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Pharmaceuticals and Personal Care Products (PPCPs) in the Streams and Aquifers of the Great Miami River Basin

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ABSTRACT

Recognizing the issue of emerging contaminants in surface water, groundwater, and drinking water, The Miami Conservancy District (MCD) conducted an occurrence survey to document presence or absence of a target group of 21 pharmaceutical and personal care product (PPCP) compounds in wastewater effluent, streams, and aquifers of the Great Miami River Basin. The survey was developed to (1.) compare concentrations of PPCPs in high flow conditions with low flow conditions; (2.) compare concentrations of PPCPs in wastewater treatment plant (WWTP) effluent, surface water, and groundwater; (3.) construct upstream to downstream profiles of occurrences and concentrations of PPCPs in order to assess cumulative effects of WWTP effluents from upstream to downstream; and (4.) compare concentrations of PPCPs in groundwater with published drinking water guidelines to determine a margin of exposure (MOE).

MCD initiated the PPCP occurrence survey in the fall of 2010, with samples collected in October–November 2010 and April–May 2011. Over the course of this survey, MCD collected water samples at three WWTP effluent sites, twenty stream or river sites, seven monitoring wells, and three municipal production wells. All samples were analyzed by Montgomery Watson Harza Laboratories (MWH) using a proprietary high pressure liquid chromatography and dual mass spectroscopy (LC/MS/MS) method referred to as Method ED2SCR.

Analysis of the surface water and groundwater samples detected low concentrations of 17 out of the 21 compounds on the target analyte list. The maximum concentration of most PPCP compounds tended to be higher during the fall 2010 sampling event when stream flows were lower compared to the spring 2011 event when stream flows were higher. Detection frequencies and mean concentrations of most PPCPs were found to be similar between the two sampling events. Overall, detection frequencies and concentrations of PPCPs were highest in the effluent samples, followed by samples collected from rivers downstream of WWTP outfalls. The survey found lower detection frequencies and concentrations of PPCPs in samples collected from headwater streams and groundwater. A screening level risk assessment using the highest concentrations of PPCPs in groundwater calculated MOEs for individual PPCP compounds ranging from 31 to over 224,000,000. The MOE methodology used in this survey was published by New York City Department of Environmental Protection in 2010.

INTRODUCTION

Pharmaceuticals and Personal Care Products (PPCPs) and other organic compounds generally associated with municipal and industrial wastewaters have received increasing national and international attention and media coverage. New analytical techniques are now available, which allow researchers to detect very low concentrations of chemicals used in the pharmaceutical industry and in household consumer products. National studies have confirmed the presence of trace levels (low parts per trillion) of PPCPs in surface water, groundwater, and finished drinking water (Benotti and others, 2006 and 2009) (Kolpin and others, 2002).

Previous studies have established that PPCPs can originate from a variety of sources, but effluents from municipal wastewater treatment plants (WWTPs) and septic systems have been identified as a significant source to surface waters (Conn and others, 2006) (Glassmeyer and others, 2005). PPCPs enter WWTPs when people excrete pharmaceutical products or their metabolites, or flush unused medications down a drain into the sewer system (New York City Department of Environmental Protection (NYCDEP), 2010). PPCPs may also enter WWTPs from such activities as washing hands, bathing, or showering. Farm animals are another potential source of PPCPs because of the widespread use of veterinary drugs (Campagnolo and others, 2002).

Results of national reconnaissance studies of source waters in the United States show that pharmaceutical drugs detected nationally include steroids, prescription, and over-the-counter drugs such as antibiotics, antidepressants, anti inflammatory drugs, hormones, and other organic chemicals, which are not completely removed by the treatment process (Focazio and others, 2008). Personal care products detected nationally include detergents, insect repellants, plasticizers, and fragrances (Kolpin and others, 2002). PPCPs are not yet regulated under the Clean Water Act or the Safe Drinking Water Act, and Ohio has not yet developed any state regulatory standards for these compounds in natural waters or drinking water.

PPCPs have previously been detected in the Great Miami River Basin by the United States Geological Survey (USGS) (Rowe and others, 2004) and The Miami Conservancy District (MCD) (Ekberg and Pletsch, 2010). Both studies detected trace levels of PPCPs in surface water. Rowe and others sampled the Great Miami River at Hamilton and groundwater at 25 wells installed in urban areas on a monthly basis between October 2000 and September 2001. The samples were analyzed for 116 household chemicals and pharmaceuticals and 61 of the compounds were detected at least once in surface water. In groundwater, only 16 of the 116 household chemicals were detected. The frequency of detection for most chemicals was greater in surface water than in groundwater.

The human health risks associated with PPCPs in aquatic environments are largely unknown; however, the risks for drinking water supplies in the Great Miami River Basin are likely to be very low since groundwater is the source water for nearly all public water supplies and most reported PPCPs detections in groundwater tend to be in the low parts per trillion range. Drinking water treatment and disinfection may potentially reduce these already low PPCP concentrations even further. The American Water Works Association Research Foundation (AWWARF) recently reviewed screening level risk assessments performed on trace concentrations of PPCPs in drinking water and concluded that assessment work performed to date does not indicate a significant health risk to consumers (Snyder and others, 2008). In 2010, New York City Department of Environmental Protection (NYCDEP) published a report, *Occurrence of Pharmaceutical and Personal Care Products (PPCPs) in Source Water of the New York City Water Supply* (NYCDEP, 2010). The report documents the methodology used by the NYCDEP to investigate the occurrence of PPCPs in the source waters of the New York City Water Supply. A screening level risk assessment was used in the occurrence study to compare concentrations of PPCPs in source water with published or derived drinking water guidelines (DWGs) to determine a margin of exposure (MOE) based upon the number of eight ounce glasses of water one would have to consume to exceed a DWG. In this investigation of PPCP occurrence in natural waters of the Great Miami River Basin, we utilized the NYCDEP's methodology to calculate MOEs for source water.

Ecological impacts of PPCPs are also largely unknown, but recent studies have reported reproductive disruption of fish exposed to estrogens in wastewater effluent (Vajda and others, 2011). Antimicrobial resistance is another concern in aquatic environments, where the presence of low levels of PPCPs exists. One study documented the presence of bacterial tetracycline resistant genes in microbes sampled from groundwater downgradient of manure storage lagoons at a swine confinement facility (Krapac and others, 2004).

Currently, there is no state or federal mandatory testing or reporting requirements for PPCPs. MCD conducted this sampling investigation of PPCPs to determine the occurrence of these compounds in the streams and aquifers of the Great Miami River Basin, so our region will be better able to understand potential ecological impacts, educate the public, and anticipate the impacts of possible future regulations.

PURPOSE

MCD conducted an occurrence survey to document potential presence or absence of a target group of PPCPs in the streams and aquifers of the Great Miami River Basin. The survey was developed to (1.) determine occurrence of PPCP compounds and compare concentrations between higher flow and lower flow conditions; (2.) compare concentrations of PPCPs in WWTP effluent, surface water, and groundwater; (3.) investigate occurrences and concentrations of PPCPs in headwater areas to downstream areas in order to assess cumulative effects of WWTP effluents from upstream to downstream; and (4.) compare concentrations of PPCPs in groundwater with drinking water guidelines developed by NYCDEP to determine compound MOEs. MCD will use the results of this occurrence survey to assess the need for a continued program on emerging contaminants and to develop a more targeted program for subsequent years to investigate issues such as characterizing sources of PPCPs, assessing PPCP removal rates at the groundwater/surface water interface, and comparing the results of this survey with new human and ecological toxicity studies yet to be completed.

SITE SELECTION AND SAMPLING

MCD initiated the PPCP occurrence survey in the fall of 2010, with samples collected in October–November 2010 and April–May 2011. For the fall 2010 sampling event, MCD collected water samples at two WWTP effluent sites, twenty stream or river sites, seven monitoring wells, and two municipal production wells (**Tables 1 and 2**). For the spring 2011 sampling event, MCD collected water samples at three WWTP effluent sites, twenty stream or river sites, seven monitoring wells, and two production wells. The locations of all sampling sites are shown in **Figure 1**.

The wastewater effluent sites are all municipal owned wastewater treatment plants, which discharge into the Great Miami River. The sites were selected in order to obtain representative concentrations of PPCPs in effluent for comparison with surface water and groundwater.

Surface water sites were divided into two categories: rivers and headwater streams, based upon upstream watershed area. Headwater stream sites all had upstream watershed areas of less than 50 square miles. Four out of the five headwater streams did not have any municipal owned

WWTP effluent outfalls. All river sites had at least one municipal owned WWTP effluent outfall upstream of their location.

Groundwater sites consisted of seven monitoring well locations and three municipal production wells. All wells are installed in the Great Miami River Buried Valley Aquifer System (GMRBVAS) within 1.3 miles of the Great Miami River channel. The monitoring wells were constructed with 2-inch PVC casings and 10-foot well screens. Well depths ranged from 40 to 208 feet below the ground surface. Production wells sampled in this survey were large diameter, high capacity wells with depths ranging from 40 to 99 feet below ground surface.

In addition to the water samples collected at each site, MCD collected the following Quality Control (QC) samples:

- Sample Duplicate—MCD collected a sample and sample duplicate at one site during each round of sampling. Samples and sample duplicates were collected by filling one bottle immediately after the other. The purpose of the sample duplicate was to assess the laboratory performance by looking at the variance between the sample's results and the sample duplicate's results.

- Field Blank—MCD collected one field blank during each round of sampling. The purpose of the field blank was to assess contamination from field conditions during sampling. Field blanks were collected by pouring analyte-free water supplied by the contract laboratory into the sample bottles in the field.

FIELD METHODS

PPCPs are a class of emerging contaminants that are unregulated by U.S. Environmental Protection Agency (USEPA). Thus, there is no required sample collection or analytical procedure for water utilities or regulatory agencies. Because, the desired detection level of this occurrence survey is in the parts per trillion (ng/L) range, all samples were collected using the "*clean hands*" method (USEPA, 1996), as guidance to reduce the potential for contamination of samples from external sources. External sources of contaminants could include airborne dust, dirt, lint, as well as human contact with the samples (NYCDEP, 2010). Upon arrival at the sampling site, one member of the sampling team was designated as "*clean hands*" and one member as "*dirty hands.*" All activities involving contact with the sample bottle were conducted by "*clean hands.*" "*Dirty hands*" was responsible for all activities that did not involve direct contact with the sample.

At all stream and river sites, samples were collected manually by wading out into the thalweg of the channel, if conditions allowed, and filling the sample bottles directly from the stream. WWTP effluent outfalls were sampled directly at the outfall pipe. The production wells sampled in this survey all had sample taps, which allowed for easy bottle filling. The production wells were purged by making arrangements with the operator to have the wells turned on for several hours prior to sample collection. Monitoring wells sampled in this survey were equipped with dedicated bladder pumps and purged until the field parameters' pH, temperature, dissolved oxygen, and specific conductance stabilized indicating that stagnant water in the well casing had been removed. Sample bottles were filled directly from the bladder pump purge line once the field parameters stabilized.

ANALYTICAL METHODS

All samples were analyzed by Montgomery Watson Harza Laboratories (MWH) using a proprietary high pressure liquid chromatography and dual mass spectroscopy (LC/MS/MS) method referred to as Method ED2SCR (NYCDEP, 2010). MWH evaluated analyte detections in the context of minimum reporting levels (MRLs) established by their laboratory for each compound analyzed. The MRL is the minimum level or concentration that the laboratory can report accurately. The target analyte list for this survey included 21 compounds, which have been commonly detected in national water quality surveys (**Table 3**).

We evaluated laboratory precision based upon relative percent differences (RPDs) between replicate samples (sample and sample duplicate). Because of the exceptionally low concentrations of analytes in this investigation, very small differences in replicate samples lead to large RPDs. For this occurrence survey, we considered an RPD of 30 percent or less to be acceptable. A review of the analytical results for the samples and sample duplicates shows the relative percent differences for detected compounds range from 0 to 42 percent (**Table 4**). Only one compound (cotinine) was found to be above the desired RPD for the replicate sample collected in 2010. All other replicate sample results met the desired RPD standard.

Field blanks show that for most analytes, sampling and field procedures did not introduce contaminants into the water samples. There were two detections of PPCP compounds in the 2010 field blank. Iopromide was detected at a concentration of 10 ng/L, which is at the laboratory MRL concentration. Triclosan was detected at a concentration of 7 ng/L, 2 ng/L above the compound MRL. There were no detections of any PPCP compounds in the 2011 field blank.

RESULTS AND DISCUSSION

MCD initiated the PPCP occurrence survey in the fall of 2010, with samples collected in October–November 2010 and April–May 2011. Flows measured in the Great Miami River at the USGS Hamilton gaging station during the time period of each sampling event are shown in **Figure 2**. The Hamilton gaging station is the furthest rated gaging station downstream and closest to the mouth of the Great Miami River. Low flow conditions predominated during the fall 2010 sampling event with the measured flow in the Great Miami River at Hamilton falling below the 90 percent annual exceedance flow of 956 cubic feet per second (cfs). In contrast, the spring 2011 sampling event occurred during significant runoff events in the Great Miami River Basin with measured flows at Hamilton well above the 10 percent annual exceedance flow of 8,020 cfs for most of the sampling event. Results for each of the two sampling events are included in **Appendix A** of this report.

MWH reported detections above the MRL concentration for 17 out of the 21 compounds on the target analyte list in at least one sample (**Table 5**). The compounds estradiol, estrone, 17 alpha-ethinyl estradiol, and progesterone were not detected in any of the samples collected in this survey. A comparison of maximum concentrations detected in surface water and groundwater between the fall 2010 and the spring 2010 events is shown in **Figure 3**. This comparison does not include effluent samples, because we wanted to look at how in-stream flow conditions might impact PPCP concentrations in natural waters. The figure shows that fall 2010 maximum concentration for 11 out of the 17 compounds detected were higher than spring 2011 values. **Table 6** shows a comparison of maximum concentration, median, mean, and number of detections between the two sampling events. When a compound was not detected at a concentration above the MRL, the MRL concentration was used for the median and mean calculations. From the table one can conclude that median concentrations, mean concentrations, and number of detections above the MRL are similar (within the same order of magnitude) for most compounds. Mean concentrations of detected compounds tended to be higher for the fall 2010 event but not dramatically so. The compound sulfamethoxazole stood out as a lone exception with a much higher maximum concentration, median, and mean concentration for the fall 2010 sampling event when compared with the spring 2011 event. It is likely that the higher maximum detection concentrations reported for most compounds in 2010 were due to the lower flow conditions present during the sampling in 2010. Our results seem to suggest that higher river flows may dilute some PPCP compounds, which originate from municipal and domestic wastewater sources.

One of the purposes of this survey was to examine and compare the occurrence of PPCPs in municipal WWTP effluents with headwater streams, rivers, and aquifers. PPCP compounds detected in 100 percent of effluent samples collected in this survey include atenolol, butalbital, caffeine, carbamazepine, cotinine, fluoxetine, gemfibrozil, perfluorooctane sulfonate (PFOS), sulfamethoxazole, triclosan, and trimethoprim. PPCP compounds detected in 70 percent or more of the river samples collected in this survey include acetaminophen, caffeine, cotinine, gemfibrozil, ibuprofen, PFOS, sulfamethoxazole, triclosan, and trimethoprim (**Figure 4**). Only three PPCPs were detected in 70 percent or more of the headwater stream samples; caffeine, cotinine, and PFOS. In groundwater, sulfamethoxazole was the only PPCP compound detected with a frequency greater than 70 percent. The compounds diazepam, estradiol, estrone, 17 alpha-ethinyl estradiol, iopromide, and progesterone were not detected in any surface water or groundwater samples. Detection frequencies of PPCP compounds tended to be highest in effluent samples followed by river samples. The exceptions were the compounds acetaminophen and testosterone, which were detected more frequently in river samples. Detection frequencies were higher in headwater streams than in groundwater for the PPCPs acetaminophen, atenolol, butalbital, caffeine, cotinine, gemfibrozil, ibuprofen, and PFOS. The PPCPs carbamazepine, sulfamethoxazole, triclosan, and trimethoprim were detected at a greater frequency in groundwater samples than in the samples collected from headwater streams.

Maximum detection concentrations for each PPCP compound tended to be highest in samples collected from WWTP effluent (**Figure 5**). The lone exception was the compound bisphenol A (BPA), which had the highest detection concentration in a surface water sample. Maximum detection concentrations in river samples were greater than maximum detection concentrations in headwater stream samples for 12 out of the 16 compounds detected at concentrations above the MRL. Likewise maximum detection concentrations in river samples were greater than maximum detection concentrations in groundwater samples for 10 out of the 16 compounds detected at concentrations above the MRL.

A statistical comparison between PPCP concentrations in surface water and groundwater is shown in **Figure 6**. In the plots we combined the analytical results from river and headwater stream samples to create a larger sample size for statistical comparisons. The plots show that median and quartile values of measured concentrations of PPCPs in surface water tended to be higher than concentrations in groundwater samples.

UPSTREAM TO DOWNSTREAM PROFILES OF PPCP COMPOUNDS

Because the number and size of WWTP dischargers tends to increase from headwater areas of the Great Miami River Basin towards downstream areas, MCD designed this survey to examine differences in PPCP concentrations from upstream areas of the basin to downstream areas. **Figure 7** shows an upstream to downstream profile of six of the more frequently detected PPCPs in the Great Miami River and its tributary Bokengahalas Creek for samples collected in 2010. The profile shows a tendency for PPCP concentrations to be higher downstream of the Huber Heights sampling location. This tendency is most pronounced in the PPCP compounds caffeine and sulfamethoxazole. Sulfamethoxazole concentrations were among the highest of any PPCP concentrations measured during 2010 and showed a consistent increasing trend from upstream to downstream. Lower stream and river flows during the time of sample collection may have impacted upstream to downstream PPCP concentration trends due to the higher proportion of wastewater flow to total stream flow during the 2010 sample collection event.

The upstream to downstream PPCP concentration profile of the Great Miami River for samples collected in 2011 shows a similar but less pronounced trend of increasing concentrations downstream of Huber Heights for three of the compounds (**Figure 8**). The compounds acetaminophen, caffeine, and sulfamethoxazole all show concentration increases from upstream to downstream sample sites on the Great Miami River. This increasing trend is not apparent for carbamazepine, cotinine, and triclosan. Higher stream and river flows during the 2011 sample collection event probably reduced the proportion of wastewater flow to total stream flow. However, with the exception of the compound sulfamethoxazole, concentrations of other PPCP compounds in 2011 were similar to those measured in 2010.

It is likely that there is considerable variability on a daily, monthly, and seasonal basis in the concentrations of PPCPs originating from wastewater effluent and other sources of PPCPs. This source variability coupled with variability from other environmental factors such as in-stream flow dynamics and effluent mixing zones would make it very hard to predict PPCP compound concentrations on a given day.

IMPLICATIONS FOR DRINKING WATER

Human health risks associated with the presence of PPCPs in drinking water have not been thoroughly studied. However, a number of screening level risk assessments have been performed (Snyder and others, 2008; Wilson and others, 2006; Schwab and others 2005;

Schulman and others, 2002). The approach used in most of these screening level risk assessments is to use existing toxicological thresholds such as Acceptable Daily Intakes (ADIs) or Lowest or No Adverse Effect Levels to establish some type of toxicity reference value for each compound (USEPA, 2008). This reference value is then compared to screening level exposure estimates for the compound of interest. Some of the approaches determine a margin of exposure or MOE for the compound by dividing the toxicological threshold by the theoretical maximum intake or exposure from drinking water. This maximum exposure level is determined by two methods: (1.) an estimate of worst case conditions, and (2.) a more realistic estimate of the compound concentrations in drinking water.

For the purpose of this study, we chose to use the same approach as that used by the New York City Department of Environmental Protection (NYCDEP) in their report, *Occurrence of Pharmaceutical and Personal Care Products (PPCPs) in Source Water of the New York City Water Supply, May 26, 2010*. This approach is similar to that described in Snyder and others, 2008). The approach determined an MOE based upon the number of 8 oz glasses of water that would have to be consumed to exceed a DWG.

DWGs for individual PPCPs were derived by the NYCDEP based upon published values for acceptable daily intakes (ADIs), lowest therapeutic doses (LTDs), and maximum recommended therapeutic doses (MRTDs). The NYCDEP also utilized water recycling standards for PPCPs obtained from the publication *Australian Guidelines for Water Recycling, Augmentation of Drinking Water Supplies, May 2008* in deriving specific DWGs (Haemish and others, 2008). These Australian guidelines were developed to establish DWGs for recycled wastewater in Australia. The approach divided pharmaceutical compounds into two categories: (1.) those used solely for humans, and (2.) those used for veterinary purposes. For veterinarian pharmaceuticals, ADIs were established by various national and international food and agricultural organizations. For pharmaceuticals used solely by humans, the lowest therapeutic dose was divided by safety factors ranging from 1,000 to 10,000 to determine a surrogate—ADI. The DWGs were based upon the following calculation:

DWG = (ADI or s-ADI x BW x P)/V, where

ADI = Acceptable daily intake (µg/kg-day) as determined by international organizations

sADI = surrogate ADI (µg/kg-day) = lowest daily oral therapeutic dose for an adult (mg/day)/safety factor of 1,000 or 10,000

BW = body weight (70 kg)

V = volume of water consumed (2 L/day)

P=proportion of s-ADI from water = 100%

Since groundwater is the source water for nearly all public water systems in the Great Miami River Basin, we based our screening level exposure estimates on the highest detected concentration for each compound in groundwater. We assumed no removal of PPCPs in the drinking water treatment process. This represents the worst case scenario. **Table 7** shows our use of the NYCDEP approach for determining MOEs for the PPCPs detected in groundwater samples at concentrations above the laboratory MRL. MOEs were calculated using the following formula:

MOE (Number of 8 oz glasses of water/day) = [DWG x 2 (L/d) x 4.23 (8 oz glasses/L)] / (max water conc. (ng/L)).

This approach yielded MOEs ranging from 31 to over 224,000,000. The MOEs provide some perspective on the concentrations of PPCPs found in this survey. For example, the maximum concentration of butalbital measured in this survey was 6.6 ng/L. The DWG for butalbital is 175,000,000 ng/L. The calculated MOE for butalbital is 224,318,182 eight ounce glasses of water per day. Based on the maximum groundwater concentration of butalbital in this survey, someone would have to drink over 224 million eight ounce glasses of water to exceed published screening level risk-based drinking water guidelines.

PPCPs in the natural waters of the Great Miami River Basin are typically present in mixtures of two or more compounds. The screening level risk assessment approach used by the NYCDEP is suitable for evaluating one PPCP compound at a time. However this approach does not account for any potential additive, synergistic, or antagonistic effects that may potentially arise from a mixture of PPCP compounds. Furthermore, the approach only addresses environmental exposures through drinking water. It does not address issues such as potential impacts to aquatic ecosystems and development of antibiotic resistant strains of microbes. To evaluate these issues new approaches and risk assessment techniques will have to be developed.

CONCLUSIONS

The results of this survey indicate that PPCPs are present in very low concentrations (mostly less than 100 parts per trillion) in the streams and aquifers of the Great Miami River Basin. A total of 17 PPCP compounds were detected in at least one sampling event during this survey. Maximum concentrations of PPCPs in samples collected during low flow conditions tended to be higher when compared with maximum concentrations of PPCPs in samples collected during higher flows. In general, measured PPCP concentrations were highest in WWTP effluent. River samples had higher concentrations and detection frequencies of PPCPs than samples from headwater streams and groundwater. Groundwater samples tended to have the lowest detection frequencies and concentrations of PPCPs. The two most commonly detected PPCPs detected in groundwater were sulfamethoxazole and PFOS. Concentrations of PPCPs tended to show an increasing trend from upstream or headwater sampling sites to downstream sampling sites as the number and volume of WWTP discharges increased. PPCP concentrations in groundwater were well below published screening level risk-based drinking water guidelines. A screening level risk assessment for groundwater suggests that PPCPs in groundwater do not represent a significant health threat to local drinking water supplies that use groundwater as their source water.

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Figure 1. PPCP Sampling Location Sites

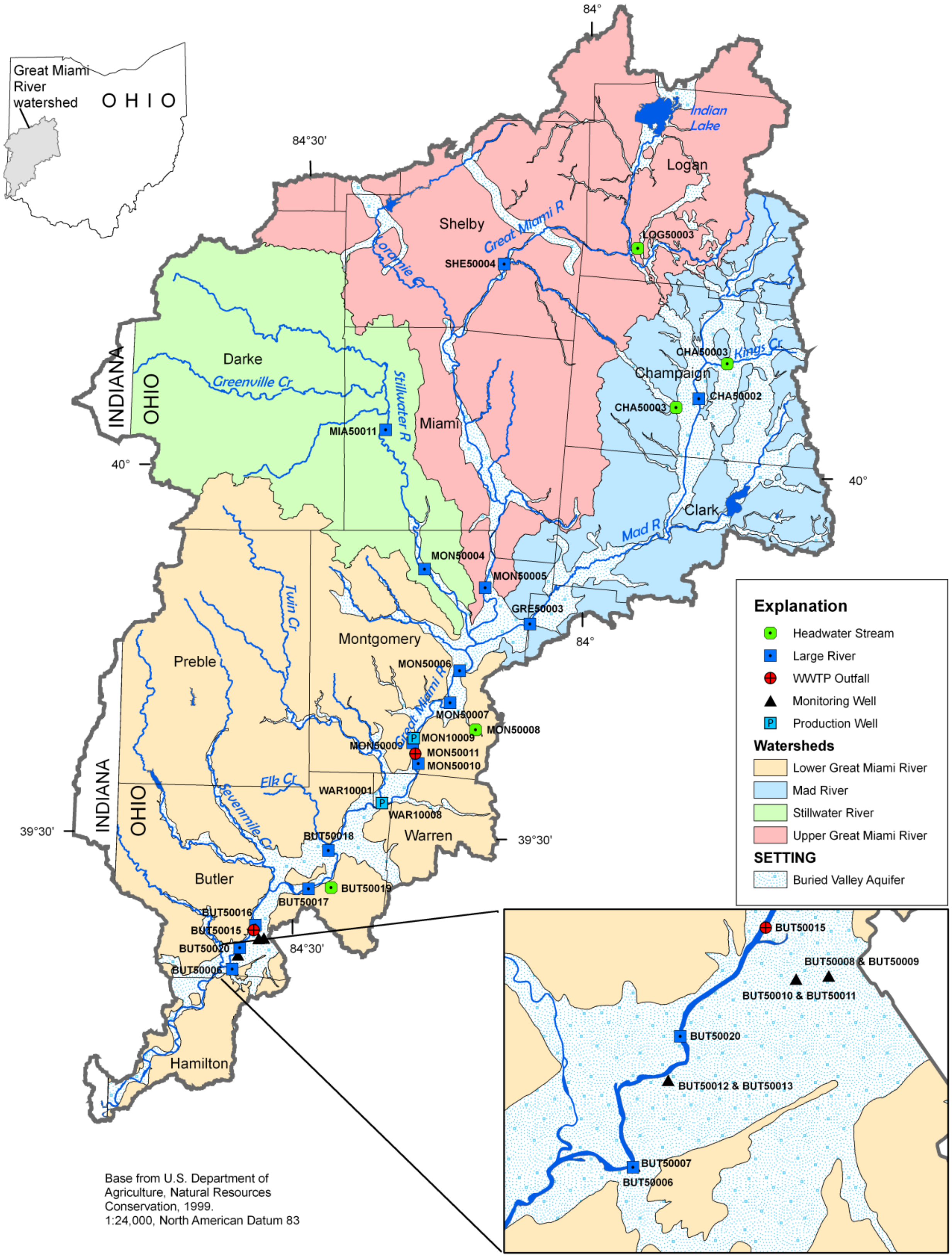

Figure 2. Great Miami River Flow at Hamilton during PPCP Sampling Events

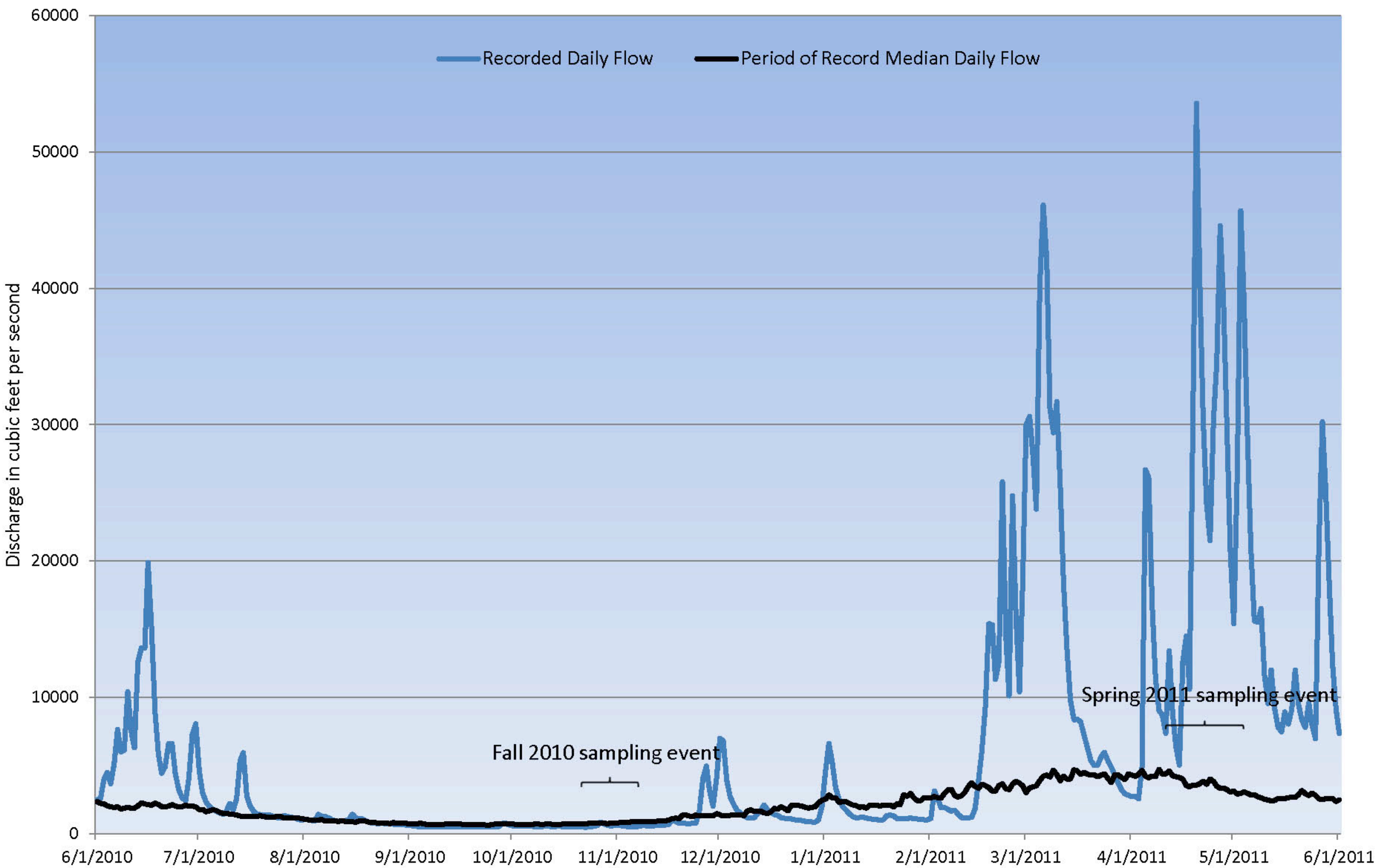

Figure 3. Comparison of Highest Measured Concentrations for PPCP Compounds between Fall 2010 and Spring 2011 Sampling Events

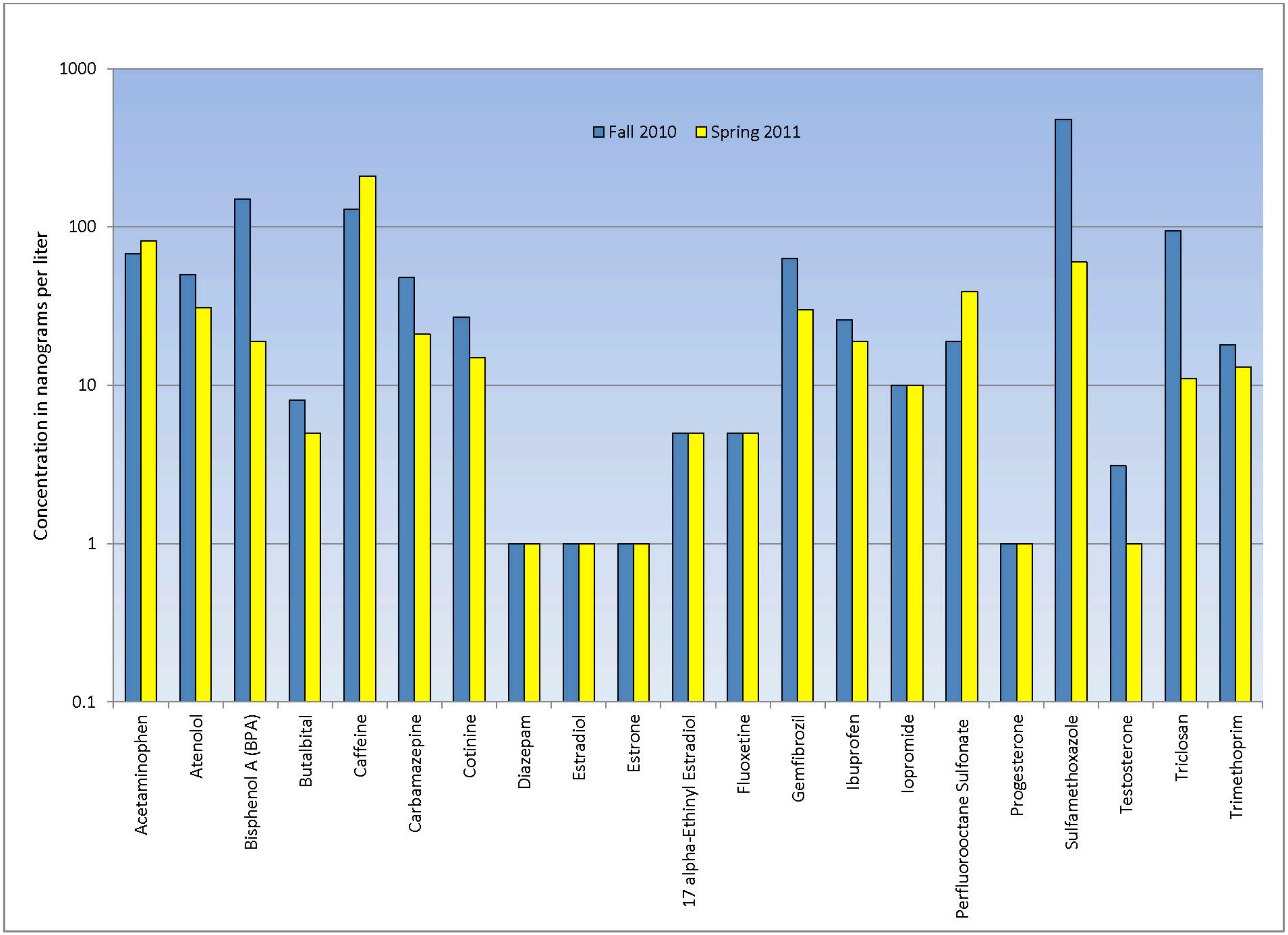

Figure 4. Detection Frequency of PPCP Compounds for All Samples Collected in This Survey

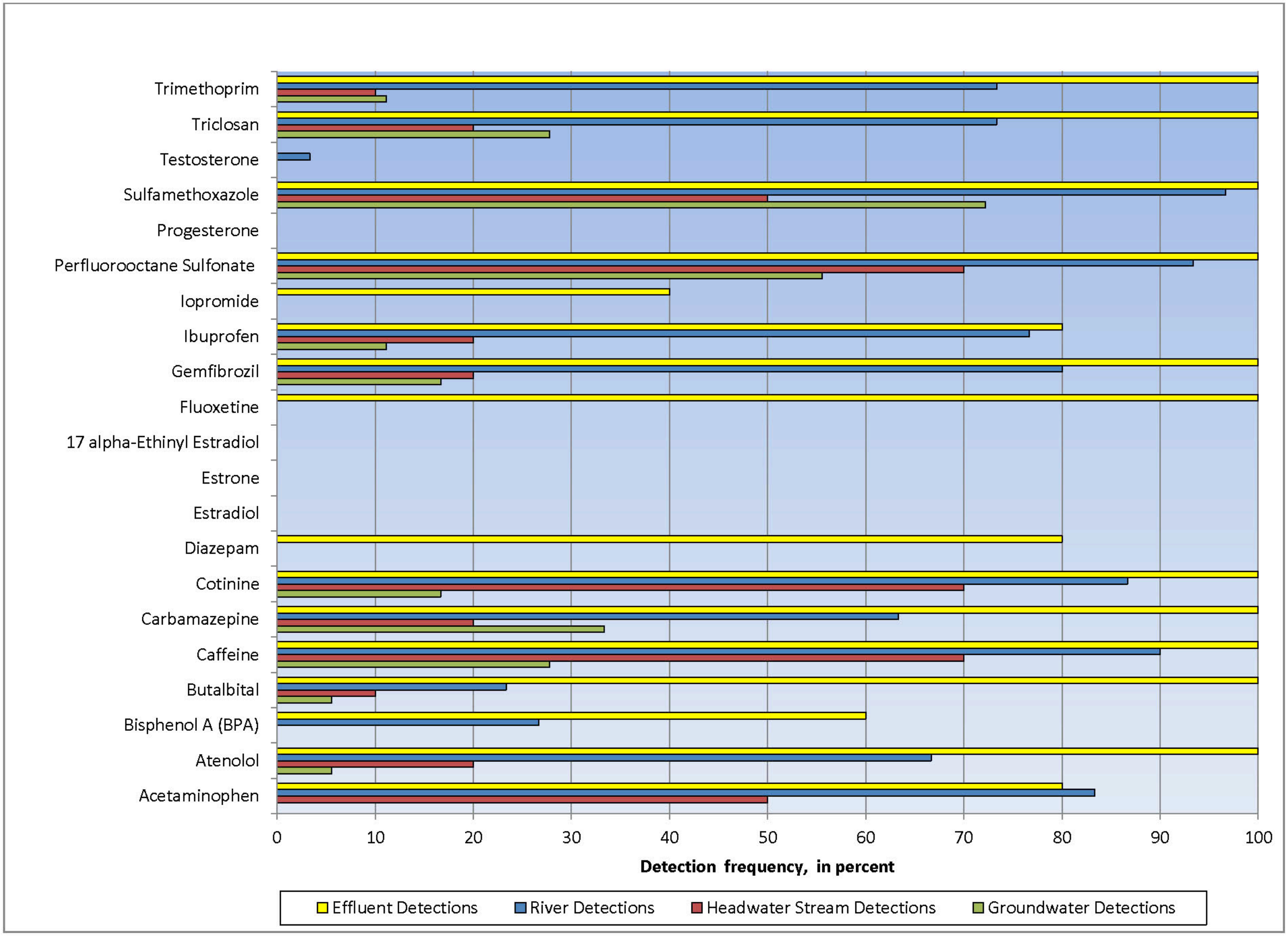

Figure 5. Comparison of Highest Measured Concentrations of PPCPs in Effluent, Rivers, Headwater Streams, and Groundwater for All Samples Collected in This Survey

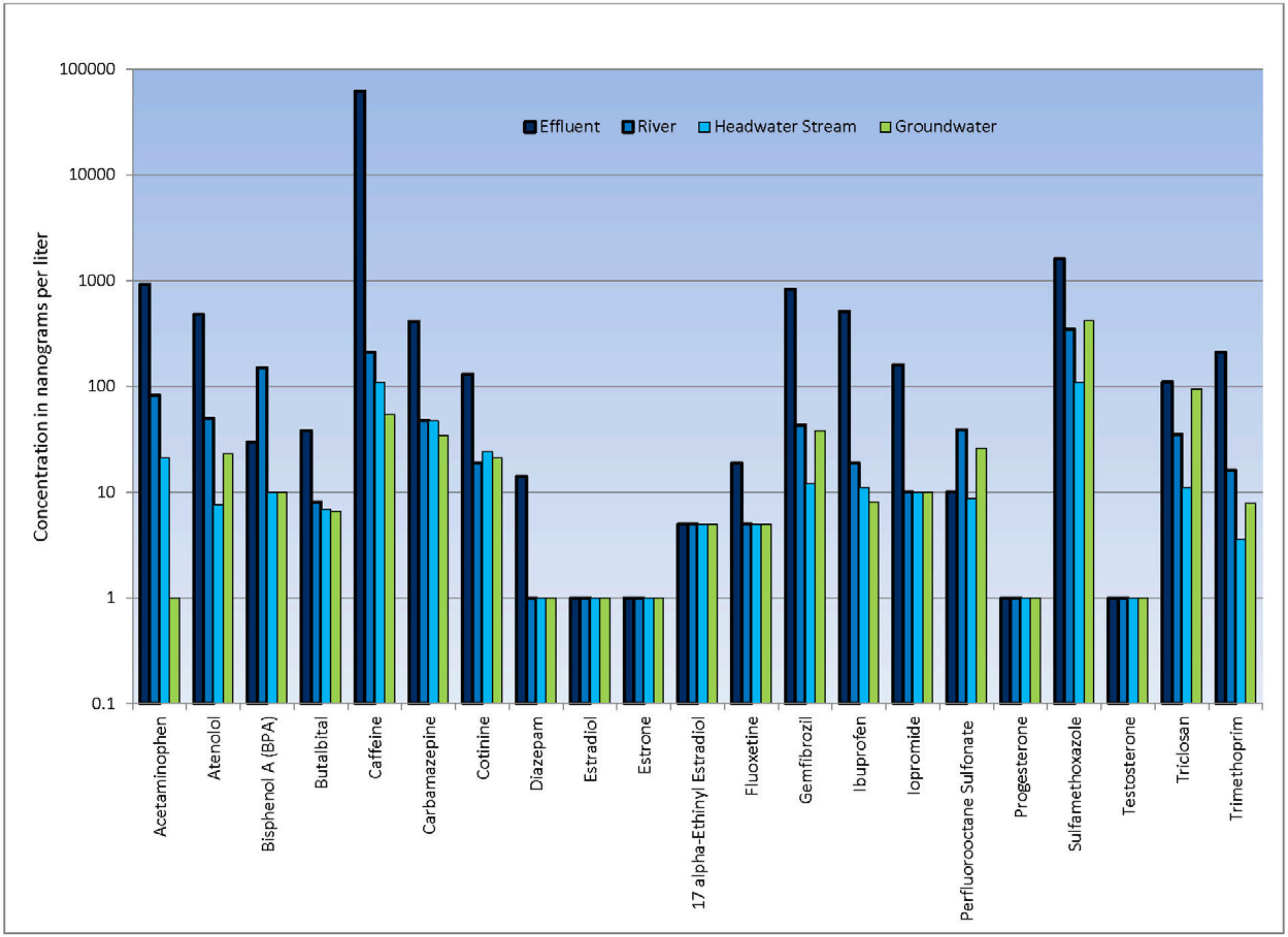

Figure 6A & 6B. Whisker Plots Showing Concentration Range of PPCP Compounds Measured in All Surface Water and Groundwater Samples Collected in 2010 and 2011

Figure 6A. Whisker Plot of All Surface Water Samples

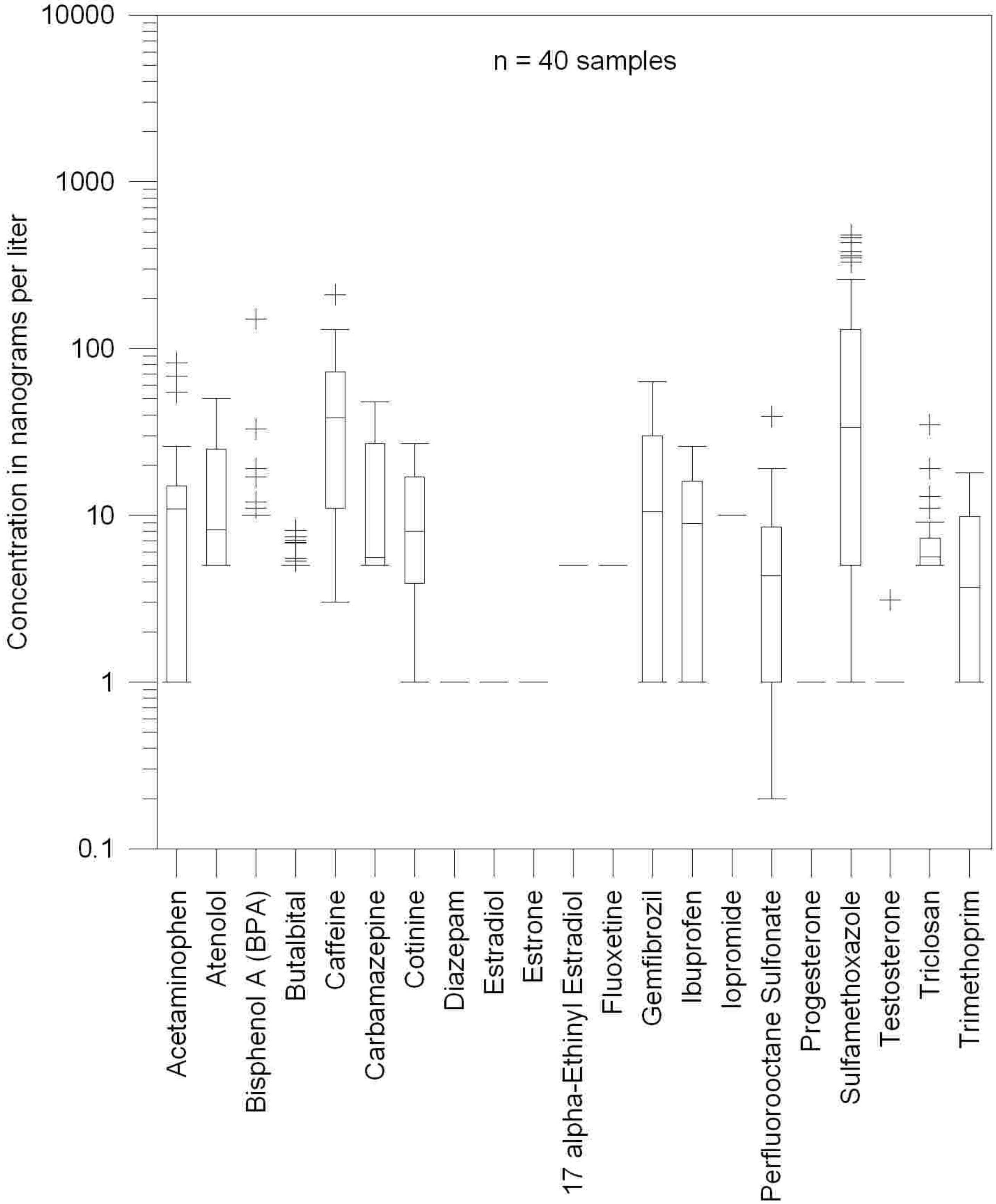

Figure 6B. Whisker Plot of All Groundwater Samples

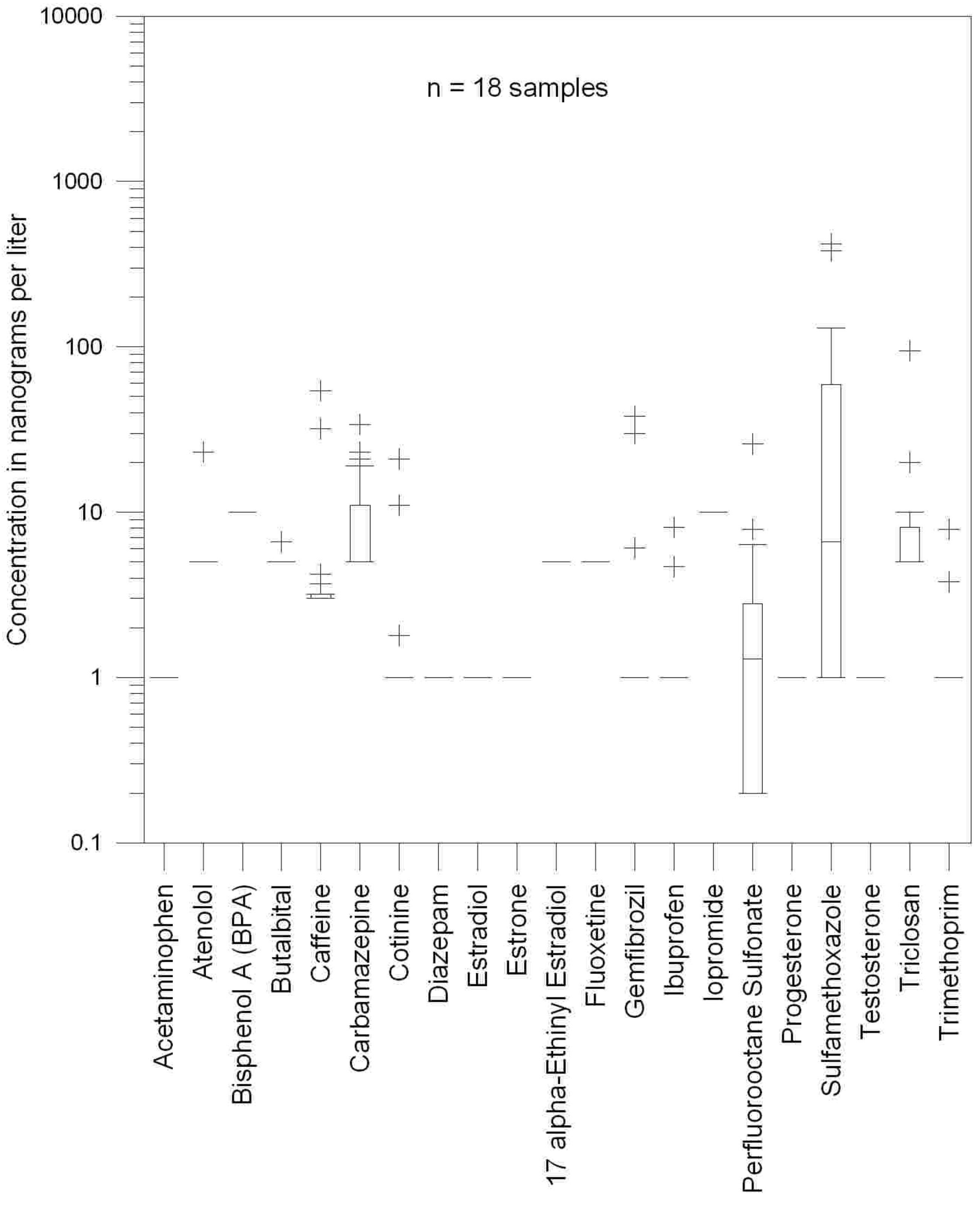

Figure 7. Downstream Profile of Six PPCP Compounds in the Great Miami River in 2010

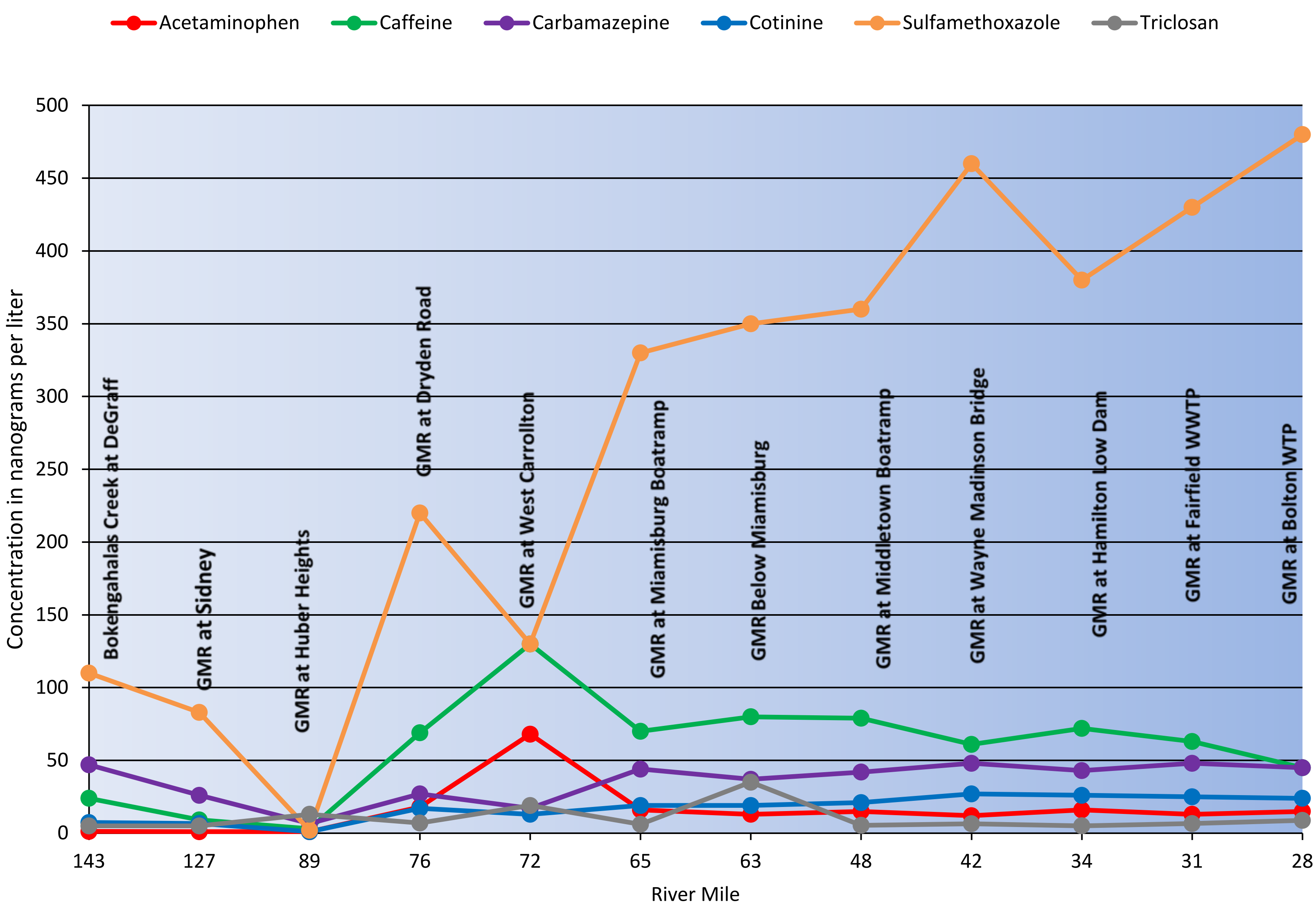

Figure 8. Downstream Profile of Six PPCP Compounds in the Great Miami River in 2011

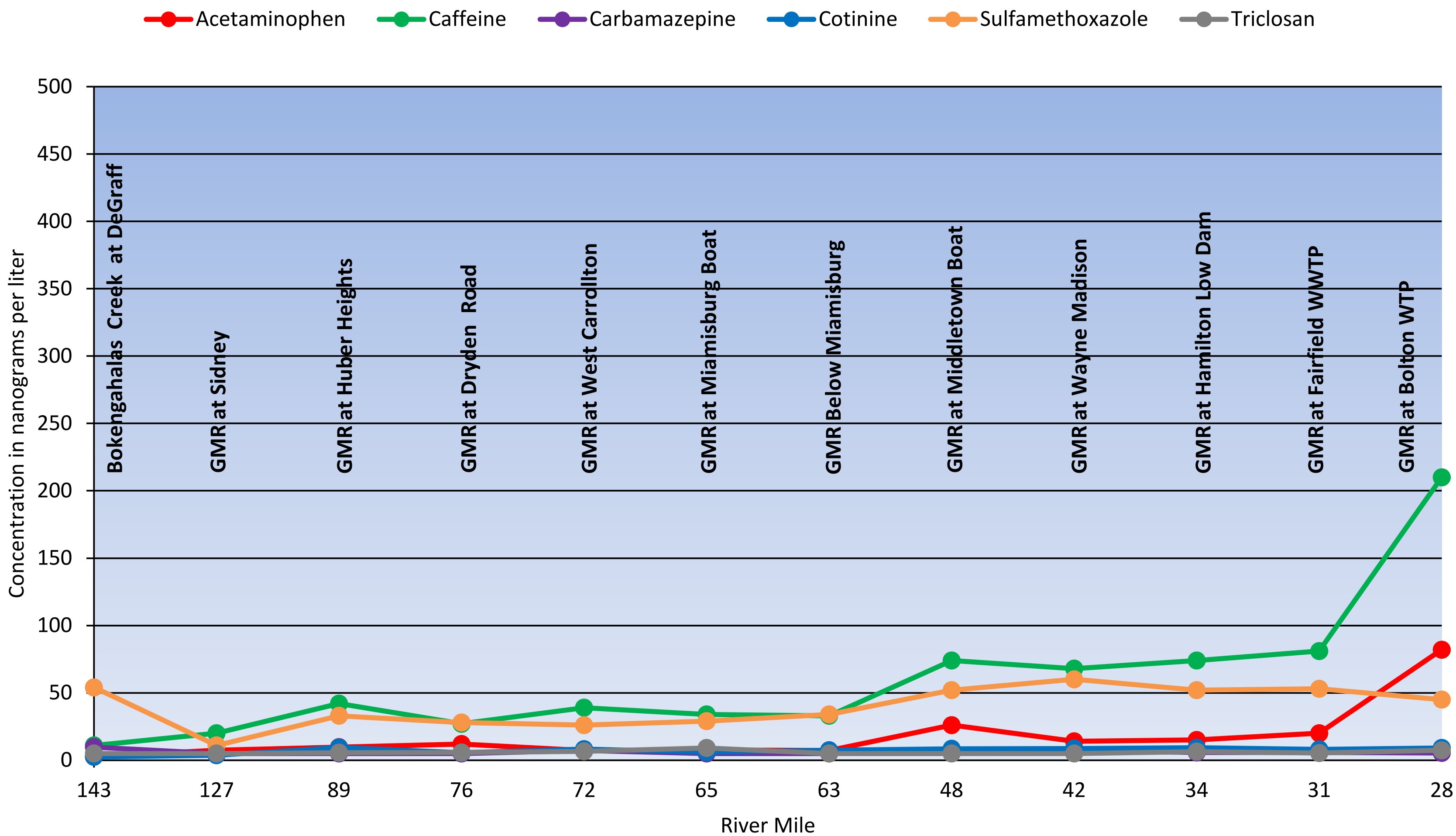

Table 1. Surface Water Sampling Sites

UNID	Sampling Location	Class	State Plane X*	State Plane Y*	Watershed	Watershed Area (mi^2)	WWTP Discharge Upgradient or Upstream?
BUT50006	GMR at Bolton WTP	River	1372631.22	486821.94	Great Miami River	3680	Yes
BUT50014	GMR at Hamilton Low Dam	River	1384221.13	508680.43	Great Miami River	3630	Yes
BUT50015	Hamilton WWTP Outfall	Effluent	1383347.82	506121.79	Great Miami River	3630	Yes
BUT50016	GMR at Fairfield WWTP	River	1376448.34	497362.03	Great Miami River	3650	Yes
BUT50017	GMR at Wayne Madison Bridge	River	1410701.04	526618.94	Great Miami River	3280	Yes
BUT50018	GMR at Middletown Boat Ramp	River	1420571.76	545768.96	Great Miami River	3190	Yes
BUT50019	Gregory Creek	Headwater Stream	1421882.23	527262.52	Gregory Creek	22.1	No
BUT50020	Fairfield WWTP Outfall	Effluent	1377034.73	497458.11	Great Miami River	3650	Yes
CHA50001	Kings Creek	Headwater Stream	1619269.80	787630.77	Kings Creek	30.2	No
CHA50002	Mad River at Urbana	River	1605100.23	770257.95	Mad River	162	Yes
CHA50003	Nettle Creek	Headwater Stream	1593782.93	765872.16	Nettle Creek	19	No
GRE50003	Mad River at Huffman Dam	River	1520944.85	658269.50	Mad River	635	Yes
LOG50003	Bokengahalas Creek at DeGraff	Headwater Stream	1574671.97	845027.45	Bokengahalas Creek	40.4	Yes
MIA50011	Stillwater River at Pleasant Hill	River	1449102.33	754875.96	Stillwater River	503	Yes
MON500010	GMR Below Miamisburg	River	1465341.62	588907.04	Great Miami River	2715	Yes
MON50004	Stillwater River at Englewood Dam	River	1468497.81	685614.99	Stillwater River	650	Yes
MON50005	GMR at Huber Heights	River	1498731.29	676343.31	Great Miami River	1160	Yes
MON50006	GMR at Dryden Road	River	1485990.41	635128.75	Great Miami River	2600	Yes
MON50007	GMR at West Carrollton	River	1481161.97	619131.55	Great Miami River	2610	Yes
MON50008	Holes Creek	Headwater Stream	1493875.50	605732.56	Holes Creek	18.7	No
MON50009	GMR at Miamisburg Boat Ramp	River	1462504.82	599306.55	Great Miami River	2720	Yes
MON50011	Miamisburg Effluent	Effluent	1463869.40	593791.62	Great Miami River	2720	Yes
SHE50004	GMR at Sidney	River	1508181.26	837236.76	Great Miami River	541	Yes

* State plane coordinates use Ohio State Plane South NAD83 (feet) coordinate system

Table 2. Groundwater Sampling Sites

UNID	Sampling Location	Well Type	State Plane X*	State Plane Y*	Watershed	Aquifer	Well Diameter (inches)	Well Depth (feet)	Well Screen Interval (feet)
BUT50007	FP1B	Monitoring Well	1372740.37	486919.87	Great Miami River	Buried Valley Aquifer	2	45	35–45
BUT50008	HSC-1S	Monitoring Well	1388439.05	502227.76	Great Miami River	Buried Valley Aquifer	2	50	40–50
BUT50009	HSC-1D	Monitoring Well	1388422.02	502231.01	Great Miami River	Buried Valley Aquifer	2	208	198–208
BUT50010	HSC-2S	Monitoring Well	1385799.79	501977.61	Great Miami River	Buried Valley Aquifer	2	50	40–50
BUT50011	HSC-2D	Monitoring Well	1385776.72	501969.47	Great Miami River	Buried Valley Aquifer	2	140	130–140
BUT50012	HSC-4D	Monitoring Well	1375460.20	493829.37	Great Miami River	Buried Valley Aquifer	2	80	70–80
BUT50013	HSC-4S	Monitoring Well	1375469.87	493829.37	Great Miami River	Buried Valley Aquifer	2	40	30–40
MON10009	Miamisburg Production Well #8	Production Well	1463098.89	601518.18	Great Miami River	Buried Valley Aquifer	20	66	41–66
WAR10001	Warren County Production Well #3	Production Well	1447286.94	569276.14	Twin Creek	Buried Valley Aquifer	18	99	45–98.5
WAR10008	Warren County Production Well #5	Production Well	1447179.04	569193.59	Twin Creek	Buried Valley Aquifer	18	40	29–40

* State plane coordinates use Ohio State Plane South NAD83 (feet) coordinate system

Table 3. Target Analyte List for the Occurrence Survey

MWH Method	Compounds Analyzed	MRL (ng/L)
EDC2SCR	Acetaminophen	1
	Atenolol	5
	Bisphenol A (BPA)	10
	Butalbital	5
	Caffeine	3
	Carbamazepine	5
	Cotinine	1
	Diazepam	1
	Estradiol	1
	Estrone	1
	17 alpha-Ethinyl Estradiol	5
	Fluoxetine	5
	Gemfibrozil	1
	Ibuprofen	1
	Iopromide	10
	Perfluorooctane Sulfonate (PFOS)	0.2
	Progesterone	1
	Sulfamethoxazole	1
	Testosterone	1
	Triclosan	5
	Trimethoprim	1

Table 4. Analytical Results for Replicate Samples and Field Blanks

UNID	Sampling Location	Units	Date Sampled	Class	Acetaminophen	Atenolol	Bisphenol A (BPA)	Butalbital	Caffeine	Carbamazepine	Cotinine
MON50011	Miamisburg Effluent	ng/L	11/3/2010	Effluent	<1	300	<10	38	26	410	17
MON50011	Miamisburg Effluent (Duplicate)	ng/L	11/3/2010	Duplicate	<1	390	<10	42	29	460	26
				RPD	0	26	0	10	11	11	42
MON50010	GMR Below Miamisburg	ng/L	5/11/2011	River	7.2	20	<10	<5	33	<5	7.4
MON50010	GMR Below Miamisburg (Duplicate)	ng/L	5/11/2011	Duplicate	7.9	19	<10	<5	38	<5	7.2
				RPD	9	5	0	0	14	0	3
MCD10001	Warren County—Twin Creek 3	ng/L	11/3/2010	Field Blank	<1	<5	<10	<5	<3	<5	<1
MCD10000	Warren County—Twin Creek 5	ng/L	5/11/2011	Field Blank	<1	<5	<10	<5	<3	<5	<1

UNID	Sampling Location	Units	Date Sampled	Class	Diazepam	Estradiol	Estrone	17 alpha-Ethinyl Estradiol	Fluoxetine	Gemfibrozil	Ibuprofen
MON50011	Miamisburg Effluent	ng/L	11/3/2010	Effluent	4.9	<1	<1	<5	19	25	<1
MON50011	Miamisburg Effluent (Duplicate)	ng/L	11/3/2010	Duplicate	4.5	<1	<1	<5	25	26	<1
				RPD	9	0	0	0	27	4	0
MON50010	GMR Below Miamisburg	ng/L	5/11/2011	River	<1	<1	<1	<5	<5	16	8.4
MON50010	GMR Below Miamisburg (Duplicate)	ng/L	5/11/2011	Duplicate	<1	<1	<1	<5	<5	16	8.5
				RPD	0	0	0	0	0	0	1
MCD10001	Warren County—Twin Creek 3	ng/L	11/3/2010	Field Blank	<1	<1	<1	<5	<5	<1	<1
MCD10000	Warren County—Twin Creek 5	ng/L	5/11/2011	Field Blank	<1	<1	<1	<5	<5	<1	<1

UNID	Sampling Location	Units	Date Sampled	Class	Iopromide	Perfluorooctane Sulfonate (PFOS)	Progesterone	Sulfamethoxazole	Testosterone	Triclosan	Trimethoprim
MON50011	Miamisburg Effluent	ng/L	11/3/2010	Effluent	160	2.6	<1	1500	<1	39	38
MON50011	Miamisburg Effluent (Duplicate)	ng/L	11/3/2010	Duplicate	180	2.5	<1	1600		47	38
				RPD	12	4	0	6	0	19	0
MON50010	GMR Below Miamisburg	ng/L	5/11/2011	River	<10	4.3	<1	34	<1	<5	7.1
MON50010	GMR Below Miamisburg (Duplicate)	ng/L	5/11/2011	Duplicate	<10	5.4	<1	33	<1	<5	7.1
				RPD	0	23	0	3	0	0	0
MCD10001	Warren County—Twin Creek 3	ng/L	11/3/2010	Field Blank	10	<0.2	<1	<1	<1	**7**	<1
MCD10000	Warren County—Twin Creek 5	ng/L	5/11/2011	Field Blank	<10	<0.2	<1	<1	<1	<5	<1

RPD—Relative Percent Difference

Table 5. Detected Compounds and Their Common Uses

Compound	Compound Use
Acetaminophen	Fever and pain reliever, nonprescription drug
Atenolol	Beta blocker, prescription drug
Bisphenol A (BPA)	Used in polycarbonate plastics and epoxy resins
Butalbital	Barbiturate, pain reliever, prescription drug
Caffeine	Stimulant found in coffee, chocolate, and soft drinks
Carbamazepine	Anticonvulsant, prescription drug
Cotinine	Nicotine metabolite
Diazepam	Anti-anxiety/insomnia, prescription drug
Fluoxetine	Antidepressant, prescription drug
Gemfibrozil	Treatment of elevated blood lipids, prescription drug
Ibuprofen	Anti-inflammatory, nonprescription drug
Iopromide	Contrast agent for medical scans
Perfluorooctane Sulfonate (PFOS)	Key ingredient in Scotchgard and fire-fighting foams
Sulfamethoxazole	Antibiotic
Testosterone	Reproductive hormone
Triclosan	Antibacterial agent used in many consumer products
Trimethoprim	Antibiotic

Table 6. Comparison of Analytical Results between Fall 2010 and Spring 2011 Sampling Events

Sample Event	Statistic	Acetaminophen	Atenolol	Bisphenol A (BPA)	Butalbital	Caffeine	Carbamazepine	Cotinine	Diazepam	Estradiol	Estrone	17 alpha-Ethinyl Estradiol
Fall 2010	Maximum	68	50	150	8.1	130	48	27	1	1	1	5
	Minimum	1	5	10	5	3	5	1	1	1	1	5
	Median	1	5	10	5	19	17	7.9	1	1	1	5
	Mean	8	16	16	6	34	21	11	1	1	1	5
	MRL	1	5	10	5	3	5	1	1	1	1	5
	# of Detections	13	11	4	9	19	18	18	0	0	0	0
Spring 2011	Maximum	82	31	19	5	210	21	15	1	1	1	5
	Minimum	1	5	10	5	3	5	1	1	1	1	5
	Median	7.2	5	10	5	28	5	5.2	1	1	1	5
	Mean	11	9	11	5	36	6	5	1	1	1	5
	MRL	1	5	10	5	3	5	1	1	1	1	5
	# of Detections	17	12	4	0	20	10	18	0	0	0	0

Sample Event	Statistic	Fluoxetine	Gemfibrozil	Ibuprofen	Iopromide	Perfluorooctane Sulfonate (PFOS)	Progesterone	Sulfamethoxazole	Testosterone	Triclosan	Trimethoprim
Fall 2010	Maximum	5	63	26	10	19	1	480	3.1	95	18
	Minimum	5	1	1	10	0.2	1	1	1	5	1
	Median	5	1	1	10	3	1	89	1	6.6	1
	Mean	5	19	7	10	5	1	163	1	12	5
	MRL	5	1	1	10	0.2	1	1	1	5	1
	# of Detections	0	13	12	0	22	0	22	1	20	12
Spring 2011	Maximum	5	30	19	10	39	1	60	1	11	13
	Minimum	5	1	1	10	0.2	1	1	1	5	1
	Median	5	1.4	4.2	10	2.4	1	20	1	5	1
	Mean	5	8	7	10	5	1	24	1	6	4
	MRL	5	1	1	10	0.2	1	1	1	5	1
	# of Detections	0	16	15	0	20	0	25	0	9	13

Table 7. Derivation of Margins of Exposure (MOEs) for PPCP Compounds Detected in Groundwater

Detected Compound	Max. Conc. in Groundwater (ng/L)	Toxicity Threshold	Basis	DWG (ng/L)	MOE Based on Number of Eight-ounce Glasses of Water/Day to Exceed DWG	Reference
Atenolol*	23	3,330 µg/kg/day	MRTD	116,550,000	42,870,130	2
Butalbital*	6.6	5,000 µg/kg/day	MRTD	175,000,000	224,318,182	2, 4
Caffeine*	54	100 mg/(8-oz. cup)		423,000,000	66,270,000	3, 4
Carbamazepine*	34	200 mg/day	LTD	100,000	24,882	1, 4
Cotinine*	21	20 mg/day	LTD	10,000	4,029	1, 4
Gemfibrozil*	38	1,200 mg/day	LTD	600,000	133,579	1, 4
Ibuprofen*	8.1	800 mg/day	LTD	400,000	417,778	1, 4
Perfluorooctane Sulfonate (PFOS)	26	30 µg/kg/day	ADI	200	65	5
Sulfamethoxazole	420	10 µg/kg/day	ADI	35,000	705	1, 4
Triclosan*	95	1.5 µg/kg/day	ADI	350	31	1
Trimethoprim*	7.9	20 µg/kg/day	ADI	70,000	74,962	1

* Found in fewer than 40% of groundwater samples.

Number of eight-ounce glasses/day = [DWG*2(L/d)*4.23 eight oz./L]/(max. water conc. (ng/L))

ADI = Acceptable Daily Intake—Maximum amount of a substance to which an individual can be exposed on a daily basis over his or her life span, without causing any harmful effects.
DWG = Drinking Water Guideline obtained from *Australian Guidelines for Water Recycling,* Augmentation of Drinking Water Supplies, May 2008, Environment Protection and Heritage Council, National Health and Medical Research Council, Natural Resource Management Ministerial Council.
LTD = Lowest Therapeutic Dose—The lowest dose which produces the desired clinical effect.
MRTD = Maximum Recommended Therapeutic Dose—The recommended maximum amount of drug to be given to a patient without causing adverse health effects.
NI = No Information

[1] Australian Guidelines for Water Recycling, Augmentation of Drinking Water Supplies, May 2008, Environmental Protection and Heritage Council, National Health and Medical Research Council, Natural Resource Management Ministerial Council.
[2] U.S. Food and Drug Administration (FDA), Maximum Recommended Therapeutic Dose (MRTD) Database.
[3] Gilbert S.G., *A Small Dose of Toxicology—The Health Effects of Common Chemicals*. CRC Press, Boca Raton, February 2004.
[4] New York City Department of Environmental Protection, Occurrence of Pharmaceutical and Personal Care Products (PPCPs) in Source Water of the New York City Water Supply, Mary 26, 2010.
[5] U.S. Environmental Protection Agency Provisional Health Advisories for Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS), January 8, 2009.

Appendix A Fall 2010 Sampling Event

UNID	Sampling Location	Units	Date Sampled	Class	Acetaminophen	Atenolol	Bisphenol A (BPA)	Butalbital	Caffeine
BUT50015	Hamilton Outfall	ng/L	10/20/2010	Effluent	920.0	480.0	30.0	30.0	62,000.0
MON50011	Miamisburg Effluent	ng/L	11/3/2010	Effluent	<1	300.0	<10	38.0	26.0
BUT50007	FP1B	ng/L	10/20/2010	Monitoring Well	<1	<5	<10	6.6	4.2
BUT50008	HSC-1S	ng/L	10/19/2010	Monitoring Well	<1	<5	<10	<5	<3
BUT50009	HSC-1D	ng/L	10/19/2010	Monitoring Well	<1	<5	<10	<5	3.7
BUT50010	HSC-2S	ng/L	10/20/2010	Monitoring Well	<1	<5	<10	<5	<3
BUT50011	HSC-2D	ng/L	10/20/2010	Monitoring Well	<1	<5	<10	<5	<3
BUT50012	HSC-4D	ng/L	10/18/2010	Monitoring Well	<1	23.0	<10	<5	54.0
BUT50013	HSC-4S	ng/L	10/18/2010	Monitoring Well	<1	<5	<10	<5	32.0
MON10009	Miamisburg Production Well #8	ng/L	11/3/2010	Production Well	<1	<5	<10	<5	<3
WAR10001	Warren County Production Well #3	ng/L	11/3/2010	Production Well	<1	<5	<10	<5	<3
BUT50006	GMR at Bolton WTP	ng/L	10/20/2010	River	15.0	46.0	12.0	7.1	45.0
BUT50014	GMR at Hamilton Low Dam	ng/L	10/20/2010	River	16.0	33.0	<10	7.4	72.0
BUT50016	GMR at Fairfield WWTP	ng/L	10/20/2010	River	13.0	36.0	11.0	6.8	63.0
BUT50017	GMR at Wayne Madison Bridge	ng/L	10/20/2010	River	12.0	50.0	<10	8.1	61.0
BUT50018	GMR at Middletown Boat Ramp	ng/L	10/20/2010	River	15.0	35.0	<10	7.4	79.0
CHA50002	Mad River at Urbana	ng/L	10/25/2010	River	<1	<5	<10	<5	<3
GRE50003	Mad River at Huffman Dam	ng/L	10/18/2010	River	8.3	25.0	<10	5.3	91.0
MIA50011	Stillwater River at Pleasant Hill	ng/L	10/25/2010	River	1.9	<5	<10	<5	19.0
MON500010	GMR Below Miamisburg	ng/L	10/19/2010	River	13.0	40.0	33.0	5.5	80.0
MON50004	Stillwater River at Englewood Dam	ng/L	10/18/2010	River	<1	<5	<10	<5	<3
MON50005	GMR at Huber Heights	ng/L	10/18/2010	River	<1	<5	<10	<5	<3
MON50006	GMR at Dryden Road	ng/L	10/18/2010	River	18.0	23.0	<10	<5	69.0
MON50007	GMR at West Carrollton	ng/L	10/18/2010	River	68.0	26.0	<10	<5	130.0
MON50009	GMR at Miamisburg Boat Ramp	ng/L	10/19/2010	River	16.0	42.0	150.0	<5	70.0
SHE50004	GMR at Sidney	ng/L	11/3/2010	River	<1	<5	<10	<5	9.1
BUT50019	Gregory Creek	ng/L	11/3/2010	Headwater Stream	<1	<5	<10	<5	43.0
CHA50001	Kings Creek	ng/L	10/25/2010	Headwater Stream	21.0	<5	<10	<5	<3
CHA50003	Nettle Creek	ng/L	10/25/2010	Headwater Stream	<1	<5	<10	<5	<3
LOG50003	Bokengahalas Creek at DeGraff	ng/L	10/25/2010	Headwater Stream	1.2	<5	<10	6.9	24.0
MON50008	Holes Creek	ng/L	10/19/2010	Headwater Stream	<1	<5	<10	<5	6.4

UNID	Sampling Location	Units	Date Sampled	Class	Carbamazepine	Cotinine	Diazepam	Estradiol	Estrone
BUT50015	Hamilton Outfall	ng/L	10/20/2010	Effluent	120.0	130.0	14.0	<1	<1
MON50011	Miamisburg Effluent	ng/L	11/3/2010	Effluent	410.0	17.0	4.9	<1	<1
BUT50007	FP1B	ng/L	10/20/2010	Monitoring Well	23.0	1.8	<1	<1	<1
BUT50008	HSC-1S	ng/L	10/19/2010	Monitoring Well	<5	<1	<1	<1	<1
BUT50009	HSC-1D	ng/L	10/19/2010	Monitoring Well	<5	<1	<1	<1	<1
BUT50010	HSC-2S	ng/L	10/20/2010	Monitoring Well	<5	<1	<1	<1	<1
BUT50011	HSC-2D	ng/L	10/20/2010	Monitoring Well	<5	<1	<1	<1	<1
BUT50012	HSC-4D	ng/L	10/18/2010	Monitoring Well	34.0	21.0	<1	<1	<1
BUT50013	HSC-4S	ng/L	10/18/2010	Monitoring Well	19.0	11.0	<1	<1	<1
MON10009	Miamisburg Production Well #8	ng/L	11/3/2010	Production Well	8.8	<1	<1	<1	<1
WAR10001	Warren County Production Well #3	ng/L	11/3/2010	Production Well	<5	<1	<1	<1	<1
BUT50006	GMR at Bolton WTP	ng/L	10/20/2010	River	45.0	24.0	<1	<1	<1
BUT50014	GMR at Hamilton Low Dam	ng/L	10/20/2010	River	43.0	26.0	<1	<1	<1
BUT50016	GMR at Fairfield WWTP	ng/L	10/20/2010	River	48.0	25.0	<1	<1	<1
BUT50017	GMR at Wayne Madison Bridge	ng/L	10/20/2010	River	48.0	27.0	<1	<1	<1
BUT50018	GMR at Middletown Boat Ramp	ng/L	10/20/2010	River	42.0	21.0	<1	<1	<1
CHA50002	Mad River at Urbana	ng/L	10/25/2010	River	<5	<1	<1	<1	<1
GRE50003	Mad River at Huffman Dam	ng/L	10/18/2010	River	34.0	19.0	<1	<1	<1
MIA50011	Stillwater River at Pleasant Hill	ng/L	10/25/2010	River	17.0	7.9	<1	<1	<1
MON500010	GMR Below Miamisburg	ng/L	10/19/2010	River	37.0	19.0	<1	<1	<1
MON50004	Stillwater River at Englewood Dam	ng/L	10/18/2010	River	<5	<1	<1	<1	<1
MON50005	GMR at Huber Heights	ng/L	10/18/2010	River	6.6	<1	<1	<1	<1
MON50006	GMR at Dryden Road	ng/L	10/18/2010	River	27.0	17.0	<1	<1	<1
MON50007	GMR at West Carrollton	ng/L	10/18/2010	River	17.0	13.0	<1	<1	<1
MON50009	GMR at Miamisburg Boat Ramp	ng/L	10/19/2010	River	44.0	19.0	<1	<1	<1
SHE50004	GMR at Sidney	ng/L	11/3/2010	River	26.0	6.7	<1	<1	<1
BUT50019	Gregory Creek	ng/L	11/3/2010	Headwater Stream	<5	24.0	<1	<1	<1
CHA50001	Kings Creek	ng/L	10/25/2010	Headwater Stream	<5	<1	<1	<1	<1
CHA50003	Nettle Creek	ng/L	10/25/2010	Headwater Stream	<5	<1	<1	<1	<1
LOG50003	Bokengahalas Creek at DeGraff	ng/L	10/25/2010	Headwater Stream	47.0	7.3	<1	<1	<1
MON50008	Holes Creek	ng/L	10/19/2010	Headwater Stream	<5	9.1	<1	<1	<1

UNID	Sampling Location	Units	Date Sampled	Class	17 alpha-Ethinyl Estradiol	Fluoxetine	Gemfibrozil	Ibuprofen
BUT50015	Hamilton Outfall	ng/L	10/20/2010	Effluent	<5	14.0	260.0	510.0
MON50011	Miamisburg Effluent	ng/L	11/3/2010	Effluent	<5	19.0	25.0	<1
BUT50007	FP1B	ng/L	10/20/2010	Monitoring Well	<5	<5	6.1	<1
BUT50008	HSC-1S	ng/L	10/19/2010	Monitoring Well	<5	<5	<1	<1
BUT50009	HSC-1D	ng/L	10/19/2010	Monitoring Well	<5	<5	<1	<1
BUT50010	HSC-2S	ng/L	10/20/2010	Monitoring Well	<5	<5	<1	<1
BUT50011	HSC-2D	ng/L	10/20/2010	Monitoring Well	<5	<5	<1	<1
BUT50012	HSC-4D	ng/L	10/18/2010	Monitoring Well	<5	<5	38.0	8.1
BUT50013	HSC-4S	ng/L	10/18/2010	Monitoring Well	<5	<5	30.0	4.7
MON10009	Miamisburg Production Well #8	ng/L	11/3/2010	Production Well	<5	<5	<1	<1
WAR10001	Warren County Production Well #3	ng/L	11/3/2010	Production Well	<5	<5	<1	<1
BUT50006	GMR at Bolton WTP	ng/L	10/20/2010	River	<5	<5	60.0	26.0
BUT50014	GMR at Hamilton Low Dam	ng/L	10/20/2010	River	<5	<5	63.0	26.0
BUT50016	GMR at Fairfield WWTP	ng/L	10/20/2010	River	<5	<5	57.0	25.0
BUT50017	GMR at Wayne Madison Bridge	ng/L	10/20/2010	River	<5	<5	55.0	9.4
BUT50018	GMR at Middletown Boat Ramp	ng/L	10/20/2010	River	<5	<5	49.0	18.0
CHA50002	Mad River at Urbana	ng/L	10/25/2010	River	<5	<5	<1	<1
GRE50003	Mad River at Huffman Dam	ng/L	10/18/2010	River	<5	<5	33.0	15.0
MIA50011	Stillwater River at Pleasant Hill	ng/L	10/25/2010	River	<5	<5	<1	<1
MON500010	GMR Below Miamisburg	ng/L	10/19/2010	River	<5	<5	43.0	10.0
MON50004	Stillwater River at Englewood Dam	ng/L	10/18/2010	River	<5	<5	<1	<1
MON50005	GMR at Huber Heights	ng/L	10/18/2010	River	<5	<5	<1	<1
MON50006	GMR at Dryden Road	ng/L	10/18/2010	River	<5	<5	40.0	10.0
MON50007	GMR at West Carrollton	ng/L	10/18/2010	River	<5	<5	11.0	16.0
MON50009	GMR at Miamisburg Boat Ramp	ng/L	10/19/2010	River	<5	<5	40.0	8.3
SHE50004	GMR at Sidney	ng/L	11/3/2010	River	<5	<5	<1	<1
BUT50019	Gregory Creek	ng/L	11/3/2010	Headwater Stream	<5	<5	<1	<1
CHA50001	Kings Creek	ng/L	10/25/2010	Headwater Stream	<5	<5	<1	<1
CHA50003	Nettle Creek	ng/L	10/25/2010	Headwater Stream	<5	<5	<1	<1
LOG50003	Bokengahalas Creek at DeGraff	ng/L	10/25/2010	Headwater Stream	<5	<5	<1	<1
MON50008	Holes Creek	ng/L	10/19/2010	Headwater Stream	<5	<5	<1	<1

UNID	Sampling Location	Units	Date Sampled	Class	Iopromide	Perfluorooctane Sulfonate (PFOS)	Progesterone
BUT50015	Hamilton Outfall	ng/L	10/20/2010	Effluent	<10	4.1	<1
MON50011	Miamisburg Effluent	ng/L	11/3/2010	Effluent	160.0	2.6	<1
BUT50007	FP1B	ng/L	10/20/2010	Monitoring Well	<10	3.8	<1
BUT50008	HSC-1S	ng/L	10/19/2010	Monitoring Well	<10	1.5	<1
BUT50009	HSC-1D	ng/L	10/19/2010	Monitoring Well	<10	<0.2	<1
BUT50010	HSC-2S	ng/L	10/20/2010	Monitoring Well	<10	<0.2	<1
BUT50011	HSC-2D	ng/L	10/20/2010	Monitoring Well	<10	<0.2	<1
BUT50012	HSC-4D	ng/L	10/18/2010	Monitoring Well	<10	2.8	<1
BUT50013	HSC-4S	ng/L	10/18/2010	Monitoring Well	<10	1.6	<1
MON10009	Miamisburg Production Well #8	ng/L	11/3/2010	Production Well	<10	6.4	<1
WAR10001	Warren County Production Well #3	ng/L	11/3/2010	Production Well	<10	<0.2	<1
BUT50006	GMR at Bolton WTP	ng/L	10/20/2010	River	<10	9.1	<1
BUT50014	GMR at Hamilton Low Dam	ng/L	10/20/2010	River	<10	8.5	<1
BUT50016	GMR at Fairfield WWTP	ng/L	10/20/2010	River	<10	19.0	<1
BUT50017	GMR at Wayne Madison Bridge	ng/L	10/20/2010	River	<10	17.0	<1
BUT50018	GMR at Middletown Boat Ramp	ng/L	10/20/2010	River	<10	6.3	<1
CHA50002	Mad River at Urbana	ng/L	10/25/2010	River	<10	<0.2	<1
GRE50003	Mad River at Huffman Dam	ng/L	10/18/2010	River	<10	9.1	<1
MIA50011	Stillwater River at Pleasant Hill	ng/L	10/25/2010	River	<10	0.5	<1
MON500010	GMR Below Miamisburg	ng/L	10/19/2010	River	<10	6.8	<1
MON50004	Stillwater River at Englewood Dam	ng/L	10/18/2010	River	<10	17.0	<1
MON50005	GMR at Huber Heights	ng/L	10/18/2010	River	<10	2.8	<1
MON50006	GMR at Dryden Road	ng/L	10/18/2010	River	<10	6.3	<1
MON50007	GMR at West Carrollton	ng/L	10/18/2010	River	<10	7.3	<1
MON50009	GMR at Miamisburg Boat Ramp	ng/L	10/19/2010	River	<10	6.7	<1
SHE50004	GMR at Sidney	ng/L	11/3/2010	River	<10	0.6	<1
BUT50019	Gregory Creek	ng/L	11/3/2010	Headwater Stream	<10	2.4	<1
CHA50001	Kings Creek	ng/L	10/25/2010	Headwater Stream	<10	<0.2	<1
CHA50003	Nettle Creek	ng/L	10/25/2010	Headwater Stream	<10	<0.2	<1
LOG50003	Bokengahalas Creek at DeGraff	ng/L	10/25/2010	Headwater Stream	<10	3.0	<1
MON50008	Holes Creek	ng/L	10/19/2010	Headwater Stream	<10	6.3	<1

UNID	Sampling Location	Units	Date Sampled	Class	Sulfamethoxazole	Testosterone	Triclosan	Trimethoprim
BUT50015	Hamilton Outfall	ng/L	10/20/2010	Effluent	1,600.0	<1	54.0	59.0
MON50011	Miamisburg Effluent	ng/L	11/3/2010	Effluent	1,500.0	<1	39.0	38.0
BUT50007	FP1B	ng/L	10/20/2010	Monitoring Well	420.0	<1	10.0	<1
BUT50008	HSC-1S	ng/L	10/19/2010	Monitoring Well	9.2	<1	20.0	<1
BUT50009	HSC-1D	ng/L	10/19/2010	Monitoring Well	<1	<1	9.6	<1
BUT50010	HSC-2S	ng/L	10/20/2010	Monitoring Well	1.5	<1	<5	<1
BUT50011	HSC-2D	ng/L	10/20/2010	Monitoring Well	<1	<1	<5	<1
BUT50012	HSC-4D	ng/L	10/18/2010	Monitoring Well	380.0	<1	95.0	7.9
BUT50013	HSC-4S	ng/L	10/18/2010	Monitoring Well	130.0	<1	8.1	3.8
MON10009	Miamisburg Production Well #8	ng/L	11/3/2010	Production Well	89.0	<1	<5	<1
WAR10001	Warren County Production Well #3	ng/L	11/3/2010	Production Well	<1	<1	<5	<1
BUT50006	GMR at Bolton WTP	ng/L	10/20/2010	River	480.0	3.1	8.8	15.0
BUT50014	GMR at Hamilton Low Dam	ng/L	10/20/2010	River	380.0	<1	5.1	13.0
BUT50016	GMR at Fairfield WWTP	ng/L	10/20/2010	River	430.0	<1	6.6	12.0
BUT50017	GMR at Wayne Madison Bridge	ng/L	10/20/2010	River	460.0	<1	6.5	18.0
BUT50018	GMR at Middletown Boat Ramp	ng/L	10/20/2010	River	360.0	<1	5.4	12.0
CHA50002	Mad River at Urbana	ng/L	10/25/2010	River	<1	<1	5.6	<1
GRE50003	Mad River at Huffman Dam	ng/L	10/18/2010	River	260.0	<1	11.0	7.0
MIA50011	Stillwater River at Pleasant Hill	ng/L	10/25/2010	River	78.0	<1	7.4	<1
MON500010	GMR Below Miamisburg	ng/L	10/19/2010	River	350.0	<1	35.0	15.0
MON50004	Stillwater River at Englewood Dam	ng/L	10/18/2010	River	17.0	<1	7.1	<1
MON50005	GMR at Huber Heights	ng/L	10/18/2010	River	2.0	<1	13.0	<1
MON50006	GMR at Dryden Road	ng/L	10/18/2010	River	220.0	<1	7.0	8.8
MON50007	GMR at West Carrollton	ng/L	10/18/2010	River	130.0	<1	19.0	5.1
MON50009	GMR at Miamisburg Boat Ramp	ng/L	10/19/2010	River	330.0	<1	6.1	16.0
SHE50004	GMR at Sidney	ng/L	11/3/2010	River	83.0	<1	<5	<1
BUT50019	Gregory Creek	ng/L	11/3/2010	Headwater Stream	<1	<1	<5	<1
CHA50001	Kings Creek	ng/L	10/25/2010	Headwater Stream	<1	<1	<5	<1
CHA50003	Nettle Creek	ng/L	10/25/2010	Headwater Stream	<1	<1	<5	<1
LOG50003	Bokengahalas Creek at DeGraff	ng/L	10/25/2010	Headwater Stream	110.0	<1	<5	<1
MON50008	Holes Creek	ng/L	10/19/2010	Headwater Stream	4.8	<1	11.0	<1

Fall 2011 Sampling Event

UNID	Sampling Location	Units	Date Sampled	Class	Acetaminophen	Atenolol	Bisphenol A (BPA)	Butalbital	Caffeine
MON50010	GMR Below Miamisburg A	ng/L	5/11/2011	Duplicate	7.9	19.0	<10	<5	38.0
BUT50020	Fairfield Outfall	ng/L	4/14/2011	Effluent	3.3	470.0	15.0	15.0	5.0
MON50011	Miamisburg Effluent	ng/L	5/11/2011	Effluent	8.9	280.0	<10	6.8	5.6
BUT50015	Hamilton Outfall	ng/L	4/14/2011	Effluent	230.0	290.0	26.0	13.0	1,000.0
MCD1000		ng/L	5/11/2011	Field Blank	<1	<5	<10	<5	<3
BUT50007	FP1B	ng/L	4/12/2011	Monitoring Well	<1	<5	<10	<5	<3
BUT50008	HSC-1S	ng/L	4/12/2011	Monitoring Well	<1	<5	<10	<5	<3
BUT50009	HSC-1D	ng/L	4/12/2011	Monitoring Well	<1	<5	<10	<5	<3
BUT50010	HSC-2S	ng/L	4/14/2011	Monitoring Well	<1	<5	<10	<5	<3
BUT50011	HSC-2D	ng/L	4/14/2011	Monitoring Well	<1	<5	<10	<5	<3
BUT50012	HSC-4D	ng/L	4/12/2011	Monitoring Well	<1	<5	<10	<5	<3
BUT50013	HSC-4S	ng/L	4/12/2011	Monitoring Well	<1	<5	<10	<5	<3
MON10009	Miamisburg Production Well #8	ng/L	5/11/2011	Production Well	<1	<5	<10	<5	3.2
WAR10008	Warren County Production Well #5	ng/L	5/11/2011	Production Well	<1	<5	<10	<5	<3
BUT50006	GMR at Bolton WTP	ng/L	4/12/2011	River	82.0	11.0	<10	<5	210.0
BUT50014	GMR at Hamilton Low Dam	ng/L	4/14/2011	River	15.0	14.0	12.0	<5	74.0
BUT50016	Fairfield WWTP	ng/L	4/14/2011	River	20.0	18.0	19.0	<5	81.0
BUT50017	GMR at Wayne Madison Bridge	ng/L	4/14/2011	River	14.0	18.0	17.0	<5	68.0
BUT50018	GMR at Middletown Boat Ramp	ng/L	4/14/2011	River	26.0	14.0	12.0	<5	74.0
CHA50002	Mad River at Urbana	ng/L	4/13/2011	River	<1	<5	<10	<5	6.1
GRE50003	Mad River at Huffman Dam	ng/L	5/11/2011	River	55.0	<5	<10	<5	38.0
MIA50011	Stillwater River at Pleasant Hill	ng/L	4/13/2011	River	13.0	<5	<10	<5	35.0
MON50010	GMR Below Miamisburg	ng/L	5/11/2011	River	7.2	20.0	<10	<5	33.0
MON50004	Stillwater River at Englewood Dam	ng/L	4/13/2011	River	12.0	<5	<10	<5	52.0
MON50005	GMR at Huber Heights	ng/L	4/13/2011	River	9.7	8.8	<10	<5	42.0
MON50006	GMR at Dryden Road	ng/L	5/11/2011	River	12.0	11.0	<10	<5	27.0
MON50007	GMR at West Carrollton	ng/L	5/11/2011	River	7.1	31.0	<10	<5	39.0
MON50009	GMR at Miamisburg Boat Ramp	ng/L	5/11/2011	River	7.6	15.0	<10	<5	34.0
SHE50004	GMR at Sidney	ng/L	4/13/2011	River	7.3	<5	<10	<5	20.0
BUT50019	Gregory Creek	ng/L	4/14/2011	Headwater Stream	8.0	<5	<10	<5	34.0
CHA50001	Kings Creek	ng/L	4/13/2011	Headwater Stream	<1	<5	<10	<5	<3
CHA50003	Nettle Creek	ng/L	4/13/2011	Headwater Stream	15.0	5.7	<10	<5	110.0
LOG50003	Bokengahalas Creek at DeGraff	ng/L	4/13/2011	Headwater Stream	2.7	7.6	<10	<5	11.0
MON50008	Holes Creek	ng/L	4/14/2011	Headwater Stream	<1	<5	<10	<5	28.0

UNID	Sampling Location	Units	Date Sampled	Class	Carbamazepine	Cotinine	Diazepam	Estradiol	Estrone
MON50010	GMR Below Miamisburg A	ng/L	5/11/2011	Duplicate	<5	7.2	<1	<1	<1
BUT50020	Fairfield Outfall	ng/L	4/14/2011	Effluent	90.0	37.0	1.7	<1	<1
MON50011	Miamisburg Effluent	ng/L	5/11/2011	Effluent	98.0	31.0	<1	<1	<1
BUT50015	Hamilton Outfall	ng/L	4/14/2011	Effluent	55.0	39.0	2.3	<1	<1
MCD1000		ng/L	5/11/2011	Field Blank	<5	<1	<1	<1	<1
BUT50007	FP1B	ng/L	4/12/2011	Monitoring Well	21.0	<1	<1	<1	<1
BUT50008	HSC-1S	ng/L	4/12/2011	Monitoring Well	<5	<1	<1	<1	<1
BUT50009	HSC-1D	ng/L	4/12/2011	Monitoring Well	<5	<1	<1	<1	<1
BUT50010	HSC-2S	ng/L	4/14/2011	Monitoring Well	<5	<1	<1	<1	<1
BUT50011	HSC-2D	ng/L	4/14/2011	Monitoring Well	<5	<1	<1	<1	<1
BUT50012	HSC-4D	ng/L	4/12/2011	Monitoring Well	6.0	<1	<1	<1	<1
BUT50013	HSC-4S	ng/L	4/12/2011	Monitoring Well	<5	<1	<1	<1	<1
MON10009	Miamisburg Production Well #8	ng/L	5/11/2011	Production Well	11.0	<1	<1	<1	<1
WAR10008	Warren County Production Well #5	ng/L	5/11/2011	Production Well	<5	<1	<1	<1	<1
BUT50006	GMR at Bolton WTP	ng/L	4/12/2011	River	5.4	9.1	<1	<1	<1
BUT50014	GMR at Hamilton Low Dam	ng/L	4/14/2011	River	5.7	9.2	<1	<1	<1
BUT50016	Fairfield WWTP	ng/L	4/14/2011	River	5.7	8.1	<1	<1	<1
BUT50017	GMR at Wayne Madison Bridge	ng/L	4/14/2011	River	7.1	8.7	<1	<1	<1
BUT50018	GMR at Middletown Boat Ramp	ng/L	4/14/2011	River	7.0	8.5	<1	<1	<1
CHA50002	Mad River at Urbana	ng/L	4/13/2011	River	<5	<1	<1	<1	<1
GRE50003	Mad River at Huffman Dam	ng/L	5/11/2011	River	<5	15.0	<1	<1	<1
MIA50011	Stillwater River at Pleasant Hill	ng/L	4/13/2011	River	<5	5.7	<1	<1	<1
MON50010	GMR Below Miamisburg	ng/L	5/11/2011	River	<5	7.4	<1	<1	<1
MON50004	Stillwater River at Englewood Dam	ng/L	4/13/2011	River	<5	5.9	<1	<1	<1
MON50005	GMR at Huber Heights	ng/L	4/13/2011	River	<5	9.5	<1	<1	<1
MON50006	GMR at Dryden Road	ng/L	5/11/2011	River	<5	5.6	<1	<1	<1
MON50007	GMR at West Carrollton	ng/L	5/11/2011	River	7.1	8.2	<1	<1	<1
MON50009	GMR at Miamisburg Boat Ramp	ng/L	5/11/2011	River	<5	6.0	<1	<1	<1
SHE50004	GMR at Sidney	ng/L	4/13/2011	River	<5	3.7	<1	<1	<1
BUT50019	Gregory Creek	ng/L	4/14/2011	Headwater Stream	<5	6.4	<1	<1	<1
CHA50001	Kings Creek	ng/L	4/13/2011	Headwater Stream	<5	<1	<1	<1	<1
CHA50003	Nettle Creek	ng/L	4/13/2011	Headwater Stream	<5	5.2	<1	<1	<1
LOG50003	Bokengahalas Creek at DeGraff	ng/L	4/13/2011	Headwater Stream	9.7	2.5	<1	<1	<1
MON50008	Holes Creek	ng/L	4/14/2011	Headwater Stream	<5	3.9	<1	<1	<1

UNID	Sampling Location	Units	Date Sampled	Class	17 alpha-Ethinyl Estradiol	Fluoxetine	Gemfibrozil	Ibuprofen
MON50010	GMR Below Miamisburg A	ng/L	5/11/2011	Duplicate	<5	<5	16.0	8.5
BUT50020	Fairfield Outfall	ng/L	4/14/2011	Effluent	<5	18.0	830.0	28.0
MON50011	Miamisburg Effluent	ng/L	5/11/2011	Effluent	<5	14.0	3.5	12.0
BUT50015	Hamilton Outfall	ng/L	4/14/2011	Effluent	<5	11.0	270.0	250.0
MCD1000		ng/L	5/11/2011	Field Blank	<5	<5	<1	<1
BUT50007	FP1B	ng/L	4/12/2011	Monitoring Well	<5	<5	<1	<1
BUT50008	HSC-1S	ng/L	4/12/2011	Monitoring Well	<5	<5	<1	<1
BUT50009	HSC-1D	ng/L	4/12/2011	Monitoring Well	<5	<5	<1	<1
BUT50010	HSC-2S	ng/L	4/14/2011	Monitoring Well	<5	<5	<1	<1
BUT50011	HSC-2D	ng/L	4/14/2011	Monitoring Well	<5	<5	<1	<1
BUT50012	HSC-4D	ng/L	4/12/2011	Monitoring Well	<5	<5	<1	<1
BUT50013	HSC-4S	ng/L	4/12/2011	Monitoring Well	<5	<5	<1	<1
MON10009	Miamisburg Production Well #8	ng/L	5/11/2011	Production Well	<5	<5	<1	<1
WAR10008	Warren County Production Well #5	ng/L	5/11/2011	Production Well	<5	<5	<1	<1
BUT50006	GMR at Bolton WTP	ng/L	4/12/2011	River	<5	<5	19.0	19.0
BUT50014	GMR at Hamilton Low Dam	ng/L	4/14/2011	River	<5	<5	25.0	16.0
BUT50016	Fairfield WWTP	ng/L	4/14/2011	River	<5	<5	25.0	16.0
BUT50017	GMR at Wayne Madison Bridge	ng/L	4/14/2011	River	<5	<5	30.0	19.0
BUT50018	GMR at Middletown Boat Ramp	ng/L	4/14/2011	River	<5	<5	23.0	18.0
CHA50002	Mad River at Urbana	ng/L	4/13/2011	River	<5	<5	<1	<1
GRE50003	Mad River at Huffman Dam	ng/L	5/11/2011	River	<5	<5	5.4	9.4
MIA50011	Stillwater River at Pleasant Hill	ng/L	4/13/2011	River	<5	<5	3.1	7.4
MON50010	GMR Below Miamisburg	ng/L	5/11/2011	River	<5	<5	16.0	8.4
MON50004	Stillwater River at Englewood Dam	ng/L	4/13/2011	River	<5	<5	5.9	14.0
MON50005	GMR at Huber Heights	ng/L	4/13/2011	River	<5	<5	20.0	13.0
MON50006	GMR at Dryden Road	ng/L	5/11/2011	River	<5	<5	9.9	4.2
MON50007	GMR at West Carrollton	ng/L	5/11/2011	River	<5	<5	11.0	11.0
MON50009	GMR at Miamisburg Boat Ramp	ng/L	5/11/2011	River	<5	<5	14.0	5.5
SHE50004	GMR at Sidney	ng/L	4/13/2011	River	<5	<5	1.3	<1
BUT50019	Gregory Creek	ng/L	4/14/2011	Headwater Stream	<5	<5	<1	11.0
CHA50001	Kings Creek	ng/L	4/13/2011	Headwater Stream	<5	<5	<1	<1
CHA50003	Nettle Creek	ng/L	4/13/2011	Headwater Stream	<5	<5	12.0	11.0
LOG50003	Bokengahalas Creek at DeGraff	ng/L	4/13/2011	Headwater Stream	<5	<5	1.4	<1
MON50008	Holes Creek	ng/L	4/14/2011	Headwater Stream	<5	<5	<1	<1

UNID	Sampling Location	Units	Date Sampled	Class	Iopromide	Perfluorooctane Sulfonate (PFOS)	Progesterone
MON50010	GMR Below Miamisburg A	ng/L	5/11/2011	Duplicate	<10	5.4	<1
BUT50020	Fairfield Outfall	ng/L	4/14/2011	Effluent	<10	10.0	<1
MON50011	Miamisburg Effluent	ng/L	5/11/2011	Effluent	<10	4.1	<1
BUT50015	Hamilton Outfall	ng/L	4/14/2011	Effluent	13.0	2.1	<1
MCD1000		ng/L	5/11/2011	Field Blank	<10	<0.2	<1
BUT50007	FP1B	ng/L	4/12/2011	Monitoring Well	<10	1.1	<1
BUT50008	HSC-1S	ng/L	4/12/2011	Monitoring Well	<10	1.6	<1
BUT50009	HSC-1D	ng/L	4/12/2011	Monitoring Well	<10	<0.2	<1
BUT50010	HSC-2S	ng/L	4/14/2011	Monitoring Well	<10	<0.2	<1
BUT50011	HSC-2D	ng/L	4/14/2011	Monitoring Well	<10	<0.2	<1
BUT50012	HSC-4D	ng/L	4/12/2011	Monitoring Well	<10	2.4	<1
BUT50013	HSC-4S	ng/L	4/12/2011	Monitoring Well	<10	26.0	<1
MON10009	Miamisburg Production Well #8	ng/L	5/11/2011	Production Well	<10	7.9	<1
WAR10008	Warren County Production Well #5	ng/L	5/11/2011	Production Well	<10	<0.2	<1
BUT50006	GMR at Bolton WTP	ng/L	4/12/2011	River	<10	8.7	<1
BUT50014	GMR at Hamilton Low Dam	ng/L	4/14/2011	River	<10	2.3	<1
BUT50016	Fairfield WWTP	ng/L	4/14/2011	River	<10	2.5	<1
BUT50017	GMR at Wayne Madison Bridge	ng/L	4/14/2011	River	<10	39.0	<1
BUT50018	GMR at Middletown Boat Ramp	ng/L	4/14/2011	River	<10	10.0	<1
CHA50002	Mad River at Urbana	ng/L	4/13/2011	River	<10	<0.2	<1
GRE50003	Mad River at Huffman Dam	ng/L	5/11/2011	River	<10	6.9	<1
MIA50011	Stillwater River at Pleasant Hill	ng/L	4/13/2011	River	<10	4.3	<1
MON50010	GMR Below Miamisburg	ng/L	5/11/2011	River	<10	4.3	<1
MON50004	Stillwater River at Englewood Dam	ng/L	4/13/2011	River	<10	1.0	<1
MON50005	GMR at Huber Heights	ng/L	4/13/2011	River	<10	4.0	<1
MON50006	GMR at Dryden Road	ng/L	5/11/2011	River	<10	4.4	<1
MON50007	GMR at West Carrollton	ng/L	5/11/2011	River	<10	6.5	<1
MON50009	GMR at Miamisburg Boat Ramp	ng/L	5/11/2011	River	<10	8.4	<1
SHE50004	GMR at Sidney	ng/L	4/13/2011	River	<10	1.1	<1
BUT50019	Gregory Creek	ng/L	4/14/2011	Headwater Stream	<10	8.7	<1
CHA50001	Kings Creek	ng/L	4/13/2011	Headwater Stream	<10	<0.2	<1
CHA50003	Nettle Creek	ng/L	4/13/2011	Headwater Stream	<10	0.7	<1
LOG50003	Bokengahalas Creek at DeGraff	ng/L	4/13/2011	Headwater Stream	<10	0.4	<1
MON50008	Holes Creek	ng/L	4/14/2011	Headwater Stream	<10	1.2	<1

UNID	Sampling Location	Units	Date Sampled	Class	Sulfamethoxazole	Testosterone	Triclosan	Trimethoprim
MON50010	GMR Below Miamisburg A	ng/L	5/11/2011	Duplicate	33.0	<1	<5	7.1
BUT50020	Fairfield Outfall	ng/L	4/14/2011	Effluent	310.0	<1	110.0	210.0
MON50011	Miamisburg Effluent	ng/L	5/11/2011	Effluent	350.0	<1	8.9	140.0
BUT50015	Hamilton Outfall	ng/L	4/14/2011	Effluent	520.0	<1	52.0	190.0
MCD1000		ng/L	5/11/2011	Field Blank	<1	<1	<5	<1
BUT50007	FP1B	ng/L	4/12/2011	Monitoring Well	21.0	<1	<5	<1
BUT50008	HSC-1S	ng/L	4/12/2011	Monitoring Well	6.3	<1	<5	<1
BUT50009	HSC-1D	ng/L	4/12/2011	Monitoring Well	<1	<1	<5	<1
BUT50010	HSC-2S	ng/L	4/14/2011	Monitoring Well	<1	<1	<5	<1
BUT50011	HSC-2D	ng/L	4/14/2011	Monitoring Well	1.3	<1	<5	<1
BUT50012	HSC-4D	ng/L	4/12/2011	Monitoring Well	4.0	<1	<5	<1
BUT50013	HSC-4S	ng/L	4/12/2011	Monitoring Well	9.0	<1	<5	<1
MON10009	Miamisburg Production Well #8	ng/L	5/11/2011	Production Well	59.0	<1	<5	<1
WAR10008	Warren County Production Well #5	ng/L	5/11/2011	Production Well	6.9	<1	<5	<1
BUT50006	GMR at Bolton WTP	ng/L	4/12/2011	River	45.0	<1	7.3	8.9
BUT50014	GMR at Hamilton Low Dam	ng/L	4/14/2011	River	52.0	<1	6.4	13.0
BUT50016	Fairfield WWTP	ng/L	4/14/2011	River	53.0	<1	5.3	9.8
BUT50017	GMR at Wayne Madison Bridge	ng/L	4/14/2011	River	60.0	<1	<5	12.0
BUT50018	GMR at Middletown Boat Ramp	ng/L	4/14/2011	River	52.0	<1	<5	9.3
CHA50002	Mad River at Urbana	ng/L	4/13/2011	River	5.0	<1	<5	<1
GRE50003	Mad River at Huffman Dam	ng/L	5/11/2011	River	13.0	<1	6.0	2.1
MIA50011	Stillwater River at Pleasant Hill	ng/L	4/13/2011	River	17.0	<1	<5	<1
MON50010	GMR Below Miamisburg	ng/L	5/11/2011	River	34.0	<1	<5	7.1
MON50004	Stillwater River at Englewood Dam	ng/L	4/13/2011	River	19.0	<1	<5	1.7
MON50005	GMR at Huber Heights	ng/L	4/13/2011	River	33.0	<1	5.6	5.9
MON50006	GMR at Dryden Road	ng/L	5/11/2011	River	28.0	<1	5.7	4.9
MON50007	GMR at West Carrollton	ng/L	5/11/2011	River	26.0	<1	6.6	3.8
MON50009	GMR at Miamisburg Boat Ramp	ng/L	5/11/2011	River	29.0	<1	9.1	4.6
SHE50004	GMR at Sidney	ng/L	4/13/2011	River	11.0	<1	<5	<1
BUT50019	Gregory Creek	ng/L	4/14/2011	Headwater Stream	<1	<1	<5	<1
CHA50001	Kings Creek	ng/L	4/13/2011	Headwater Stream	<1	<1	<5	<1
CHA50003	Nettle Creek	ng/L	4/13/2011	Headwater Stream	24.0	<1	11.0	3.6
LOG50003	Bokengahalas Creek at DeGraff	ng/L	4/13/2011	Headwater Stream	54.0	<1	<5	<1
MON50008	Holes Creek	ng/L	4/14/2011	Headwater Stream	1.5	<1	<5	<1