

## 4.0 Surface Water and Treated Effluent Pathway

### Results in Brief: 2003 Surface Water and Treated Effluent Pathway

**Surveillance Monitoring** — No surface water or treated effluent analytical results from samples collected in 2003 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 one constituent and one location, while benchmark toxicity value (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 2003, 562 pounds (255 kg) of uranium were discharged in treated effluent to the Great Miami River. Approximately 118 pounds (54 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 681 pounds [308.7 kg]) increased 4.3 percent from the 2002 estimate.

**Sediment** — There were no FRL exceedances for any sediment result in 2003.

This chapter presents the 2003 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, 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 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 2003. 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 2003 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 Project including dryer operation, pit excavation and waste material handling, and railcar loading
- Construction activities associated with the Accelerated Waste Retrieval; RCS; 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.

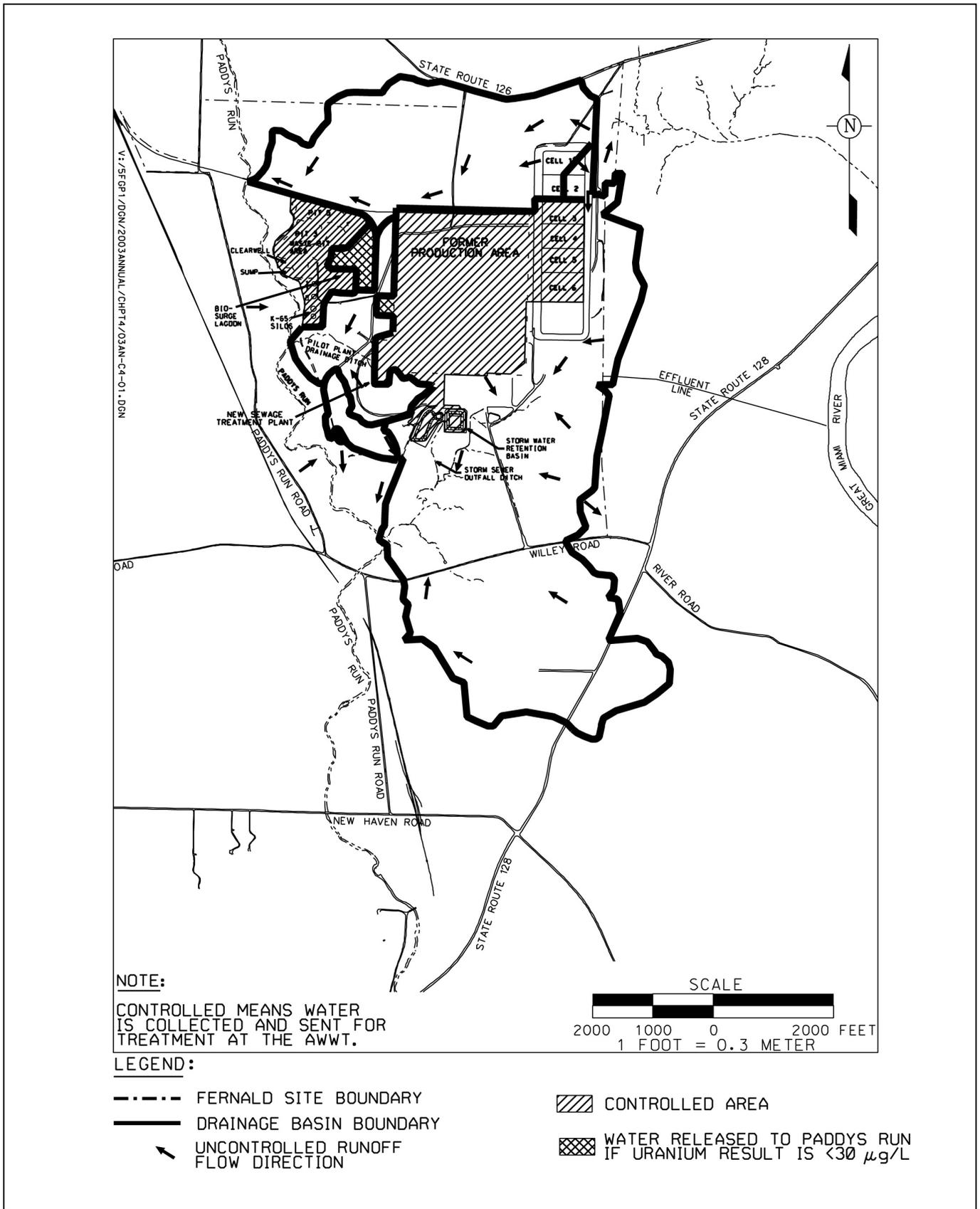


Figure 4-1. Controlled Surface Water Areas and Uncontrolled Runoff Flow Directions

Each remediation project is responsible for constructing and maintaining the engineered control structures required under its 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 reseeded of eroded areas) were performed in 2003 as a result of these inspections. Though no new storm water controls were installed in 2003, many engineered controls installed during previous years were still used and maintained.

### 4.3 Surface Water, Treated Effluent, and Sediment Monitoring Program for 2003

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, FFCRA, 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 2-1 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.

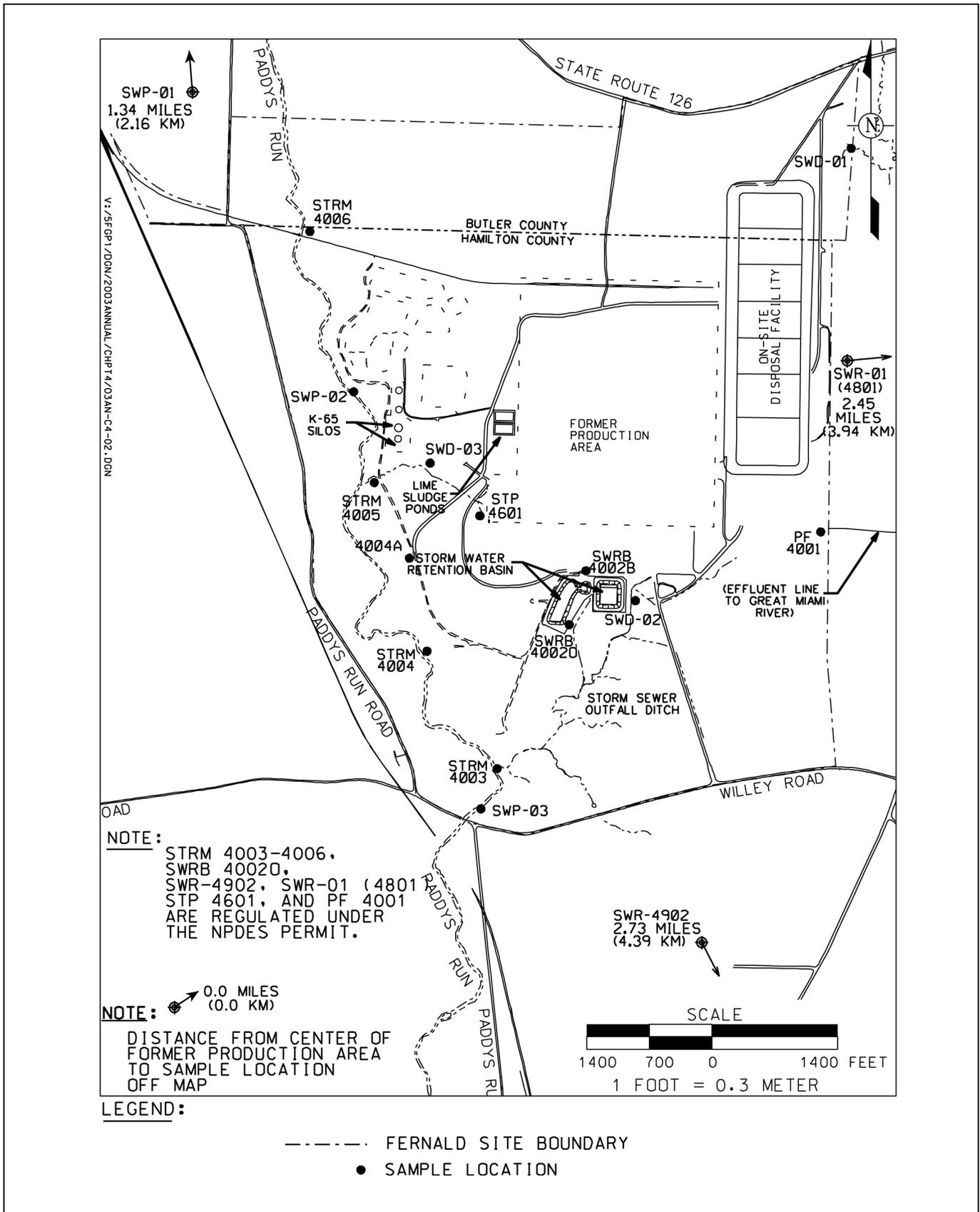
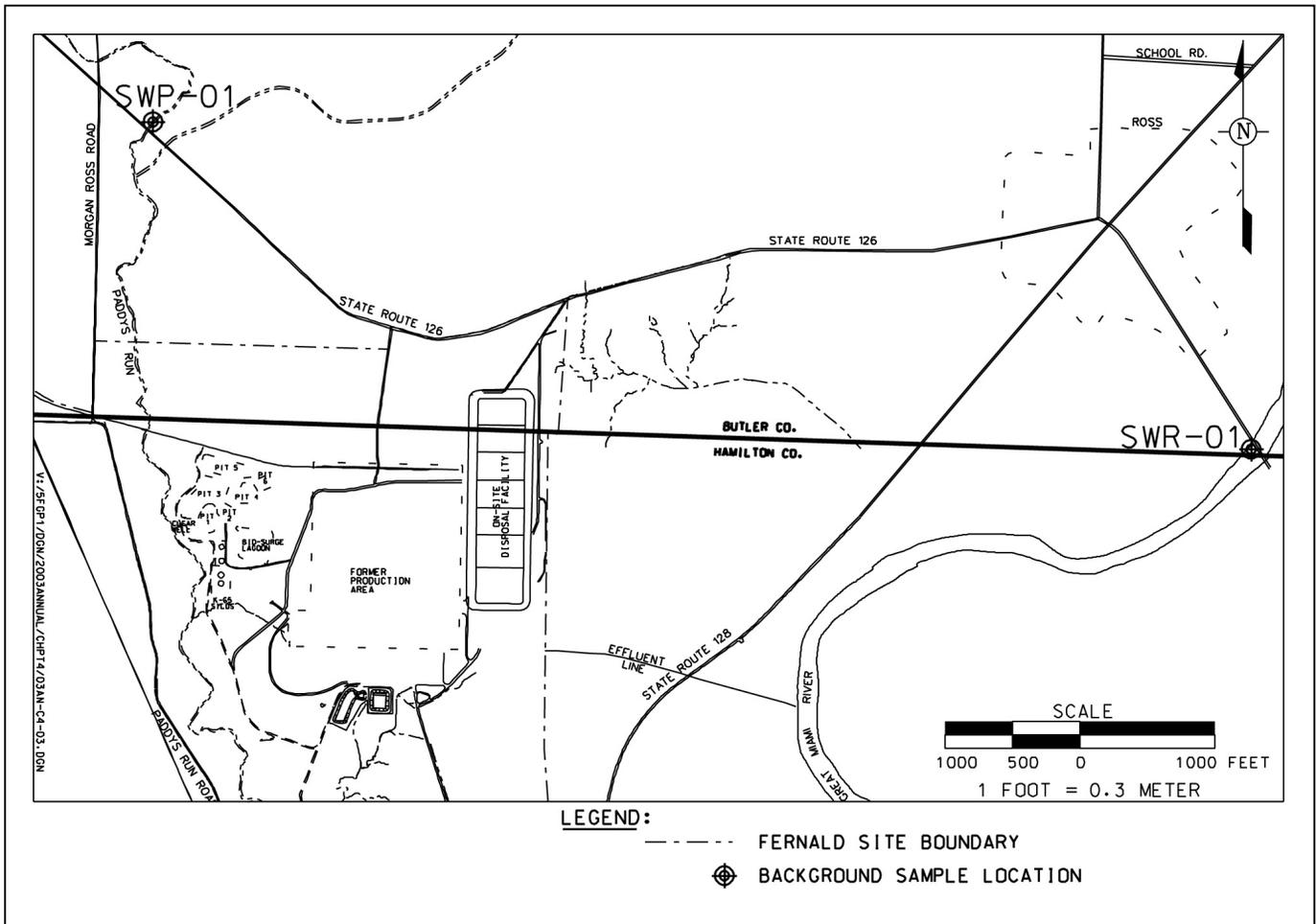


Figure 4-2. IEMP/NPDES Surface Water and Treated Effluent Sample Locations



**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 2003 sampling efforts were evaluated to provide surveillance monitoring of remediation activities. This evaluation showed that during 2003, 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 two 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 was one FRL exceedance in 2003 at location SWP-01 for mercury. There were no BTV exceedances at this location. Locations SWP-01 (and SWR-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 2003**

Constituent	Number of Locations Exceeding FRL	Number of Locations Exceeding BTV <sup>a</sup>	Surface Water FRL	Surface Water BTV <sup>a</sup>	Range of 2003 Data Above FRL <sup>a</sup>	Range of 2003 Data Above BTV <sup>a</sup>
<b>Inorganics</b>			(mg/L)	(mg/L)	(mg/L)	(mg/L)
Cadmium	0	1	0.0098	0.0035	NA	0.00679 to 0.0124 <sup>b</sup>
Chromium	1	NA	0.010 <sup>c</sup>	NA	0.0142	NA
Mercury	1	NA	0.00020	NA	0.000214	NA

<sup>a</sup>NA = not applicable

<sup>b</sup>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 equal to the associated FRL and above the associated BTV.

<sup>c</sup>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.

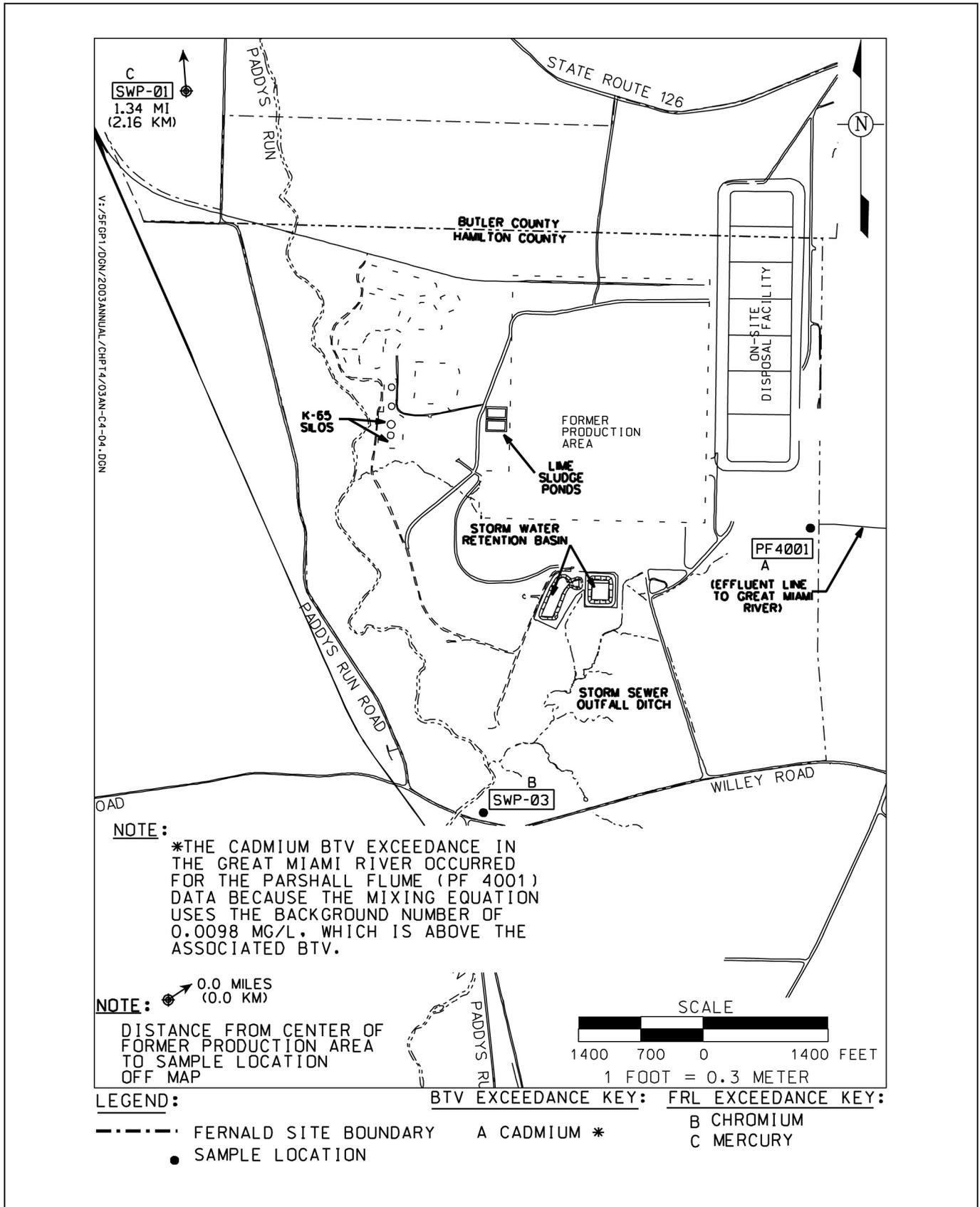


Figure 4-4. Constituents with 2003 Results Above FRLs or BTVs

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 was one FRL exceedance at location SWP-03 for chromium and there were two exceedances of the cadmium BTV at the Parshall Flume (PF 4001), as discussed later in this chapter.

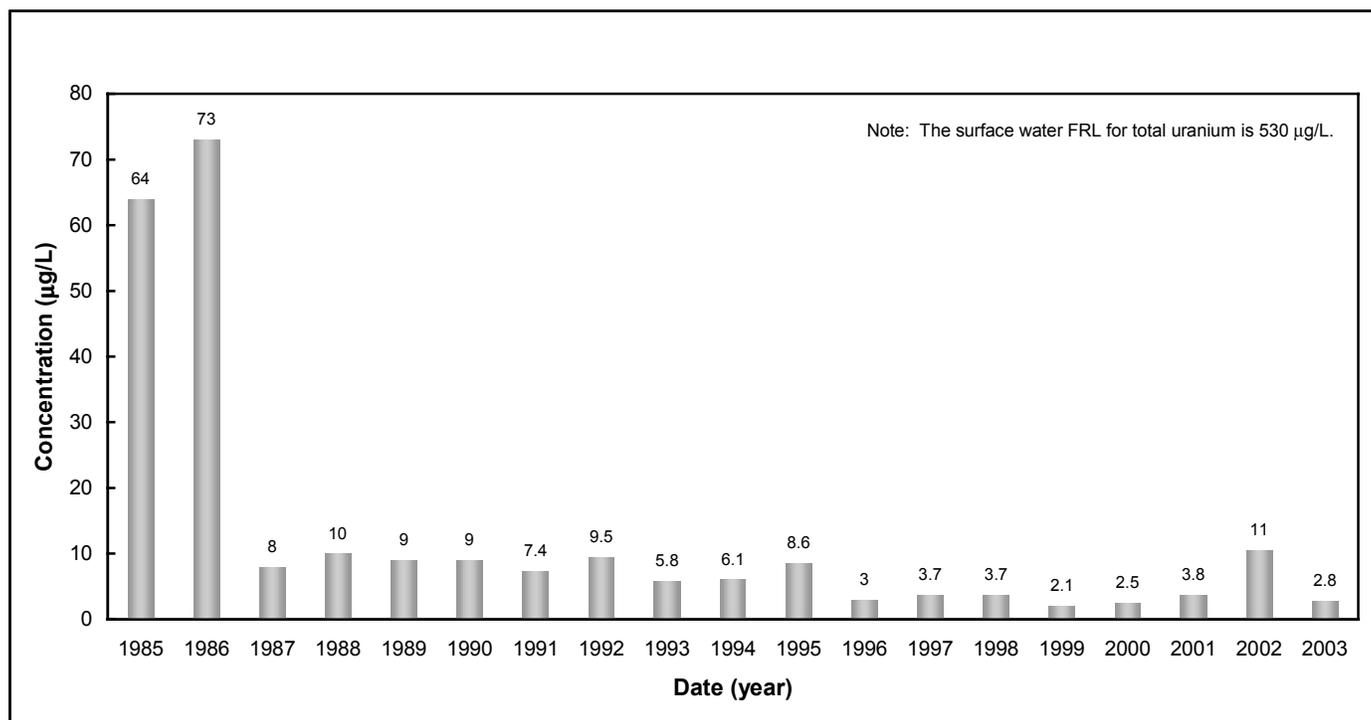
Even with the Fernald site's implementation of storm water and sediment controls, sporadic FRL and BTV exceedances can be expected until final remediation of contaminated source areas (soils and sediments) are complete. A Mann-Kendall statistical test for trend was run for each 2003 FRL exceedance at 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 B.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.

As indicated previously, there was one FRL exceedance at location SWP-03 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. As noted previously, the FRL is actually based on hexavalent chromium (Operable Unit 5 Record of Decision, Table 9-5). However, due to holding time considerations, total chromium is analyzed which provides a more conservative result.



**Figure 4-5. Annual Average Total Uranium Concentrations in Paddys Run at Willey Road (SWP-03) Sample Location, 1985-2003**

The maximum total uranium concentration at SWP-03 during 2003 was 3.7 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 2003. 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 were two BTV exceedances, for cadmium, as mentioned previously. 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 2003. 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 152.7 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 1.04 µg/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 2003 are discussed further 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 2003 three of the five surface water locations 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 0.0996 mg/L and 0.0228 mg/L from samples collected on March 13 and April 21, 2003, respectively, exceeded the groundwater FRL for zinc of 0.021 mg/L.

**TABLE 4-2**  
**SURFACE WATER TOTAL URANIUM RESULTS EXCEEDING THE GROUNDWATER FRL**  
**AT CROSS-MEDIA IMPACT LOCATIONS DURING 2003**

Location	Number of Surface Water Results Exceeding the Groundwater FRL for Total Uranium <sup>a</sup>	Total Number of Samples	Range of 2003 Data above FRL (µg/L)
STRM 4005	4	4	40.0 – 157.9
SWD-03	1	1	41.6
SWRB 4002O	1	1	309.3

<sup>a</sup>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 to address the cross-media concern. Additional details concerning the cross-media impacts are presented in Appendix B, Attachment B.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 discharge limit of 600 pounds (272 kg) per year 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 2003 there were four bypass events as a result of significant precipitation, and three bypass events for maintenance activities. (The storm water bypass event of May 11 through May 12 occurred during an approved maintenance outage.) Table 4-3 summarizes these Storm Water Retention Basin treatment bypass events during 2003. Figure 4-6 shows that the cumulative mass of total uranium discharged to the Great Miami River during 2003 was 562.44 pounds (255.3 kg), which is below the annual discharge limit of 600 pounds (272 kg). Figure 4-7 shows that the total uranium monthly average concentration limit was met every month during 2003.

**TABLE 4-3**  
**2003 SIGNIFICANT PRECIPITATION AND TREATMENT PLANT MAINTENANCE BYPASS EVENTS**

Event	Duration (hours)	Number of Bypass Days <sup>a</sup>	Cumulative Number of Bypass Days	Total Uranium Discharge (lbs)	Total Water Discharged (M gal)
<b>Significant Precipitation Bypasses</b>				(to Great Miami River)	(to Great Miami River)
May 11 through May 12	47.42	NA <sup>b</sup>	NA <sup>b</sup>	12.5	1.84
June 14 through June 18	98.75	4	4	12.6	4.36
July 10 through July 12	50	2	6	10.6	2.92
September 2 through September 4	42	1	7	9.42	2.27
<b>Treatment Plant Maintenance Bypasses<sup>c</sup></b>					
May 9 through May 19	264	11	11	36.72	18.56
June 9 through June 11	72	3	14	19.8	6.1
July 21 through July 23	72	3	17	17.15	6.29

<sup>a</sup>Days are counted according to the definition provided in the Operations and Maintenance Master Plan for the Aquifer Restoration/Wastewater Treatment Project.

<sup>b</sup>NA = not applicable. The May storm water bypass occurred during an approved scheduled maintenance bypass; therefore, the days do not count against the allowable 10 days.

<sup>c</sup>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 B.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.

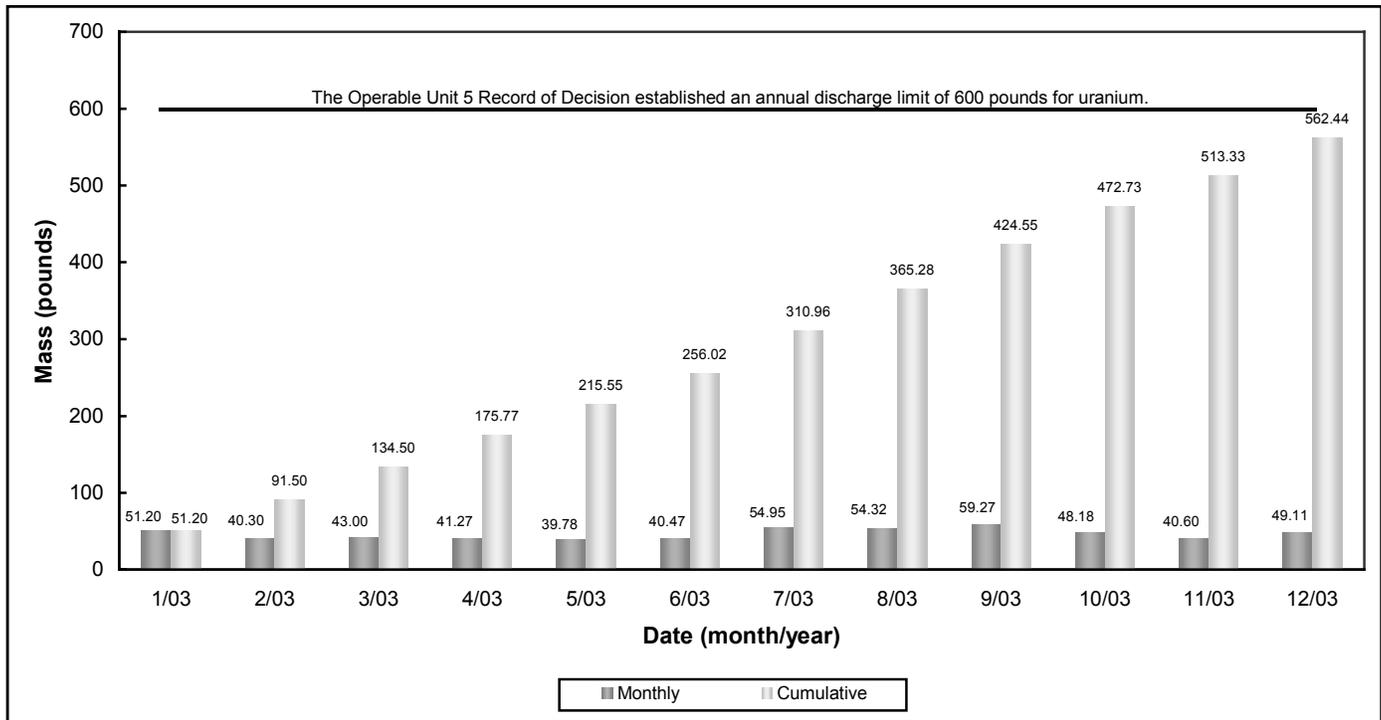


Figure 4-6. Pounds of Uranium Discharged to the Great Miami River from the Parshall Flume (PF 4001) in 2003

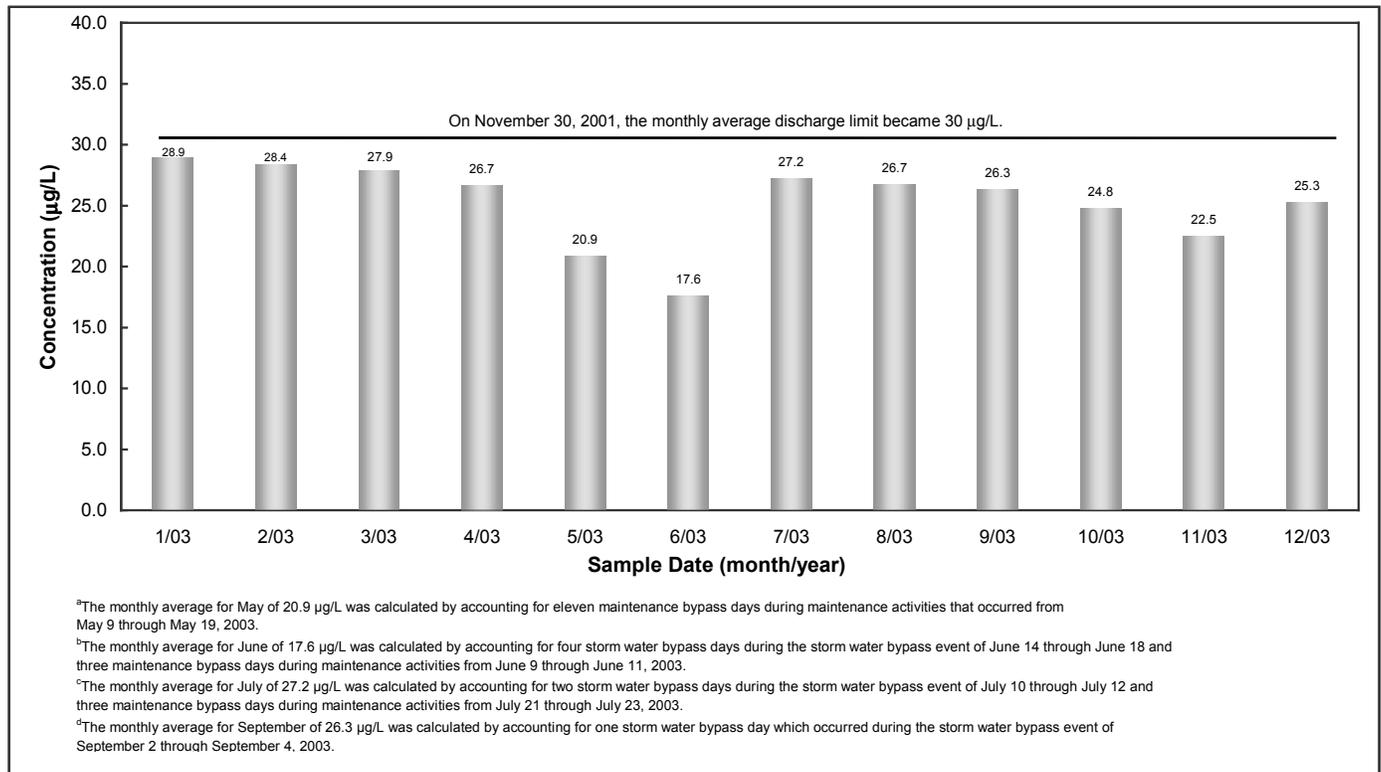


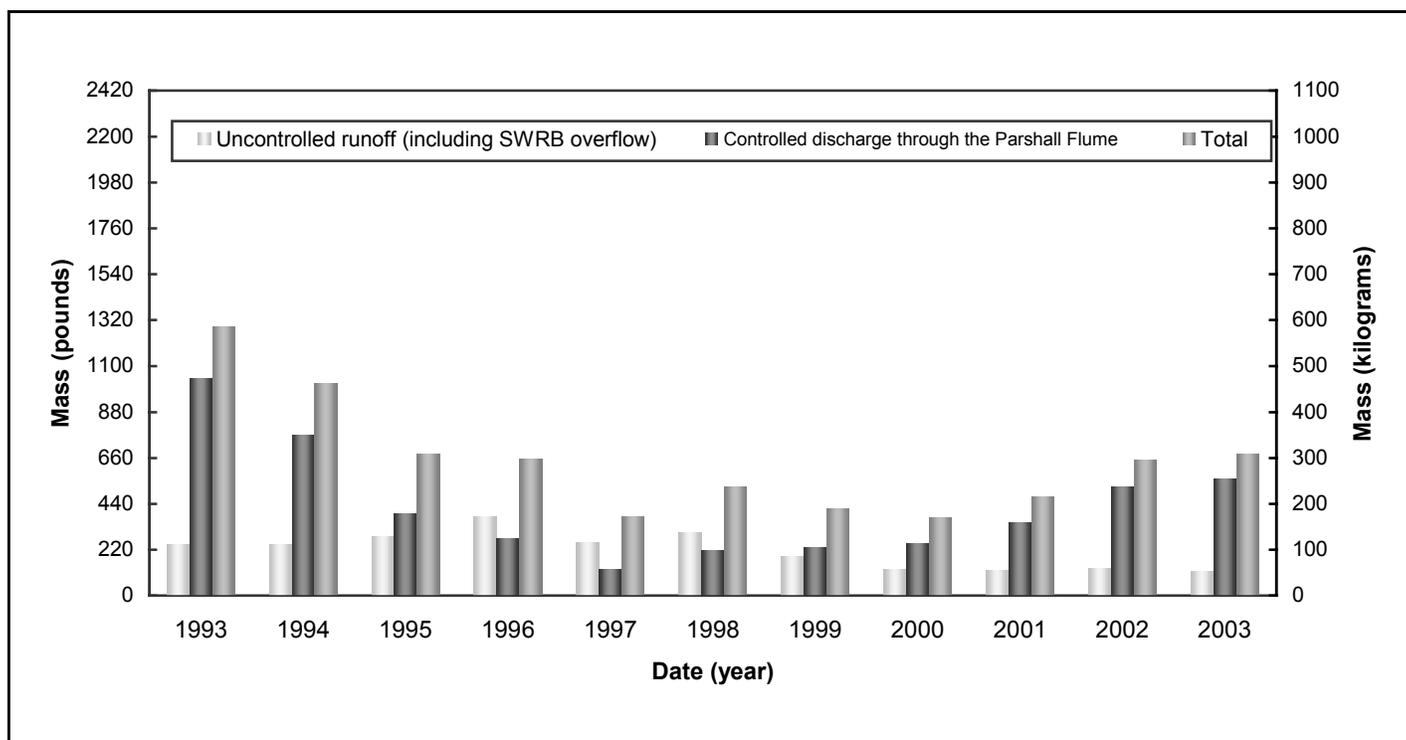
Figure 4-7. 2003 Monthly Average Total Uranium Concentration in Water Discharged from the Parshall Flume (PF 4001) to the Great Miami River

### 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 July 1, 2003, and expires on June 30, 2008. The permit specifies discharge and sample requirements, as well as discharge limits for several constituents. Figure 4-2 identifies NPDES sample locations. A total of 16 non-compliances 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 2003**

Date/ Month	Location	Parameter	Permit Limit	Actual Result	Possible Cause	Corrective Action
1/26	PF 4001 (Parshall Flume Treated Effluent)	Oil and Grease	105 kg/d	237.37 kg/d	Unknown	None. Continue to monitor and observe.
2/6	STP 4601 (Sewage Treatment Plant Effluent)	Total Suspended Solids	40 mg/L	146 mg/L	Low biological activity	None. Continue to monitor and observe.
2/11	STP 4601 (Sewage Treatment Plant Effluent)	Total Suspended Solids	40 mg/L	142 mg/L	Low biological activity	Addition of biological cultures
2/14	STP 4601 (Sewage Treatment Plant Effluent)	Total Suspended Solids	40 mg/L	76 mg/L	Low biological activity	Addition of biological cultures
2/17	STP 4601 (Sewage Treatment Plant Effluent)	Total Suspended Solids	40 mg/L	52 mg/L	Low biological activity	Addition of biological cultures
February	STP 4601 (Sewage Treatment Plant Effluent)	Total Suspended Solids (avg.)	20 mg/L	64.5 mg/L	Low biological activity	Addition of biological cultures
3/17	PF 4001 (Parshall Flume Treated Effluent)	Oil and Grease	10 mg/L	10.6 mg/L	Unknown	None. Continue to monitor and observe.
3/17	PF 4001 (Parshall Flume Treated Effluent)	Oil and Grease	105 kg/d	208.2 kg/d	Unknown	None. Continue to monitor and observe.
March	STP 4601 (Sewage Treatment Plant Effluent)	Total Suspended Solids (avg.)	20 mg/L	27 mg/L	Fluctuating ambient temperatures	None. Continue to monitor and observe.
4/23	PF 4001 (Parshall Flume Treated Effluent)	Oil and Grease	10 mg/L	12.8 mg/L	Unknown	None. Continue to monitor and observe.
4/23	PF 4001 (Parshall Flume Treated Effluent)	Oil and Grease	105 kg/d	276.1 kg/d	Unknown	None. Continue to monitor and observe.
6/11	STP 4601 (Sewage Treatment Plant Effluent)	Fecal Coliform	2000 colonies/100 mL	31,875	Malfunction of ultraviolet (UV) disinfection units	Cleaned and repaired UV units
6/15	SWRB 40020 (Storm Water Retention Basin Overflow)	Total Suspended Solids	50 mg/L	112 mg/L	Storm Water Bypass	None. Continue to monitor and observe.
6/24	PF 4001 (Parshall Flume Treated Effluent)	Oil and Grease	105 kg/d	164.2 kg/d	Unknown	None. Continue to monitor and observe.
June	STP 4601 (Sewage Treatment Plant Effluent)	Total Suspended Solids (avg.)	20 mg/L	20.65	Unknown	None. Continue to monitor and observe.
8/18	STP 4601 (Sewage Treatment Plant Effluent)	Total Suspended Solids	40 mg/L	43 mg/L	Low biological activity	Addition of biological cultures



**Figure 4-8. Uranium Discharged Via the Surface Water Pathway, 1993-2003**

#### 4.3.3 Uranium Discharges in Surface Water and Treated Effluent

As identified in Figure 4-6, 562.44 pounds (255.3 kg) of uranium in treated effluent were discharged to the Great Miami River through the Parshall Flume (PF 4001) in 2003. 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 2003.

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 2003, 44.66 inches (113.4 cm) of precipitation fell at the Fernald site; therefore, an estimated 116.12 pounds (52.7 kg) of uranium entered the environment through uncontrolled runoff. In addition, the Storm Water Retention Basin experienced one overflow during 2003. On June 15, 2003 approximately 835,000 gallons overflowed which resulted in approximately 2.15 pounds (0.98 kg) of uranium being discharged to the environment. Therefore, a total of 118.27 pounds (53.7 kg) of uranium was discharged 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 680.71 pounds (309 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 December 2003 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, 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 2003. Results for all constituents were below their respective sediment FRLs. Additionally, results were consistent with data collected in previous years with the exception of one thorium-230 result from Paddys Run just above the Storm Sewer Outfall Ditch confluence (new maximum of 13.6 pCi/g versus the sediment FRL of 18,000 pCi/g).

Until final certification of the site's drainage ways, monitoring of sediment will continue under the IEMP or the soil/sediment characterization and excavation program 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 B.2, of this report contains additional details of the sediment monitoring results.

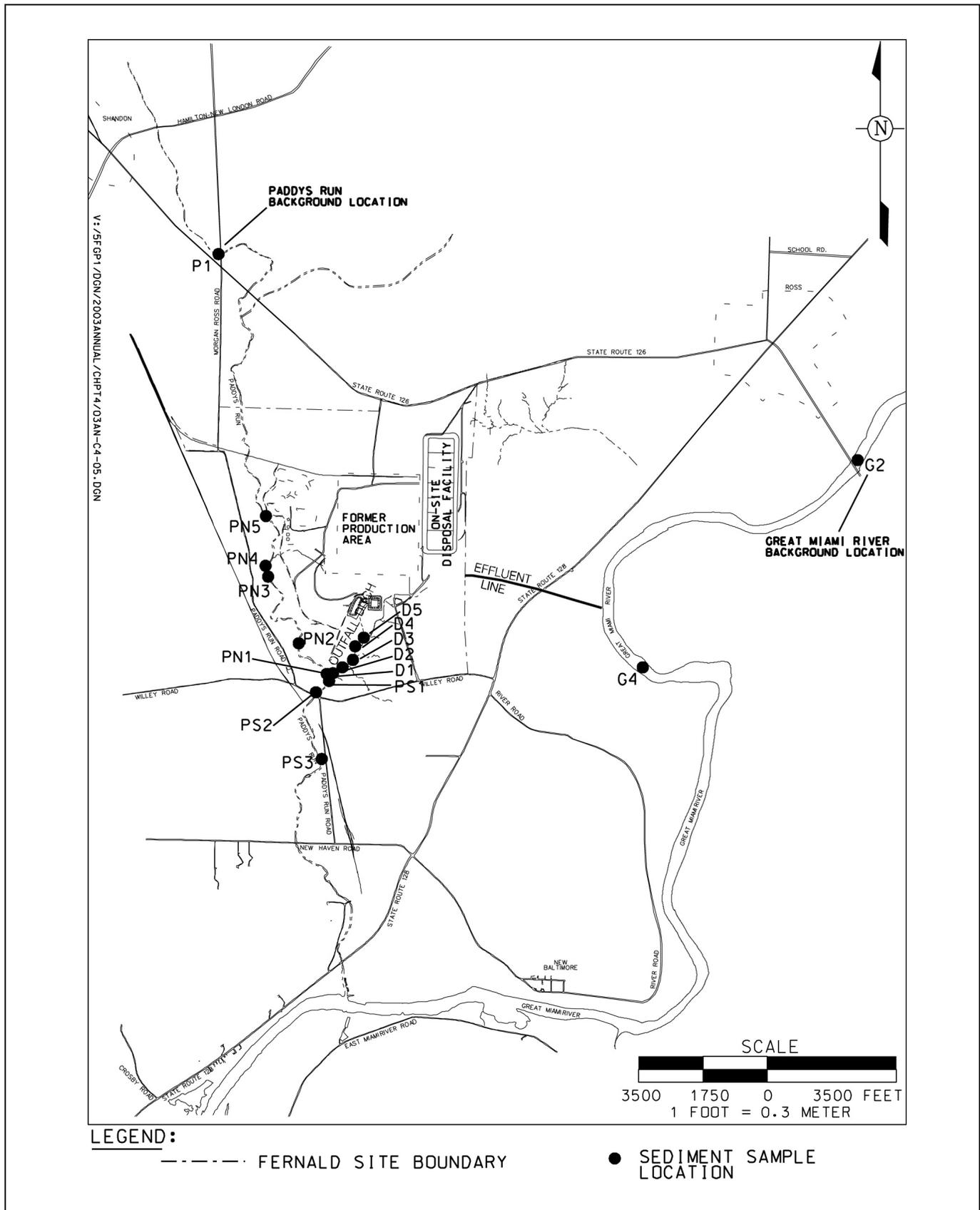


Figure 4-9. 2003 Sediment Sample Locations

**TABLE 4-5**  
**2003 SUMMARY STATISTICS FOR SEDIMENT MONITORING PROGRAM**

Radionuclide	Sediment FRL	No. of Samples <sup>a</sup>	2003 Results - Concentration (dry weight)			
			Minimum <sup>a,b,c,d</sup>		Maximum <sup>a,b,c</sup>	
			(pCi/g)	(mg/kg)	(pCi/g)	(mg/kg)
<b>Great Miami River, North of the Effluent Line (G2)</b>						
Total Uranium	210 mg/kg	1	0.288	(0.426)	NA	NA
<b>Great Miami River, South of the Effluent Line (G4)</b>						
Total Uranium	210 mg/kg	1	1.90	(2.81)	NA	NA
<b>Paddys Run Background, North of S.R. 126 (P1)</b>						
Radium-226	2.9 pCi/g	1	0.717	NA	NA	NA
Radium-228	4.8 pCi/g	1	0.437	NA	NA	NA
Thorium-228	3.2 pCi/g	1	0.416	NA	NA	NA
Thorium-230	18,000 pCi/g	1	0.000	NA	NA	NA
Thorium-232	1.6 pCi/g	1	0.437	NA	NA	NA
Total Uranium	210 mg/kg	1	1.64	(2.43)	NA	NA
<b>Paddys Run, North of the Storm Sewer Outfall Ditch (PN1-PN5)</b>						
Radium-226	2.9 pCi/g	5	0.481	NA	0.871	NA
Radium-228	4.8 pCi/g	5	0.416	NA	0.602	NA
Thorium-228	3.2 pCi/g	5	0.428	NA	0.620	NA
Thorium-230	18,000 pCi/g	5	0.000	NA	13.6	NA
Thorium-232	1.6 pCi/g	5	0.416	NA	0.602	NA
Total Uranium	210 mg/kg	5	1.66	(2.46)	3.28	(4.86)
<b>Storm Sewer Outfall Ditch (D1-D5)</b>						
Radium-226	2.9 pCi/g	5	0.699	NA	0.809	NA
Radium-228	4.8 pCi/g	5	0.340	NA	0.496	NA
Thorium-228	3.2 pCi/g	5	0.342	NA	0.495	NA
Thorium-230	18,000 pCi/g	5	0.000	NA	0.296	NA
Thorium-232	1.6 pCi/g	5	0.340	NA	0.496	NA
Total Uranium	210 mg/kg	5	0.317	(0.468)	6.27	(9.28)
<b>Paddys Run, South of the Storm Sewer Outfall Ditch (PS1-PS3)</b>						
Radium-226	2.9 pCi/g	3	0.610	NA	0.677	NA
Radium-228	4.8 pCi/g	3	0.327	NA	0.513	NA
Thorium-228	3.2 pCi/g	3	0.316	NA	0.519	NA
Thorium-230	18,000 pCi/g	3	0.000	NA	0.000	NA
Thorium-232	1.6 pCi/g	3	0.327	NA	0.513	NA
Total Uranium	210 mg/kg	3	0.292	(0.432)	0.476	(0.705)

<sup>a</sup>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 and maximum).

<sup>b</sup>If the number of samples is greater than or 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.

<sup>c</sup>NA = not applicable

<sup>d</sup>Where concentrations are below the detection limit, each result used in the summary statistics is set at half the detection limit.