Clermont County Office of Environmental Quality
2005 Water Quality Sampling Final Report

Introduction

In 1996, Clermont County established a monitoring program to characterize surface water quality within the county. Data collected through this program allow the county to analyze watershed conditions, identify potential water quality problems, support planning and management programs, and track trends and progress over time. Marking the tenth year of the program, the 2005 sampling schedule was designed with these goals in mind, and consisted of four distinct, yet related components. The first involved bi-weekly collection of grab samples from Shayler Run and Hall Run in the lower East Fork Little Miami River watershed. These samples were analyzed for ammonia (NH_3), nitrate-nitrite (NO_3-NO_2), dissolved ortho-phosphates (ortho-P), total phosphorus (TP), total suspended solids (TSS), 5-day carbonaceous oxygen demand ($CBOD_5$), and *E. coli*. (Results of these analyses will be compared to past and future data to track trends within the watershed over time.)

The second component of the 2005 sampling program involves investigating potential illicit discharges into the surface waters within Clermont County by conducting dry weather sampling above and below suspected discharges. By sampling in low-flow conditions, any water quality issues can be more easily identified with specific point source discharges, as opposed to the more diffuse, non-point source runoff associated with storm events. Areas targeted for this study included Wolfpen Run in the Lower East Fork watershed, and several un-named streams in the Miamiville area in Miami Township. Samples in this study were analyzed for the same parameters as those in the ambient sampling program.

The third component of the county's water quality monitoring program in 2005 involves the collection of water samples at the county's long-term monitoring stations located on Shayler Run (SHYLER1.7) and Hall Run (HALL0.2) during storm events (wet weather sampling). Unlike the dry weather sampling described above, which is aimed at identifying specific sources of illicit discharge, the wet weather sampling is intended to quantify the cumulative impacts of major rain events, which serve to flush contaminants such as chemicals from agricultural applications, oil and gas from parking lot run-offs and other contaminants that can not be identified as coming from any specific point (hence the term non-point source pollution). These types of stressors primarily enter streams during and immediately after rainstorms, and this component of the sampling program is intended to capture these events. In this way, the county can determine the magnitude of these non-point source loadings, and monitor the effectiveness of programs designed to eliminate or reduce them.

During the May-October sampling season, which was unusually dry, only two wet weather events were sampled; August 30-31 (a major rain event associated with Hurricane Katrina), and September 19. Samples were collected using an ISCO 6700

series refrigerated autosampler. The autosampler was programmed to collect six sets of samples collected at two hour intervals after the stream exceeded a pre-determined level. These samples are then aggregated into three composite samples representing the rise, peak, and fall of the stream in response to the storm event. Level and rainfall data were also recorded at the stations using an ISCO 4220 submerged probe flow meter and an ISCO 670 tipping-bucket rain gauge, respectively. Samples collected by the autosampler were analyzed for NH_3, NO_3-NO_2, ortho-P, TP, TSS, $CBOD_5$, and *E. coli*.

This report summarizes the results of these three components of the county's 2005 sampling program. The county also collected information on fish and invertebrate communities in eight locations located throughout the county this summer, following Ohio EPA standard operation procedures. Measuring the biological communities in the stream provides an integrated assessment of stream quality over time, and eliminates the risk of missing a significant event by not collecting samples for chemical analysis at the correct time. Results of these studies are presented in a separate report prepared by EA Engineering.

Ambient Sampling

Weather and Stream Conditions During Sampling

Samples collected from the Hall Run and Shayler Run locations were characterized as either "dry" or "wet" samples, based on the amount of precipitation received over the 48 hours preceding sample collection. If less than 0.1 inches of rain fell in the 48 hours before the time of sampling, the sample was classified as dry weather samples. If 0.1 inches of rain or more fell during the 48 hour period, the sample was categorized as a wet weather sample. The sample set dates and categories are provided in Table 1 below:

Table 1a: Weather conditions prior to time of sampling, Shayler Run Sampling Station.

Sample Date	Sample Category	Sample Day Precip. (in.)	Daily Precip. One day prior to sampling (in.)	Daily Precip. Two days prior to sampling (in.)	Stream Stage at Sampling (feet)
May 26	Dry	0.00	0.00	0.00	0.76, steady
June 7	Dry	0.00	0.00	0.00	0.68, falling
June 21	Dry	0.00	0.00	0.00	0.67, falling
July 7	Dry	0.00	0.03	0.00	0.77, falling
July 21	Wet	0.04	0.67	0.20	0.77, falling
August 4	Dry	0.00	0.00	0.00	0.31, falling
August 18	Dry	0.00	0.05	0.00	0.59, steady
September 1	Wet	1.02	2.15	0.03	1.12, falling
September 15	Dry	0.00	0.00	0.00	0.54, steady
September 29	Wet	0.00	0.00	0.41	1.13, falling
October 13	Dry	0.00	0.00	0.00	0.63, steady
October 27	Wet	0.00	0.13	0.18	0.88, falling

Table 1b: Weather conditions prior to time of sampling, Hall Run Sampling Station.

Sample Date	Sample Category	Sample Day Precip. (in.)	Daily Precip. One day prior to sampling (in.)	Daily Precip. Two days prior to sampling (in.)	Stream Stage at Sampling (feet)
May 26	Dry	0.00	0.00	0.00	1.62, steady
June 7	Dry	0.00	0.01	0.00	1.61, steady
June 21	Dry	0.03	0.00	0.00	1.68, falling
July 7	Dry	0.01	0.02	0.02	1.64, steady
July 21*	Wet	0.03	0.03**	0.02	0.81, falling
August 4	Dry	0.00	0.00	0.00	0.63, steady
August 18	Dry	0.02	0.03	0.03	0.63, steady
September 1	Wet	0.03**	0.01**	0.02	0.90, falling
September 15	Dry	0.00	0.00	0.00	0.61, steady
September 29	Wet	0.00	0.34	0.07	0.84, falling
October 13	Dry	0.00	0.00	0.01	0.66, falling
October 27	Wet	0.00	0.14	0.19	0.81. falling

***** **Staff Gage replaced on July 12, level sensor recalibrated at that time.**

****** **Rainfall monitoring device failed to properly record significant rainfall event. Device found to be clogged and was cleaned after 9/1 sampling.**

By identifying the weather conditions preceding each sampling event, it is hoped that contaminant concentrations can be linked to base- or low-flow conditions, or high-flow associated with stormwater run-off, thus providing valuable diagnostic information regarding potential source(s) of pollution. However, because this component of the county's sampling program involves set bi-weekly sampling, it is often observed that even so-called wet weather sampling occurs at times when the stream has nearly returned to ambient conditions.

Ambient Stream Sampling Results

Nutrients

Ammonia contamination does not appear to be a problem in the Shayler Run and Hall Run watersheds, with no ambient samples recording a concentration above the method detection limit of 0.1 mg/L. Nitrate-nitrite and phosphorus data are presented in Table 2 below:

Sampling Location/ Parameter	NO3-NO2 (mg/L)	Ortho-Phosphate (dissolved) (mg/L)	Total Phosphorus (mg/L)
SHYLR1.7			
Dry Average	0.16	0.03	0.04
Wet Average	0.44	0.03	0.06
Maximum	0.84 (Wet)	0.06 (Dry)	0.09 (Wet)
Minimum	0.08 (Dry)	< 0.02 (Both)	0.02 (Dry)
HALL0.2			
Dry Average	0.23	0.03	0.07
Wet Average	0.59	0.04	0.09
Maximum	1.47 (Wet)	0.08 (Wet)	0.13 (Dry)
Minimum	0.07 (Dry)	< 0.02 (Both)	0.04 (Dry)

Table 2. Nutrient concentrations in Shayler Run and Hall Run, May - October, 2005.

In both Shayler Run and Hall Run, nitrate-nitrite concentrations were higher in the wet weather samples than in the ambient survey (see "Wet Weather Surveys" section of this report). In the ambient survey, even the maximum observed NO_3-NO_2 concentration in Shayler Run (0.84 mg/L) is below the Ohio EPA's proposed ambient criteria value of 1.0 mg/L (*Association Between Nutrients, Habitat, and the Aquatic Biota of Ohio Rivers and Streams*, Ohio EPA Technical Bulletin MAS/1999-1-1). Hall Run had one sample, collected on September 1, that exceeded the proposed criteria value with a concentration of 1.47 mg/L. It should be noted that this was shortly after the remnants of Hurricane Katrina passed through the area, depositing 3-4 inches of rain in the process.

In both watersheds, dissolved ortho-phosphate levels were low ($\leq$ 0.06 mg/L) in all samples, averaging just 0.03 – 0.04 mg/L for both the wet weather and dry weather sample sets. Several samples were below the method detection limit of 0.02 mg/L.

As with nitrate-nitrite data, both watersheds produced higher total phosphorus concentrations in the wet weather samples, although the difference between dry weather averages and wet weather averages is less pronounced for this parameter. Total phosphorus appears to be more of a problem in Hall Run than Shayler Run. None of the Shayler Run samples exceeded the OEPA proposed criteria value of 0.1 mg/L, while Hall Run had three samples exceed this level (one dry weather and two wet weather).

Total Suspended Solids

Total suspended solids (TSS) concentrations were relatively low at both sites, partly due to the fact that sampling was not conducted during the height of any significant rain events. Results of ambient TSS sampling are presented in Table 3. By comparison, TSS concentrations in samples collected during storm events were significantly higher (see Wet Weather Sampling section of this report).

Table 3. Total Suspended Solids (TSS) in Shayler Run and Hall Run, May -October, 2005.

Sample Site	Average All Samples	Average Dry Samples	Average Wet Samples	Minimum	Maximum
SHYLR1.7	2.58	2.20	3.35	< 1.00 (Both)	7.40 (Dry)
HALL0.2	8.85	9.00	8.55	< 1.00 (Wet)	35.00 (Dry)

All TSS concentrations expressed in milligrams per liter (mg/L).

$CBOD_5$

Of the 24 samples analyzed for CBOD5 as part of the 2005 ambient water quality survey, only one (Hall Run, October 27) had a value exceeding the method detection limit of 2.0 mg/L. Its value was 2.5 mg/L. These data, combined with the relatively high dissolved oxygen levels recorded at these stations throughout the summer, tend to indicate that these streams are not endangered by contaminants that deplete or diminish oxygen concentrations in the water column.

E. coli

Samples were collected and analyzed for *E. coli* at each site. Ohio EPA criteria states that the *E. coli* geometric mean, based on not less than five samples collected over a 30-day period, cannot exceed 126 colony forming units (cfu) per 100 mL, and *E. coli* content cannot exceed 298 cfu/100 mL in more than 10% of the samples. Results of the county's 2005 ambient *E. coli* sampling are presented in Table 4:

Table 4. *E. coli* Concentrations in Shayler Run and Hall Run, May - October, 2005.

Sample Site	Geo. Mean All Samples	Geo. Mean Dry Samples	Geo. Mean Wet Samples	Minimum	Maximum
SHYLR1.7	63	41	178	7.7 (Dry)	900 (Wet)
HALL0.2	274	201	565	38 (Dry)	4800 (Wet)

All E. coli concentrations are expressed in colony forming units (cfu) per 100 mL.

As expected, the *E. coli* geometric mean was greater during wet weather than dry weather at both locations. As with Total Phosphorus, *E. coli* appears to be more of a problem in the Hall Run watershed than in Shayler Run. Only the wet weather geometric mean exceeded 126 cfu/100 mL in Shayler Run, while both the dry weather and wet weather geometric means exceeded this criterion in Hall Run. Also, none of the Shayler Run dry weather samples exceeded 298 cfu/100 mL, and only one Shayler Run wet weather sample (collected on September 1) exceeded this threshold. However, two dry weather samples and two wet weather samples exceeded this value in Hall Run, including the September 1 wet weather sample that contained 4800 cfu/100 mL.

Dry Weather Surveys

As stated in the introduction, the county performed a series of dry weather studies during the summer of 2005 in an effort to identify potential illicit discharges in the Wolfpen Run and Miamiville areas of the county. Both of these areas have been sampled as part of the county's ambient monitoring program in prior years, and were shown to have poor water quality as a result of these efforts. This year's study was designed to focus in on potential sources of water quality impairment within these two watersheds.

Sampling Locations

Specifically, grab samples were collected from eight sites in the Miamiville area and five sites on Wolfpen Run on July 11, July 27, and October 5, 2005. Maps of these sampling locations are presented in Figure 1 (Miamiville) and Figure 2 (Wolfpen) below:

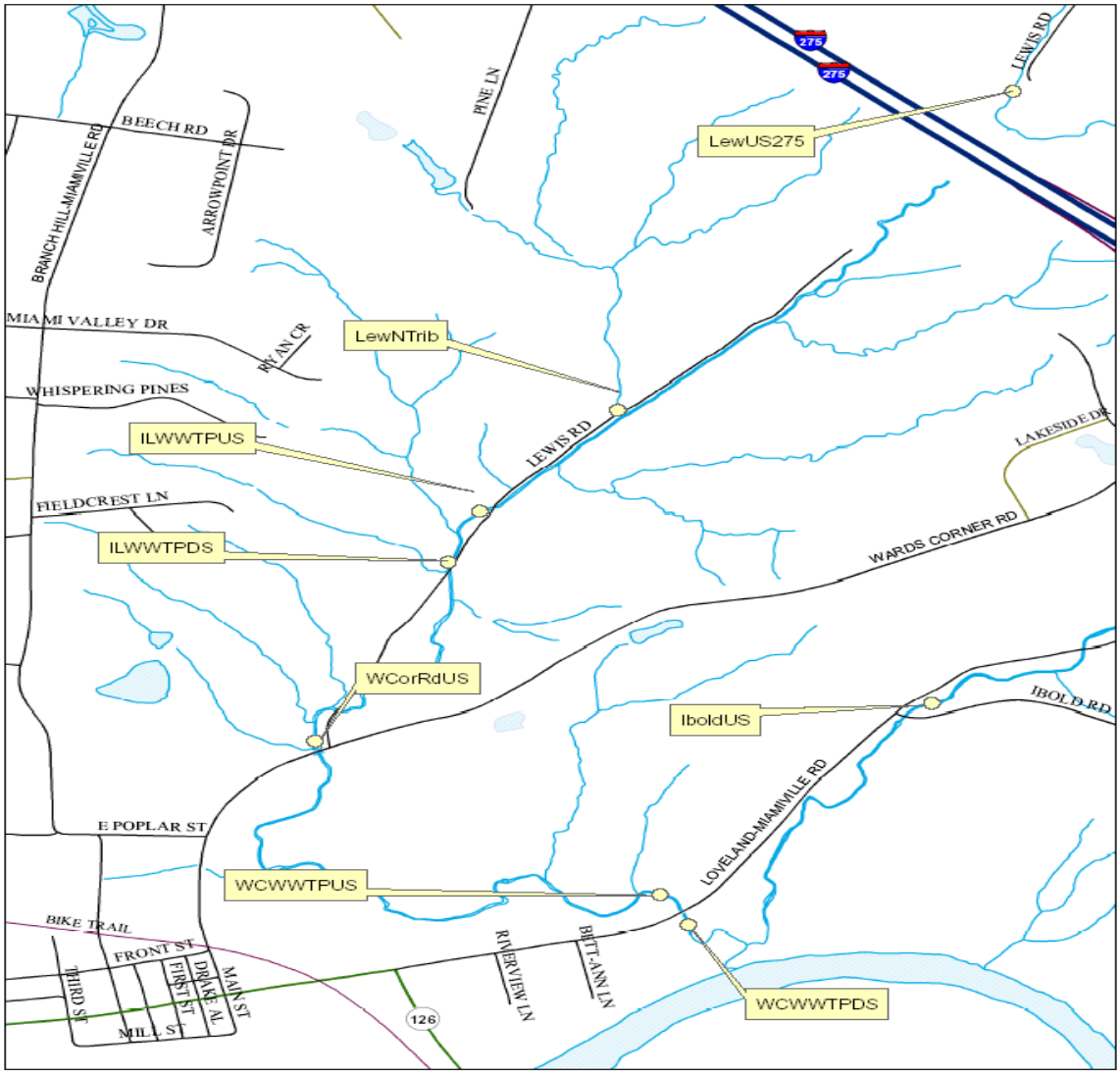

Figure 1. 2005 Dry Weather Survey - Miamiville Sampling Locations.

The Miamiville sampling focused on an un-named stream that flows adjacent to Lewis Road before crossing Wards Corner Road and running south into the Little Miami River. The stream receives effluent from the Indian Lookout and Wards Corner wastewater treatment plants. The first sample (LewUS275) is just north of I-275 and is the most upstream site sampled. The next site (LewNTrib) is a tributary to the main stream channel running along Lewis Road south of I-275. The next two samples (ILWWTPUS and ILWWTPDS) are immediately upstream and downstream of the Indian Lookout Wastewater Treatment Plant discharge, respectively. The next site (WCorRdUS) is slightly downstream at the intersection of Lewis Road and Wards Corner Road. The next two sites (WCWWTPUS and WCWWTPDS) are immediately upstream and downstream of the Wards Corner Wastewater Treatment Plant effluent, and the final site (IBOLDUS) is on another branch of the stream that combines with the Lewis Road branch just before discharging into the Little Miami River.

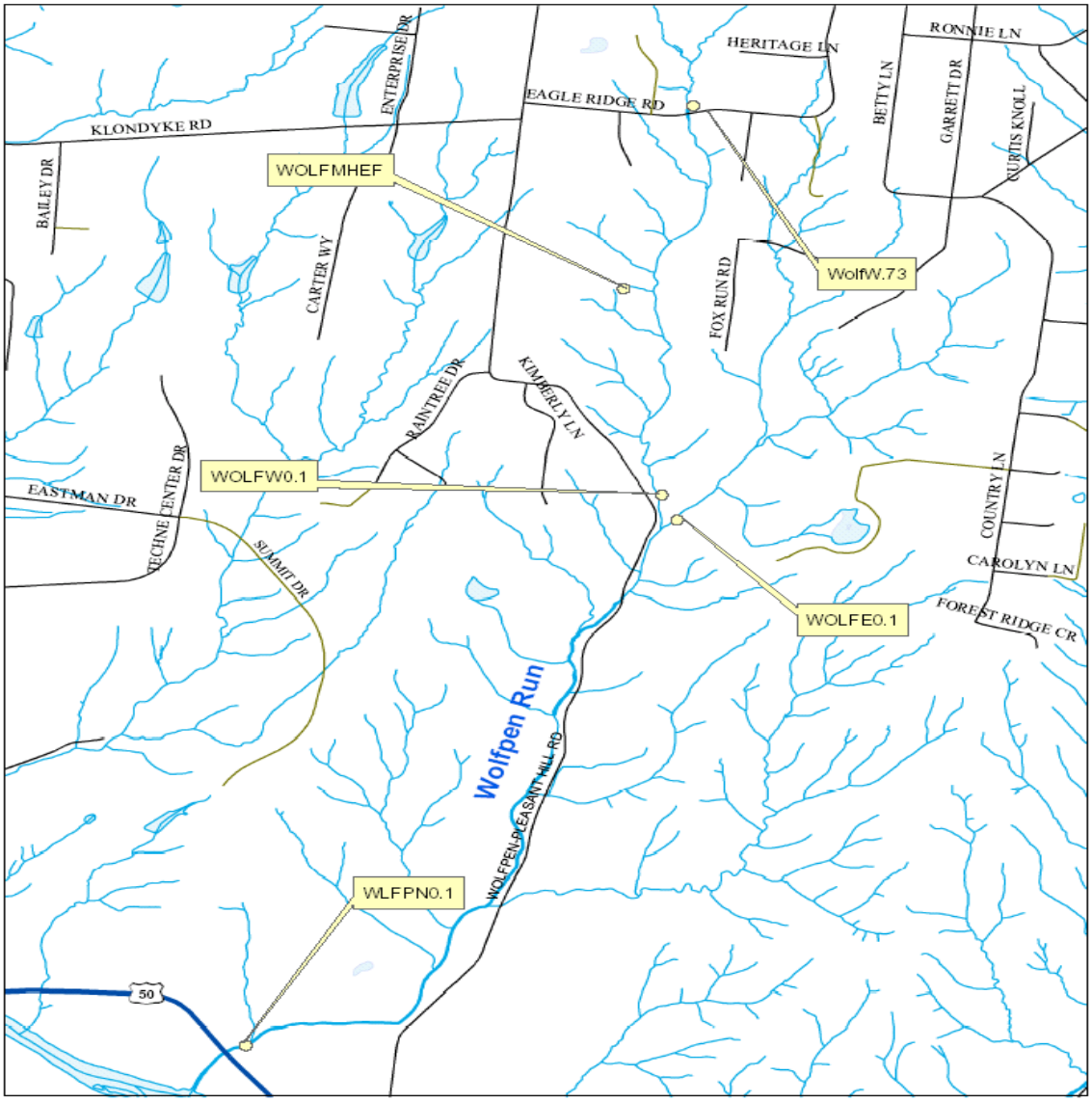

Figure 2. 2005 Dry Weather Survey – Wolfpen Run Sampling Locations.

The first site in the Wolfpen Run study area (WolfW.73) is on the west branch of Wolfpen Run, 0.73 miles from it's confluence with the East Fork Little Miami River, near the point where the stream is leaving the Eagle Ridge subdivision at Wolfpen-Pleasant Hill Road. The next site (WOLFMHEF) is the effluent of a Mobile Home Park wastewater treatment system discharging into the west branch of Wolfpen Run. The next two sites (WOLFE0.1 and WOLFW0.1) are on the east branch and west branch of Wolfpen Run, just prior to their confluence with one another downstream from the Mobile Home Park. The final sampling site (WOLFPN0.1) is on Wolfpen Run at U.S. 50, approximately 0.1 miles from the stream's confluence with the East Fork Little Miami River.

Dry Weather Survey Results

Miamiville Area

Results of the surveys conducted in the Miamiville area are presented in Table 5 and Table 6 below:

Table 5. Nutrient Results from Miamiville Dry Weather Surveys.

Sampling Site	Ammonia	NO_3-NO_2	Ortho-P	TP
LewisUS275	< 0.1 (N/A)	0.44 (0.22 - 0.65)	0.19 (0.14 - 0.26)	0.21 (0.15 - 0.29)
LewNTrib	< 0.1 (N/A)	0.21 (0.13 - 0.30)	0.07 (0.05 - 0.07)	0.10 (0.09 - 0.11)
ILWWTPUS	< 0.1 (N/A)	1.03 (0.89 - 1.18)	0.57 (0.30 - 1.10)	0.55 (0.35 - 0.91)
ILWWTPDS	< 0.1 (N/A)	4.91 (1.15 - 10.21)	0.82 (0.27 - 1.20)	1.07 (0.32 - 1.45)
WCorRdUS	< 0.1 (N/A)	2.50 (1.94 - 2.87)	0.17 (0.12 - 0.26)	0.21 (0.13 - 0.32)
WCWWTPUS	< 0.1 (N/A)	0.47 (0.14 - 0.95)	0.14 (0.13 - 0.15)	0.18 (0.17 - 0.19)
WCWWTPDS	< 0.1 (N/A)	15.08 (11.51 - 16.91)	1.96 (1.39 - 3.00)	3.12 (2.50 - 3.63)
IboldUS	< 0.1 (N/A)	0.31 (0.24 - 0.39)	0.31 (0.24 - 0.39)	0.13 (0.12 - 0.14)

Results presented as average, with range in parentheses. All units are mg/L.

Table 6. Other Results from Miamiville Dry Weather Surveys.

Sampling Site	TSS	$CBOD_5$	*E. coli*
LewisUS275	2.70 (1.30 - 4.40)	< 2.0 (N/A)	264 (220 - 320)
LewNTrib	3.10 (2.60 - 3.60)	< 2.0 (N/A)	169 (110 - 260)
ILWWTPUS	6.90 (3.60 - 10.10)	< 2.0 (N/A)	198 (100 - 520)
ILWWTPDS	3.87 (2.70 - 4.80)	< 2.0 (N/A)	686 (460 - 890)
WCorRdUS	2.80 (2.00 - 4.40)	< 2.0 (N/A)	180 (92 - 290)
WCWWTPUS	4.53 (1.30 - 7.90)	< 2.0 (N/A)	37 (8 - 170)
WCWWTPDS	9.10 (3.50 - 16.00)	< 2.0 (N/A)	343 (120 - 600)
IboldUS	3.47 (1.30 - 5.10)	< 2.0 (N/A)	72 (15 - 290)

TSS and $CBOD_5$ results presented as average, with range in parentheses. TSS and $CBOD_5$ units are mg/L.
E. coli results presented as geometric means, with range in parentheses. E. coli units are cfu/100 mL

Ammonia concentrations were below the method detection limit of 0.1 mg/L for all samples collected in this study. NO_3-NO_2 was detected in all samples, with several samples having concentrations greater than the OEPA's proposed criteria value of 1.0 mg/L. Specifically, the average concentration immediately above the Indian Lookout wastewater treatment plant (ILWWTPUS) was 1.03 mg/L, up from 0.44 mg/L in the headwater sample (LewisUS275) and 0.21 mg/L in the upstream tributary (LewNTrib). The reason for this increase is unknown at this time. The survey did not include sampling of two tributaries entering the stream above this location from the south (see map). These tributaries drain an area that includes several commercial properties on Wards Corner Road that may be contributing to this load. NO_3-NO_2 concentrations jumped to 4.91 mg/L in the sampling site immediately downstream from the Indian Lookout WWTP discharge (ILWWTPDS). It should be noted that this sample was not collected directly at the WWTP discharge point, but rather from the point where the tributary containing the WWTP effluent enters the mainstem of the stream. Therefore,

high nutrient levels observed in this sample may be the result of unsewered homes in the watershed as well as the WWTP effluent. Concentrations were still high, averaging 2.50 mg/L, downstream at the intersection of Lewis Road and Wards Corner Road. NO_3-NO_2 levels dropped to an average of 0.47 mg/L by the time the stream reached the Wards Corner waterwater treatment plant effluent, then jumped to an average of 15.08 mg/L in the samples collected immediately downstream from this discharge. The stream branch adjacent to Ibold Road had a relatively low average value of 0.31 mg/L.

A very similar trend is seen for ortho-phosphate and total phosphorus values in these samples. Concentrations are slightly elevated immediately upstream of the Indian Lookout wastewater treatment plant, and rise dramatically immediately below the discharge from the Indian Lookout and Wards Corner WWTPs. It should be noted that only one sample (LewNTrib, October 5) had a TP concentration below the OEPA proposed criteria value of 0.1 mg/L.

E. coli concentrations also rose downstream of the WWTP discharges. It should be noted that the most upstream sample above I275 also had relatively high levels of *E. coli*. This may be due to the high number of home sewage treatment systems in this part of the watershed. It is not appropriate to compare these results to the OEPA criteria for E. coli, and the criteria requires a minimum of five samples in a 30-day period, which we do not have in this survey.

Wolfpen Run

Results of sampling performed in the Wolfpen Run watershed are presented in Table 7 and Table 8 below:

Table 7. Nutrient Results from Wolfpen Run Dry Weather Surveys.

Sampling Site	Ammonia	NO_3-NO_2	Ortho-P	TP
WolfW.73	< 0.1 (N/A)	4.33 (1.97 – 5.92)	1.46 (1.12 – 2.00)	1.54 (0.87 – 2.01)
WOLFMHEF	< 0.1 (N/A)	14.30 (8.37 – 18.03)	2.38 (1.44 – 3.97)	3.36 (1.98 – 4.46)
WOLFE0.1	< 0.1 (N/A)	1.63 (1.03 – 2.02)	0.44 (0.42 – 0.48)	0.48 (0.46 – 0.49)
WOLFW0.1	< 0.1 (N/A)	4.63 (3.16 – 6.32)	0.88 (0.82 – 0.92)	1.20 (0.70 – 0.22)
WLFPN0.1	< 0.1 (N/A)	0.26 (0.14 – 0.37)	0.10 (0.06 – 0.14)	0.14 (0.07 – 0.22)

Results presented as average, with range in parentheses. All units are mg/L.

Table 8. Other Results from Wolfpen Run Dry Weather Surveys.

Sampling Site	TSS	$CBOD_5$	*E. coli*
WolfW.73	37.13 (10.40 – 85.00)	< 2.0 (N/A)	195 (54 – 650)
WOLFMHEF	2.47 (2.10 – 2.80)	< 2.0 (N/A)	2819 (1400 – 8000)
WOLFE0.1	4.10 (2.80 – 6.40)	< 2.0 (N/A)	121 (69 – 370)
WOLFW0.1	18.50 (4.10 – 30.00)	< 2.0 (N/A)	69 (46 – 85)
WLFPN0.1	12.55 (1.10 – 24.00)	< 2.0 (N/A)	158 (92 – 270)

TSS and $CBOD_5$ results presented as average, with range in parentheses. TSS and $CBOD_5$ units are mg/L.
E. coli results presented as geometric means, with range in parentheses. E. coli units are cfu/100 mL

As was the case in the Miamiville survey, ammonia concentrations in all samples collected in Wolfpen Run were below detection levels. Nitrate-nitrite values were high (average = 4.33 mg/L) in the uppermost sample (WolfW.73), a site located on the west branch of Wolfpen Run adjacent to Eagle Ridge Drive. At this location, the stream is draining out of the Eagle Ridge subdivision. This area has been shown to have a high number of discharging Home Sewage Treatment Systems, many of which have been tested previously and shown to be performing poorly. This may be contributing to the contaminants found in water samples collected at this location. The next downstream sample, also located on the west branch of Wolfpen, was the effluent from a package wastewater treatment plant serving a mobile home park located on Wolfpen-Pleasant Hill Road. These samples showed the highest NO_3-NO_2 values (average = 14.3 mg/L) of any collected in the survey. NO_2-NO_3 values are still relatively high (average = 4.63 mg/L) some distance downstream from this location, at WOLFW0.1, just upstream form the point where the west branch and east branch of Wolfpen Run converge. Conversely, the samples collected in the east branch just upstream from this point (WOLFE0.1) showed relatively low NO_2-NO_3 (average = 1.63 mg/L). By the time the stream nears its confluence with the East Fork Little Miami River (WLFPN0.1), NO_2-NO_3 values are at their lowest levels (average = 0.26 mg/L), showing that there a processes ongoing within the stream that are effectively removing NO_2-NO_3 from the water column. A very similar pattern exists for dissolved ortho-phosphate and total phosphorus. It should be noted that even the lowest TP levels in the survey (average value of 0.14 mg/L at WLFPN0.1) were above the proposed OEPA criteria value of 0.1 mg/L.

Total Suspended Solids (TSS) values were highest at WolfW.73, the most upstream sampling location (average = 37.13 mg/L). There does not appear to be any discernible spacial trend in TSS concentrations along the watershed. $CBOD_5$ values did not exceed the method detection limit of 2.0 mg/L for any of the samples collected in this study. The only samples with consistently high *E. coli* concentration were those collected at WOLFMHEF, the effluent of the mobile home park treatment plant (average = 2829 cfu/100 mL).

Wet Weather Surveys

As stated in the introduction, there were only two wet weather surveys conducted by the county in 2005 (August 30-31 and September 19). Results of these surveys are presented in Table 9 and Table 10 below:

Table 9. Shayler Run Wet Weather Sampling Results, May - October, 2005.

August 30-31, 2005

Stream Stage	Ammonia	NO_3-NO_2	Ortho-P	TP	TSS	$CBOD_5$	*E. coli*
Rising	< 0.10	0.89	0.05	0.40	460	2.10	> 6000
Peak/Level	< 0.10	1.40	0.07	0.94	2130	4.20	> 6000
Falling	< 0.10	1.61	0.10	0.45	552	3.10	> 6000

September 19, 2005

Stream Stage	Ammonia	NO_3-NO_2	Ortho-P	TP	TSS	$CBOD_5$	*E. coli*
Rising	< 0.10	0.46	0.02	0.04	3.6	< 2.00	1300
Peak/Level	< 0.10	0.62	0.04	0.14	25.6	< 2.00	4500
Falling	< 0.10	0.70	0.04	0.13	21.6	2.50	3700

Table 10. Hall Run Wet Weather Sampling Results, May - October, 2005.

August 30-31, 2005

Stream Stage	Ammonia	NO_3-NO_2	Ortho-P	TP	TSS	$CBOD_5$	*E. coli*
Rising	0.12	0.41	0.04	2.29	1590	7.50	> 6000
Peak/Level	< 0.10	0.77	0.14	1.67	2560	5.50	> 6000
Falling	< 0.10	1.35	0.09	0.49	1380	5.50	> 6000

September 19, 2005

Stream Stage	Ammonia	NO_3-NO_2	Ortho-P	TP	TSS	$CBOD_5$	*E. coli*
Rising	0.23	0.53	0.07	1.56	688	5.60	> 8000
Peak/Level	< 0.10	0.82	0.07	0.46	194	3.60	> 8000
Falling	< 0.10	0.94	0.06	0.21	58	3.10	> 4800

Nutrients

As inferred from the ambient samples collected from these sites, the wet weather survey results seem to indicate that ammonia is not a problem in these watersheds. Only the "Rising" samples from Hall Run show ammonia levels above the method detection limit of 0.1 mg/L (0.12 mg/L on August 30-31 and 0.23 mg/L on September 19). Nitrate-nitrite levels increase over time in each sampling event, exceeding the OEPA proposed criteria value of 1.0 mg/L in three samples on August 30-31 (Shayler Run "Peak", Shayler Run "Falling" and Hall Run "Falling"). Ortho-phosphate levels were relatively low, with only two values at or above 0.1 mg/L. All but one of the samples had total

phosphorus levels greater than the proposed OEPA criteria value of 0.1 mg/L, with particularly high TP levels in the Hall Run samples. This is consistent with the results of the ambient sampling survey, in which Hall Run samples generally had TP levels greater than those reported in Shayler Run.

Total Suspended Solids

As expected, TSS values were greater in the wet weather samples than in the ambient samples, as rain events strong enough to trigger the autosamplers tend to flush particulate matter out of the watershed at higher than normal rates. This was particularly true during the August 30-31 event in Hall Run, when all three samples had TSS values >1000 mg/L. It is interesting to note the trend in TSS levels over the course of each sampling event. On August 30-31, both sites captured the desired rise-peak-fall progression in TSS levels along with the rise-peak-fall of the stream. During the September 19 event, however, the sampler in Shayler Run appears to capture the early stages of the TSS progression (rise-peak), while the Hall Run sampling devise appears to miss the rise and only capture peak-fall. These differences may be due to differences in the size of the two watersheds.

$CBOD_5$

Unlike the ambient samples, a majority of wet weather samples had detectable $CBOD_5$ concentrations, particularly in Hall Run during the August 30-31 event. However, it is unlikely that the observed $CBOD_5$ values would result in any degradation in stream quality. $CBOD_5$ is primarily used as an indicator of stream quality because of its impact on in-stream dissolved oxygen levels. However, under high-flow conditions such as those associated with major rainfall events, there is ample mixing in the stream to maintain high dissolved oxygen levels, regardless of the biological or chemical oxygen demand placed on the stream by various contaminants.

E. coli

Perhaps the most significant result of the wet weather surveys was the high *E. coli* concentrations observed in all of the samples, ranging from 1300 cfu/100 mL to greater than 8000 cfu/100 mL. There are at least three possible explanations. First, the storm events cause runoff from properties in the watershed with home sewage treatment systems that may inadequately treat the home's sewage, thus contaminating the stormwater running off of the property. If this is the case for a significant number of households in the watershed, it could result in the high *E. coli* values observed during these storm events. Another possibility would be the contamination from sewers in the watershed. Both Hall Run and Shayler Run have sewer lines running in close proximity to the stream channel. If these sewers are infiltrated with rain water during major storm events, they have the potential to overflow, resulting in untreated sewage entering the stream. One other possibility would be the influence of animals in the watershed. While the area is not agricultural and, therefore, does not contain any livestock, residential pets and the large numbers of Canada geese observed in the area may contribute fecal contaminants as well. As seen with the ambient sampling data, the problem seems to be worse in the Hall Run watershed.

Conclusions

The bi-weekly ambient sampling conducted at Shalyer Run and Hall Run in 2005 showed no signs of ammonia contamination. Also, there is little evidence of nutrient contamination, and low suspended solids concentrations provide little eveidnce to suggest significant sediment loading in these watersheds. Likewise, low $CBOD_5$ values, combined with the high dissolved oxygen values recorded at these locations throughout the summer, tend to indicate that these streams are not endangered by contaminants that reduce or deplete oxygen from the water column. The only parameter examined in these samples that provide any cause for concern is *E. coli*, an indicator of fecal contamination, particularly in Hall Run. This could be due to failing on-site septic systems, overflow from sanitary sewers (located in close proximity to both of these streams), or other illicit discharges.

The dry weather surveys also provided no evidence of ammonia contamination or problems associated with suspended solids, high $CBOD_5$ or low dissolved oxygen. However, nutrient levels were elevated in several instances. Specifically, in the Miamiville area, NO_2-NO_3 concentrations rose slightly as the stream progressed south of I-275 and rose sharply immediately downstream of the Indian Lookout and Wards Corner WWTP effluent discharge locations. A similar pattern was observed for Total Phosphorus. Fortunately, the decision by the Clermont County Sewer District to replace these two facilities with a new regional plant should eliminate these pollutant loads. In Wolfpen Run, nutrient levels were high at the uppermost sampling location, possibly due to the large number of discharging home sewage treatment systems located immediately upstream of the sampling location. High nutrient concentrations were also observed in the effluent of the mobile home park wastewater treatment plant, suggesting that the plant is not performing in an optimal fashion.

The other parameter of interest in the dry weather surveys was *E. coli*. In the Miamiville study, *E. coli* values increased slightly immediately downstream from the Indian Lookout and Wards Corner WWPTs, raising above the Ohio EPA criteria values in these two locations (460-890 cfu/100 mL at Indian Lookout and 120-600 cfu/100 mL at Wards Corner). However, the highest *E. coli* values seen on any samples were those collected at the mobile home park package plant effluent on Wolfpen Run, where concentrations ranged from 1,400-8,000 cfu/100 mL. It is interesting to note how quickly *E. coli* concentrations drop as one moves downstream from a loading source, although it is unclear if this is due to breakdown, or simply the result of dilution.

As anticipated, the wet weather surveys conducted in Shayler Run and Hall Run often showed elevated concentrations of nutrients, suspended solids, $CBOD_5$ and *E. coli*, relative to the ambient samples collected throughout the summer at these same locations. This implies that a significant percentage of the contaminant loading in these watersheds could be the result of stormwater runoff associated with significant rain events.

Recommendations

Based on the results obtained in 2005, there would appear to be little value in analyzing ambient stream samples for ammonia, unless the sampling location is in close proximity to a suspected discharge containing sewage. Likewise, $CBOD_5$ analyses should be limited to wet weather sampling, as this is the only time when measurable concentrations were observed.

Further investigation is warranted to identify the source of increased nutrient and TSS concentrations in samples collected in the Miamiville area downstream of I-275 but above the effluent discharge from the Indian Lookout WWTP. Follow-up surveys should be conducted on this watershed once the new WWTP comes online and the existing plants are decommissioned to document improvements in water quality. Also, the tributaries entering the stream from the south below I-275 should be included in any future surveys of this watershed.

The Clermont County Office of Environmental Quality and Sewer District should work with the Clermont County General Health District and Ohio EPA to mandate improvements to the wastewater treatment plant being operated by the mobile home park on Wolfpen Run to reduce concentrations of nutrients and other fecal contaminants in the plant's effluent. Follow-up surveys should be conducted to document any improvements.

Efforts should be undertaken to calibrate existing discharge curves or generate new ones for Shayler Run and Hall Run, so that pollutant concentrations recorded during ambient and wet weather sampling events can be translated into overall pollutant loading values. This effort should eventually be expanded to other watersheds throughout the county.