figure 4-9 illustrates specific sediment sample locations, summarized as follows:

- Storm Sewer Outfall Ditch - five samples collected along the Storm Sewer Outfall Ditch from its confluence with Paddys Run to immediately south of the Storm Water Retention Basin (D1 through D5).

- Paddys Run - five samples collected upstream (north) of the confluence with the Storm Sewer Outfall Ditch (PN1 through PN5), three samples collected down stream (south) of the confluence (PS1 through PS3), and one background sample collected upgradient (north) of the site (P1).

- Great Miami River - one sample collected north of the effluent line (background location, G2) and one sample collected south of the effluent line (G4).

Table 4-5 presents analytical results of samples collected from the Storm Sewer Outfall Ditch, Paddys Run, and the Great Miami River in 2002. All results for all constituents were below the respective sediment FRL and consistent with data collected in previous years.

Until final certification of the site's drainage ways, monitoring of sediment will continue under the IEMP to determine the effectiveness of the engineered controls designed to reduce erosion from the Fernald site, and sedimentation of Paddys Run and its tributaries. Appendix B, Attachment 2, of this report contains additional details of the sediment monitoring results.

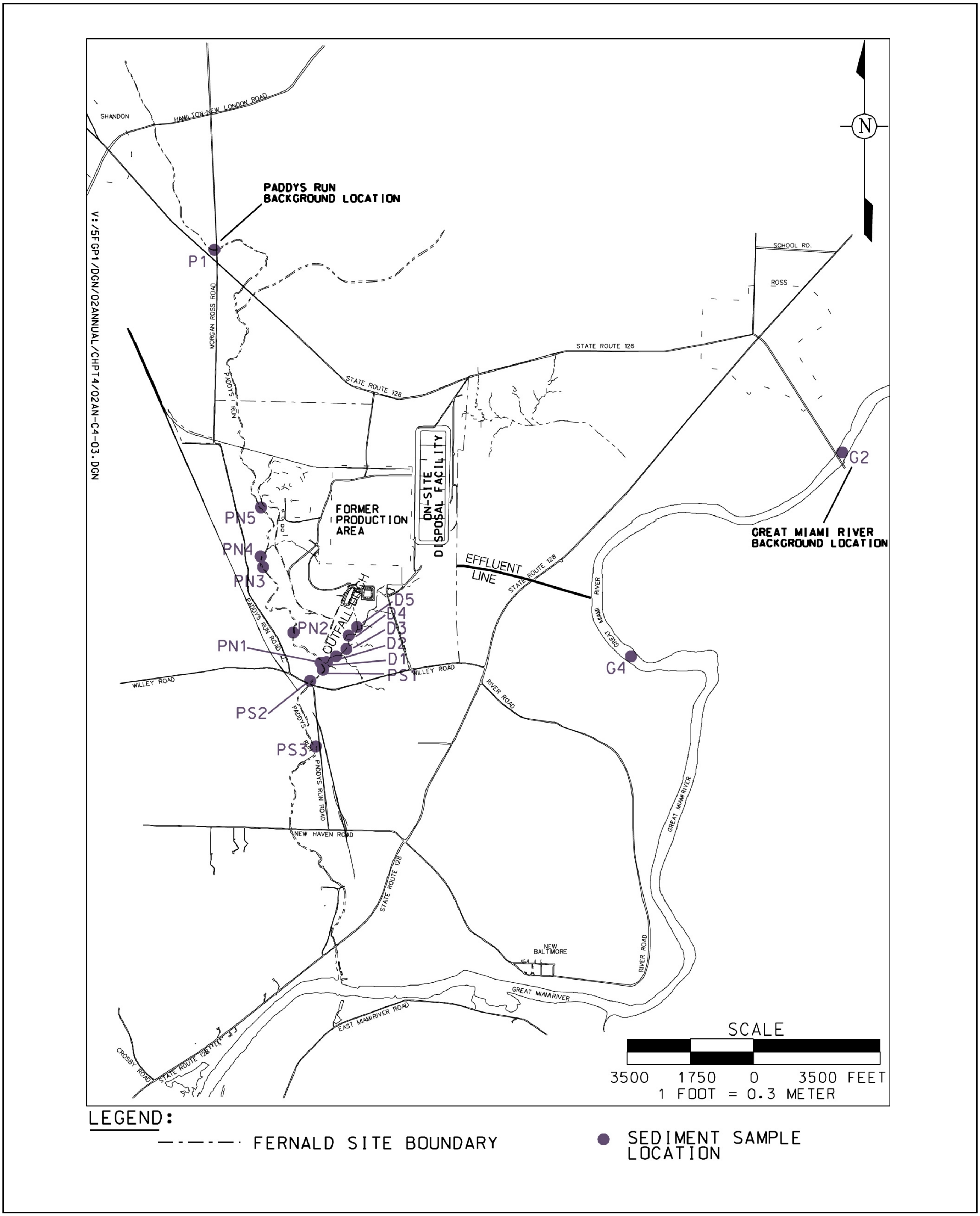

Figure 4-9. 2002 Sediment Sample Locations

TABLE 4-5

2002 SUMMARY STATISTICS FOR SEDIMENT MONITORING PROGRAM

			2002 Results - Concentration (dry weight)					
		No. of	Minimum[a,b,c,d]		Maximum[a,b,c]		Average[a,b,c,d]	
Radionuclide	Sediment FRL	Samples[a]	pCi/g	(mg/kg)	pCi/g	(mg/kg)	pCi/g	(mg/kg)
Great Miami River, North of the Effluent Line (G2)								
Total Uranium	210 mg/kg	1	1.52	(2.25)	NA	NA	NA	NA
Great Miami River, South of the Effluent Line (G4)								
Total Uranium	210 mg/kg	1	1.24	(1.84)	NA	NA	NA	NA
Paddys Run Background, North of S.R. 126 (P1)								
Radium-226	2.9 pCi/g	1	0.441	NA	NA	NA	NA	NA
Radium-228	4.8 pCi/g	1	0.537	NA	NA	NA	NA	NA
Thorium-228	3.2 pCi/g	1	0.400	NA	NA	NA	NA	NA
Thorium-230	18,000 pCi/g	1	0.757	NA	NA	NA	NA	NA
Thorium-232	1.6 pCi/g	1	0.362	NA	NA	NA	NA	NA
Total Uranium	210 mg/kg	1	0.703	(1.04)	NA	NA	NA	NA
Paddys Run, North of the Storm Sewer Outfall Ditch (PN1-PN5)								
Radium-226	2.9 pCi/g	5	0.407	NA	0.607	NA	0.5396	NA
Radium-228	4.8 pCi/g	5	0.313	NA	0.503	NA	0.4246	NA
Thorium-228	3.2 pCi/g	5	0.164	NA	0.665	NA	0.4008	NA
Thorium-230	18,000 pCi/g	5	0.785	NA	1.29	NA	0.954	NA
Thorium-232	1.6 pCi/g	5	0.251	NA	0.503	NA	0.3752	NA
Total Uranium	210 mg/kg	5	0.953	(1.41)	2.86	(4.24)	1.462	(2.164)
Storm Sewer Outfall Ditch (D1-D5)								
Radium-226	2.9 pCi/g	5	0.492	NA	0.894	NA	0.6782	NA
Radium-228	4.8 pCi/g	5	0.308	NA	0.703	NA	0.567	NA
Thorium-228	3.2 pCi/g	5	0.1475	NA	1.28	NA	0.6731	NA
Thorium-230	18,000 pCi/g	5	0.777	NA	1.85	NA	1.124	NA
Thorium-232	1.6 pCi/g	5	0.215	NA	1.59	NA	0.6112	NA
Total Uranium	210 mg/kg	5	1.493	(2.21)	17.4	(25.7)	5.12	(7.578)
Paddys Run, South of the Storm Sewer Outfall Ditch (PS1-PS3)								
Radium-226	2.9 pCi/g	1	0.648	NA	NA	NA	NA	NA
Radium-228	4.8 pCi/g	1	0.456	NA	NA	NA	NA	NA
Thorium-228	3.2 pCi/g	1	0.400	NA	NA	NA	NA	NA
Thorium-230	18,000 pCi/g	1	0.859	NA	NA	NA	NA	NA
Thorium-232	1.6 pCi/g	1	0.360	NA	NA	NA	NA	NA
Total Uranium	210 mg/kg	3	0.689	(1.02)	1.01	(1.49)	0.831	(1.23)

[a]If more than one sample is collected per sample location (e.g., split or duplicate), 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, and average).
[b]If the number of samples is greater than or equal to three, then the minimum, maximum, and average are reported. If the number of samples is equal to two, then the minimum and maximum are reported. If the number of samples is equal to one, then the result is reported as the minimum.
[c]NA = not applicable
[d]Where concentrations are below the detection limit, each result used in the summary statistics is set at half the detection limit.