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FIRSTENERGY NUCLEAR OPERATING COMPANY

BEAVER VALLEY POWER STATION

2012 ANNUAL ENVIRONMENTAL OPERATING REPORT

NON-RADIOLOGICAL

UNITS NO. 1 AND 2

LICENSES DPR-66 AND NPF-73

BEAVER VALLEY POWER STATION
ENVIRONMENTAL & CHEMISTRY SECTION

Technical Report Approval

2012 ANNUAL ENVIRONMENTAL OPERATING REPORT

(Non-Radiological)

UNITS NO. 1 AND 2

LICENSES DPR-66 AND NPF-73

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1.0 EXECUTIVE SUMMARY

1.1 INTRODUCTION

This report is submitted in accordance with Section 5.4.1 of Appendix B to Facility Operating License No. NPF-73, Beaver Valley Power Station Unit 2, Environmental Protection Plan (Non-Radiological). Beaver Valley Power Station (BVPS) is operated by FirstEnergy Nuclear Operating Company (FENOC). The objectives of the Environmental Protection Plan (EPP) are:

- Verify that the facility is operated in an environmentally acceptable manner, as established by the Final Environmental Statement-Operating License Stage (FES-OL) and other NRC environmental impact assessments.
- Coordinate NRC requirements and maintain consistency with other federal, state, and local requirements for environmental protection.
- Keep NRC informed of the environmental effects of facility construction and operation and of actions taken to control those effects.

To achieve the objectives of the EPP FENOC has written programs and procedures to comply with the EPP, protect the environment, and comply with governmental requirements primarily including the U.S. Environmental Protection Agency (EPA) and the Pennsylvania Department of Environmental Protection (PA DEP) requirements. Water quality matters identified in the FES-OL are regulated under the National Pollutants Discharge Elimination System (NPDES) Permit No. PA0025615. Waste is regulated under EPA Identification No. PAR000040485. Attachment 10.1 contains a listing of permits and certificates for environmental compliance.

The BVPS programs and procedures include pre-work and pre-project environmental evaluations, operating procedures, pollution prevention and response programs, procedures and plans, process improvement and corrective action programs, and human performance programs. Technical and managerial monitoring of tasks, operations, and other activities are performed. Any identified challenges, concerns, or questions are captured in the FENOC problem identification and resolution program with a condition report. Condition reports include investigations, cause determinations, and corrective actions.

During 2012 FENOC continued an Aquatic Monitoring Program to evaluate the potential impact of BVPS on the New Cumberland Pool of the Ohio River, and to provide information on potential impacts to BVPS operation from macrofoulers such as Asian clams and zebra mussels.

1.2 SUMMARY AND CONCLUSIONS

There were no significant environmental events during 2012. During 2012, no significant changes to operations that could affect the environment were made at Beaver Valley Power Station. ***As in previous years, results of the BVPS environmental programs did not indicate any adverse environmental impacts from station operation.***

1.3 ANALYSIS OF SIGNIFICANT ENVIRONMENTAL CHANGE

During 2012, no significant changes were made at BVPS to cause significant negative affect on the environment.

1.4 AQUATIC MONITORING PROGRAM

The 2012 BVPS Units 1 and 2 Non-Radiological Monitoring Program consisted of an Aquatic Program that included surveillance and field sampling of the Ohio River's aquatic life in the vicinity of the station. The Aquatic Program is an annual program conducted to provide baseline aquatic resources data, to assess the impact of the operation of BVPS on the aquatic ecosystem of the Ohio River, and to monitor for potential impacts of biofouling organisms (*Corbicula* and zebra mussels) on BVPS operations. This is the 36th year of operational environmental monitoring for Unit 1 and the 25th year for Unit 2. As in previous years, the results of the program did not indicate any adverse environmental impact to the aquatic life in the Ohio River associated with the operation of BVPS.

The results of the 2012 benthic macroinvertebrate survey conducted in May and September indicated a normal community structure exists in the Ohio River both upstream and downstream of the BVPS. These benthic surveys are a continuation of a Fate and Effects Study conducted from 1990 through 1992 for the Pennsylvania Department of Environmental Protection (PA DEP) to assess the ecosystem impacts of the molluscicides Nalco product H150M and sodium hypochlorite that are used to control biofouling organisms at BVPS. To date the results of the benthic studies have not indicated any impacts of operation at the BVPS including the use of these biocides on the benthic community below the BVPS discharge.

Substrate was probably the most important factor influencing the distribution and abundance of the benthic macroinvertebrates in the Ohio River near BVPS. The generally soft muck-type substrate along the shoreline found in 2012 and previous years was conducive to segmented worm (oligochaete) and midge fly larvae (chironomid) proliferation. Fifty-three macroinvertebrate taxa were identified during the 2012 monitoring program. In 2012 one new taxon was added to the cumulative list of macroinvertebrates collected near BVPS. The new taxon was *Gyraulus* sp., an indigenous planorbid snail. No state or federal threatened or endangered macroinvertebrate species were collected during 2012.

In May oligochaetes were the most frequently collected group of macroinvertebrate, while in September chironomids were the most frequently collected group. ***There were no major differences in the community structure between control and non-control stations that could be attributed to operation of BVPS. The overall community structure has changed little since***

pre-operational years, and program results did not indicate that BVPS operations were affecting the benthic community of the Ohio River.

The fish community of the Ohio River near the BVPS was sampled in May (spring), July (summer), September (fall) and November (winter) of 2012 with electrofishing and seining. Since monitoring began in the early 1970's, the number of identified fish taxa has increased from 43 to 78 for the New Cumberland Pool.

Benthivores (bottom feeders including suckers and buffalo) and forage species (e.g., gizzard shad and emerald shiners) were generally collected in the highest numbers in 2012. The total number of forage species collected in 2012 was less than in 2011. Variations in annual catch were probably attributable to normal fluctuations in the population size of the forage species and the predator populations that rely on them. Forage species, such as gizzard shad and emerald shiner with high reproductive potentials, frequently respond to changes in natural environmental factors (competition, food availability, cover, and water quality) with large fluctuations in population size. This, in turn, influences their appearance in the sample populations during annual surveys. Spawning/rearing success due to abiotic factors is usually the determining factor of the size and composition of a fish community.

In 2012, the annual catch rate was 0.59 fish per minute. The greatest catch rate in 2012 occurred in fall (September) when the catch rate was 0.92 fish per minute. Gizzard shad and white bass contributed to the majority of this total. The lowest catch rate occurred in winter (November) with a rate of 0.33 fish per electrofishing minute. The annual catch rate in 2012 (0.59 fish per minute) was lower than in the previous three years (1.27 fish per minute in 2009, 1.09 in 2010, and 0.93 in 2011). This is probably caused by the need to electrofish during the day in May, July, and November 2012 rather than at night as in all previous years.

Little difference in the species composition of the catch was observed between the control (Station 1) and non-control (Stations 2A, 2B, and 3) stations. Habitat preference and availability were probably the most important factors affecting where and when fish were collected. ***Results from the 2012 fish surveys indicated that a normal community structure for the Ohio River exists near BVPS based on species composition and relative abundance. In 2012, there was no indication of negative impact to the fish community in the Ohio River from the operation of BVPS.***

The monthly reservoir Ponar samples collected in Units 1 and 2 cooling towers and the four samples collected at the intake during 2012 indicated that *Corbicula* were present in the Ohio River and entering the station. In 2012, no settled live *Corbicula* were collected from the Unit 1 cooling tower basin during monthly reservoir sampling (Table 5.20 and Figure 5.5); however two dead *Corbicula* were collected. One live settled *Corbicula* was collected from the Unit 2 cooling tower reservoir. Although only a few settled Corbicula were collected in cooling tower Ponar sampling in 2012, their presence in the river and in the cooling tower reservoirs in relatively high densities as juveniles, indicates that they are still available for settlement. ***Overall, the numbers of Corbicula collected in the samples were comparatively low, which continued the trend over the past few years of fewer Corbicula and reflected a water-body-wide trend observed in the Ohio River.***

In 1995, live zebra mussels were collected for the first time by divers in the BVPS main intake and auxiliary intake structures during scheduled cleanings. Overall, both the number of observations and densities of settled mussels were similar in 2003-present although somewhat higher in 2008 and 2010. In 2012, settlement was noted at the intake and at the barge slip. Overall, veliger densities in 2012 were lower than in 2010 and 2011. This is likely due to annual variability in numbers of veligers in the Ohio River. ***Although densities of settled mussels in the vicinity of BVPS are low compared to other populations such as in the Lower Great Lakes, densities comparable to those in the Ohio River are sufficient to cause problems in the operation of untreated cooling water intake systems.***

2.0 ENVIRONMENTAL PROTECTION PLAN NON-COMPLIANCES

There were no Environmental Protection Plan non-compliances identified in 2012.

3.0 CHANGES INVOLVING UNREVIEWED ENVIRONMENTAL QUESTIONS

No unreviewed environmental questions were identified in 2012. Therefore, there were no changes involving an unreviewed environmental question.

4.0 NON-ROUTINE ENVIRONMENTAL REPORTS

There were no non-routine environmental reports in 2012.

5.0 AQUATIC MONITORING PROGRAM

This section of the report summarizes the Non-Radiological Environmental Program conducted for the BVPS Units 1 and 2; Operating License Numbers DPR-66 and NPF-73. This is a non-mandatory program, because on February 26, 1980, the Nuclear Regulatory Commission (NRC) granted BVPS's request to delete all of the Aquatic Monitoring Program, with the exception of the fish impingement program (Amendment No. 25), from the Environmental Technical Specifications (ETS). In 1983, BVPS was permitted to also delete the fish impingement studies from the ETS program of required sampling along with non-radiological water quality requirements. However, in the interest of providing an uninterrupted database, BVPS has continued the Aquatic Monitoring Program.

The objectives of the 2012 environmental program were:

- To monitor for any possible environmental impact of BVPS operation on the benthic macroinvertebrate and fish communities in the Ohio River;
- To provide a low level sampling program to continue an uninterrupted environmental database for the Ohio River near BVPS, pre-operational to present; and
- To evaluate the presence, growth, and reproduction of macrofouling *Corbicula* (Asiatic clam) and zebra mussels (*Dreissena* spp.) at BVPS.

5.1 SITE DESCRIPTION

BVPS is located on an approximately 453-acre tract of land on the south bank of the Ohio River in the Borough of Shippingport, Beaver County, Pennsylvania. The Shippingport Atomic Power Station once shared the site with BVPS before being decommissioned. Figure 5.1 is a plan view of BVPS. The site is approximately one mile (1.6 km) from Midland, Pennsylvania; 5 miles (8 km) from East Liverpool, Ohio; and 25 miles (40 km) from Pittsburgh, Pennsylvania. The population within a 5-mile (8 km) radius of the plant is approximately 18,000. The Borough of Midland, Pennsylvania has a population of approximately 2,635 as determinded from the 2010 U.S Census.

The station is situated at Ohio River Mile 34.8 (Latitude: 40° 36' 18"; Longitude: 80° 26' 02") at a location on the New Cumberland Pool that is 3.1 river miles (5.3 km) downstream from Montgomery Lock and Dam and 19.6 miles (31.2 km) upstream from New Cumberland Lock and Dam. The Pennsylvania-Ohio-West Virginia border is 5.2 river miles (8.4 km) downstream from the site. The river flow is regulated by a series of dams and reservoirs on the Beaver, Allegheny, Monongahela, and Ohio Rivers and their tributaries.

The study site lies along the Ohio River in a valley, which has a gradual slope that extends from the river at an elevation of 665 ft (203 m) above mean sea level, to an elevation of 1,160 ft (354 m) along a ridge south of BVPS. The plant entrance elevation at the station is approximately 735 ft (224 m) above mean sea level.

BVPS Units 1 and 2 have a gross electrical output of 1983 megawatts (MW). Units 1 and 2 have a gross electrical output rating of 974 MW and 1009 MW, respectively. The circulating water systems for each unit are considered a closed cycle system with continuous overflow, using a cooling tower to minimize heat released to the Ohio River. Commercial operation of BVPS Unit 1 began in 1976 and Unit 2 began operation in 1987.

5.2 STUDY AREA

The environmental study area was established to assess potential impacts and consists of four sampling stations, each having a north and south shore (Figure 5.1). Station 1 is located at River Mile (RM) 34.5, approximately 0.3 miles (0.5 km) upstream of BVPS and is the control station. Station 2A is located approximately 0.5 miles (0.8 km) downstream of the BVPS discharge structure in the main channel. Station 2B is located in the back channel of Phillis Island, also 0.5 miles downstream of the BVPS discharge structure. Station 2B is the principal non-control station because the majority of discharges from BVPS Units 1 and 2 are released to this back channel. Station 3 is located approximately two miles (3.2 km) downstream of BVPS and only rarely is influenced by the BVPS discharge.

5.3 METHODS

Shaw Environmental, Inc. (Shaw) was contracted to perform the 2012 Aquatic Monitoring Program as specified in BVBP-ENV-001, "Aquatic Monitoring" (site procedural guide). This procedural guide references and describes in detail the field and laboratory procedures used in the various monitoring programs, as well as the data analysis and reporting requirements. These procedures are summarized according to task in the following subsections. Sampling was conducted according to the schedule presented in Table 5.1.

5.3.1 Benthic Macroinvertebrate Monitoring

The benthic macroinvertebrate monitoring program consisted of river bottom sampling using a Ponar grab sampler at four stations on the Ohio River. Prior to 1996, duplicate sampling occurred at Stations 1, 2A, and 3, while triplicate sampling occurred at Station 2B (i.e., one sample at each shoreline and mid-channel) (Figures 5.1 and 5.2). In 1996, a review of the sampling design indicated that sampling should be performed in triplicate at each station to conform to standardized EPA procedures. Therefore, starting in 1996, triplicate samples were taken at Stations 1, 2A, and 3, as in 1995, with triplicate samples also collected at each shore and mid-channel location at Station 2B. A petite Ponar dredge was used to collect these samples, replacing the standard Ponar dredge used in prior studies.

Benthic macroinvertebrate sampling was conducted as scheduled in May and September 2012. For each 2012 field effort, 18 benthic samples were collected and processed in the laboratory. All field procedures and data analyses were conducted in accordance with the procedural guide.

The contents of each Ponar grab sample were gently washed through a U.S. Standard No. 30 sieve, and the retained contents were placed in a labeled bottle and preserved in ethanol. In the laboratory, rose bengal stain was added to aid in sorting and identifying the benthic organisms. Macroinvertebrates were sorted from each sample, identified to the lowest taxon practical and counted. Mean density (number/m^2) for each taxon was calculated for each replicate. Four indices used to describe the benthic community were calculated: Shannon-Weiner diversity index, evenness (Pielou, 1969), species richness, and the number of taxa. These estimates provide an indication of the relative quality of the macroinvertebrate community.

5.3.2 Fish Monitoring

Fish sampling was conducted in 2012 to provide a continuous baseline of data and to detect possible changes that may have occurred in the fish populations in the Ohio River near BVPS. Fish population surveys have been conducted in the Ohio River near BVPS annually from 1970 through 2012. These surveys have resulted in the collection of 73 fish species and five different hybrids.

Adult fish surveys were successfully conducted as scheduled in May, July, September, and November 2012. During each survey, fish were scheduled to be sampled at four stations (Stations 1, 2A, 2B, and 3) (Figure 5.3) by seines during the day and by standardized electrofishing techniques at night. Due to damage to the onsite boat launch, the crew was required to launch the boat from the Lock 57 Community Park Boat Launch located near Glasgow, Pennsylvania. The launch was only open until one hour after dark, so it was necessary to conduct electrofishing efforts during the day in May and July. Some stone fill was added around the onsite launch in the summer, so electrofishing was attempted from there and completed at night in September. Even with the fill, launching at the onsite ramp was very difficult. It was decided to revert to launching at the public launch in November and electrofish during the day. Electrofishing was completed at all stations and months except in November when unexpected heavy rain that continued until dark made collecting a sample at Station 3 unsafe. Seining was scheduled to be performed at Station 1 (north shore) and Station 2B (south shore of Phillis Island) to sample species that are generally under-represented in electrofishing catches (e.g., young-of-the-year fish and small cyprinids). All seining efforts were successfully completed.

Electrofishing was conducted using a boat-mounted electroshocker with floodlights attached to the bow. A Smith-Root Type VI A variable voltage, pulsed-DC electrofishing unit powered by a 5-kW generator was used. The voltage selected depended on water conductivity and was adjusted to provide constant amperage (4-6 amps) of the current through the water. The north and south shoreline areas at each station were shocked for at least ten minutes of unit "on" time (approximately five minutes along each shore) during each survey.

When large schools of fish of a single non-game species such as gizzard shad and shiners were encountered during electrofishing efforts, all of the stunned fish were not netted and retrieved onboard the boat. A few fish were netted for verification of identity, and the number of observed

stunned fish remaining in the water was estimated. The size range of the individual fish in the school was also estimated and recorded. This was done in an effort to expedite sample processing and cover a larger area during the timed electrofishing run. Regardless of the number of individuals, all game fish were boated when observed.

Fish seining was performed at Station 1 (control) and Station 2B (non-control) during each of the four 2012 BVPS fishery surveys. A 30-ft long bag seine made of 1/4-inch nylon mesh netting was used to collect fish located close to shore in one to four feet of water. Three seine hauls were performed at both Station 1 (north shore) and Station 2B (south shore of Phillis Island) during each survey.

Fish collected during electrofishing and seining efforts were processed according to standardized procedures. All captured game fishes were identified to species, counted, measured for total length (nearest 1 mm), and weighed (nearest 1 g for fish less than or equal to 1000 g and the nearest 5 g for all other fish). Non-game fishes were counted, and a random subsample of lengths was taken. Live fish were returned to the river immediately after processing was completed. All fish that were unidentifiable or of questionable identification and were obviously not on the endangered or threatened species list were placed in plastic sample bottles, preserved, labeled, and returned to the laboratory for identification. Any species of fish that had not previously been collected at BVPS was retained for the voucher collection. Any threatened or endangered species (if collected) would be photographed and released.

5.3.3 *Corbicula* Density Determinations for Cooling Tower Reservoirs

The *Corbicula* Monitoring Program at BVPS includes sampling the circulating river water and the service water systems of the BVPS (intake structure and cooling towers). The objectives of the ongoing Monitoring Program are to evaluate the presence of *Corbicula* at BVPS and to evaluate the potential for and timing of infestation of the BVPS. This program is conducted in conjunction with a program to monitor for the presence of macrofouling zebra mussels (see Section 5.3.5).

Corbicula enter BVPS from the Ohio River by passing through the water intakes, and eventually settle in low flow areas including the lower reservoirs of the Units 1 and 2 cooling towers. The density and growth of these *Corbicula* were monitored by collecting monthly samples from the lower reservoir sidewalls and sediments. The sampler used on the sidewalls consisted of a D-frame net attached behind a 24-inch long metal scraping edge. This device was connected to a pole long enough to allow the sampler to extend down into the reservoir area from the outside wall of the cooling tower. Sediments were sampled with a petite Ponar dredge.

Cooling tower reservoir sampling was historically conducted once per month. Beginning in December 1997, it was decided to forego sampling in cold water months since buildup of *Corbicula* does not occur then. Monthly sampling has been maintained throughout the warmer water months of the year. In 2012 sampling began in March and ended in mid-November.

In 2012, once each month (March through November), a single petite Ponar grab sample was

taken in the reservoir of each cooling tower to obtain density and growth information on *Corbicula* present in the bottom sediment. The samples collected from each cooling tower were returned to the laboratory and processed. Samples were individually washed, and any *Corbicula* removed and rinsed through a series of stacked U.S. Standard sieves that ranged in mesh size from 1.00 mm to 9.49 mm. Live and dead clams retained in each sieve were counted, and the numbers were recorded. The size distribution data obtained using the sieves reflected clam width, rather than length. Samples containing a small number of *Corbicula* were not sieved; individuals were measured and placed in their respective size categories. A scraping sample of about 12 square feet was also collected at each cooling tower during each monthly sampling effort. This sample was processed in a manner consistent with the petit Ponar samples.

Population surveys of both BVPS cooling tower reservoirs have been conducted during scheduled outages (1986 to present) to estimate the number of *Corbicula* present in these structures. During the scheduled shutdown period for each unit, each cooling tower reservoir bottom is sampled by petite Ponar at standardized locations within the reservoir. Counts of live and dead clams and determination of density were made. There were no scheduled outages during 2012 when samples were collected.

5.3.4 *Corbicula* Juvenile Monitoring

The *Corbicula* juvenile study was designed to collect data on *Corbicula* spawning activities and growth of individuals entering the intake from the Ohio River. From 1988 through 1998, clam cages were deployed in the intake forebay to monitor for *Corbicula* that entered the BVPS.

Observational-based concerns that the clam cages would quickly clog with sediment during high sediment periods and, as a result, would not effectively sample for *Corbicula*, led to an evaluation of an alternate sampling technique. From April through June 1997, a study was conducted to compare the results of the clam cage samplers to a petite Ponar dredge technique to determine *Corbicula* presence and density in the BVPS intake bays. It was hypothesized that using a Ponar sampler to collect bottom sediments and analysis of those sediments would provide a more representative sample of *Corbicula* settlement and growth rates, and had the added benefit of not requiring confined space entry to conduct the sampling. Results of the study confirmed this hypothesis.

During the 1998 sampling season, at the request of BVPS personnel, all clam cages were removed after the May collection. Monthly petite Ponar grabs from the forebay in the intake building continued thereafter. Samples were processed in the same manner as Cooling Tower Samples (Section 5.3.3).

From 2002 to present, because of site access restrictions, sampling with the petite Ponar has been moved to the Ohio River directly in front of the Intake Structure Building. Collections are presently scheduled to be made in conjunction with the fisheries sampling (May, July, September, and November). During each sampling month two Ponar grabs are taken approximately 20 feet off shore of the intake building. These grab samples are processed in the

same manner as when they were collected from within the Intake Structure Building.

5.3.5 Zebra Mussel Monitoring

The Zebra Mussel Monitoring Program includes sampling the Ohio River and the circulating river water system of the BVPS.

The objectives of the Monitoring Program were:

(1) To identify if zebra mussels were in the Ohio River adjacent to BVPS and provide early warning to operations personnel as to their possible infestation;

(2) To provide data as to when the larvae were mobile in the Ohio River and insights as to their vulnerability to potential treatments; and

(3) To provide data on their overall density and growth rates under different water temperatures and provide estimates on the time it requires these mussels to reach the size and density that could impact the plant.

The zebra mussel sampling for settled adults was historically conducted once per month, yearlong. Beginning in December 1997, it was decided to forego sampling in the colder water months of each year, since buildup of zebra mussels does not occur then. Monthly sampling has been maintained throughout the balance of the year. In 2012 sampling occurred from March through November.

A pump sample for zebra mussel veligers was collected at the barge slip location monthly from April through October in 1996 and 1997. The scope of the sampling was expanded in 1998 to also include the intake structure. In June 1998, the Emergency Outfall and Emergency Outfall Impact Basin locations were also added. Additional pump samples were collected from the cooling towers of Unit 1 and Unit 2 in October 1998. In 2012 veliger sampling began in April and was conducted monthly through October.

At the Intake Structure and Barge Slip the following surveillance techniques were used:

- Wall scraper sample collections (March through November) from the barge slip and the riprap near the intake structure to detect attached adults; and

- Pump sample collections from the barge slip and outside the intake structure to detect the planktonic early life forms (April through October).

At each of the cooling towers the following techniques were used:

- Monthly reservoir scraper sample collections in each cooling tower (March through November); and

- Pump samples from April through October to detect planktonic life forms.

At the Emergency Outfall and the Splash Pool the following techniques were used:

- Monthly scraper sample collections in each (March through November); and
- Pump samples in each from April through October to detect planktonic life forms.

5.3.6 Reports

Each month, activity reports that summarized the activities that took place the previous month were prepared and submitted. These reports included the results of the monthly *Corbicula*/zebra mussel monitoring including any trends observed and any preliminary results available from the benthic and fisheries programs. The reports addressed progress made on each task, and reported any observed biological activity of interest.

5.4 RESULTS OF THE AQUATIC MONITORING PROGRAM

The following sections summarize the findings for each of the program elements. Sampling dates for each of the program elements are presented in Table 5.1.

5.4.1 Benthic Macroinvertebrate Monitoring Program

Benthic surveys were performed in May and in September 2012. Benthic samples were successfully collected using a petite Ponar grab sampler at Stations 1, 2A, 2B, and 3 (Figure 5.2). Triplicate samples were taken off the south shore at Stations 1, 2A, and 3. Sampling at Station 2B, in the back channel of Phillis Island, consisted of triplicate petite Ponar grabs at the south side, middle, and north side of the channel (i.e., Sample Stations 2B1, 2B2, and 2B3, respectively).

Substrate type is an important factor in determining the composition of the benthic community. The habitats in the vicinity of BVPS are the result of damming, channelization, and river traffic. Shoreline habitats at the majority of sampling locations were generally in depositional areas that consisted of soft muck substrates composed of mixes of sand, silt, and detritus. One exception was along the north shoreline of Phillis Island at Station 2A where hard-pan clay overlain with a thin layer of fine sand dominated. The other distinct habitat, hard substrate (gravel and cobble), was located in mid-channel of the back channel of Phillis Island. The hard substrate was probably the result of channelization and ongoing scouring by river currents. In general, the substrates found at each sampling location have been consistent from year to year.

Fifty-three macroinvertebrate taxa were identified during the 2012 monitoring program (Tables 5.2 and 5.3), which was one less than in 2011. A mean density of 841 macroinvertebrates/m^2 was collected in May and 3,901/m^2 in September (Table 5.4). As in previous years, the macroinvertebrate assemblage during 2012 was dominated by burrowing organisms typical of soft unconsolidated substrates. Oligochaetes (segmented worms), mollusks (clams and snails), and chironomid (midge fly) larvae were abundant (Table 5.4). Sixteen taxa of chironomids and 12 taxa of oligochaetes were collected. Unlike in 2010 and 2011, the total mean density of organism was higher in September than in May.

Twenty-one taxa were present in the May 2012 samples. Forty-eight taxa were present in the September samples. Sixteen of the 53 taxa were present in both May and September. As in 2008-2011, immature tubificid worms were numerically the most abundant organism in May; however, the zebra mussel *Deissena polymorpha* was the most abundant taxa in September.

The Asiatic clam (*Corbicula*) has been observed in the Ohio River near BVPS from 1974 to present. Zebra mussels were first collected in the BVPS benthic samples in 1998. Adult zebra mussels, however, were detected in 1995 and 1996 by divers in the BVPS main and auxiliary intake structures during scheduled cleaning operations. Zebra mussel veligers, adults and juveniles were collected during the 1997-2012 sampling programs (see Sections 5.4.5 Zebra Mussel Monitoring Program). Both live adult *Corbicula* and adult zebra mussels were collected in benthic macroinvertebrate samples in 2012. Zebra mussels were the second most abundant and *Corbicula* the 7th most abundant species collected in benthic samples collected in 2012.

In 2012 one new taxon was added to the cumulative list of macroinvertebrates collected near BVPS (Table 5.2). The new taxon was *Gyraulus* sp., an indigenous planorbid snail. No state or federal threatened or endangered macroinvertebrate species were collected during 2012.

In the May 2012 samples, oligochaetes accounted for the highest mean density of macroinvertebrates and chironomids had the second highest (729/m^2 or 87 percent of the total density and 69/m^2 or 8 percent, respectively) (Table 5.4). Mollusks were present at a density of 33/m^2. Organisms other than oligochaetes, chironomids, and mollusks were present at a density of 10/m^2 in May.

In September 2012 samples, chironomids accounted for the highest mean density of macroinvertebrates and mollusks had the second highest (1505/m^2 or 39 percent of the total density and 1409/m^2 or 36 percent, respectively) (Table 5.4). The "others" category had the third highest mean density in September 2012 (724/m^2 or 19 percent), while oligochaetes had the fourth highest mean density (263/m^2 or seven percent).

In May 2012, the highest density of macroinvertebrates (2,236/m^2) occurred at Station 3. In September, the highest density of macroinvertebrates also occurred at Station 2B1 (8,069/m^2). In May the lowest mean density of organisms occurred at Station 2A (215/m^2). In September, the lowest mean density of organisms also occurred at Station 2B3 (1,104/m^2).

For a comparison of the control to non-control stations, Station 1 was designated the control station, because it is always out of the influence of the BVPS discharge, and Station 2B (mean density of Station 2B1, 2B2, and 2B3) was designated as the non-control station, since it is the station most regularly subjected to BVPS's discharge. Stations 3 and 2A may be under the influence of the plume under certain conditions, but it is unlikely that they are regularly influenced by BVPS.

The mean density of macroinvertebrates in the non-control station was more than two times higher ($764/m^2$) than that of the control station ($301/m^2$) in May (Table 5.5). The densities of oligochaetes, chironomids, and mollusks each were higher in the non-control samples than at the control station. No chironomids or mollusks were collected at the control station. A similar difference in density occurred from 2008 through 2011. Overall, the differences probably reflect the natural differences in substrate and natural heterogeneous distributions of these organisms between the stations rather than project-related impacts.

In September, the density of macroinvertebrates present at the control station ($4,028/m^2$) was about 15 percent greater than at the non-control station ($3,507/m^2$). This was the reverse of the previous year, when the density of macroinvertebrates was 1.4 times greater at the non-control station, but comparable to 2010. Differences were within the expected range of variation for natural populations of macroinvertebrates.

Indices that describe the relative diversity, evenness, and richness of the macroinvertebrate population structure among stations and between control and non-control sites were calculated. A higher Shannon-Weiner diversity index indicates a relatively better structured assemblage of organisms, while a lower index generally indicates a low quality or stressed community. Evenness is an index that estimates the relative contribution of each taxon to the community assemblage, the closer to 1.00, the healthier the community. The community richness is another estimate of the quality of the macroinvertebrate community with a higher richness number indicating a healthier community.

The Shannon-Weiner diversity indices in May 2012 collections ranged from 0.08 at Station 1 to 0.70 at Station 2B2 (Table 5.6). In May evenness ranged from 0.23 at Station 3 to 0.85 at Station 2A. Richness was greatest at Stations 2B2 (2.08) and lowest at Station 1 (0.33). The overall low indices are attributed to the relatively few species (two to nine) collected and the preponderance of immature tubificids (segmented worms), which contributed to from 40 percent (Station 2A) to 95 percent (Station 1) of the individuals collected. The low numbers of organisms likely is due to natural variation in the Ohio River rather than due to BVPS operations.

The Shannon-Weiner diversity of the macroinvertebrate community (0.61 to 1.13) evenness (0.45 to 0.80) and richness (2.86 to 4.89) in September 2012 were higher than in May. There was also an increase in the number of taxa present in September (14 to 26 taxa per station) compared to May (two to nine taxa per station). Relatively high numbers of taxa are frequently present in early fall due to the increased numbers of aquatic stages of insects, especially chironomids, as well as the ability to identify to lower taxonomic levels many of the tubificids that are lumped together when immature. A comparable increase in indices values in September compared to May was observed in 2010 and 2011.

In May 2012, the number of taxa was appreciably lower in the control station (Station 1) than in the non-control stations (2B1, 2B2, 2B3) (two versus six, eight and nine). The diversity was higher at the control station, but the evenness and richness indices were lower than at the non-control stations (Table 5.6). In September 2012 the indices between the control and non-control stations were, in general, comparable. Similar trends were apparent in the previous four study years and were likely due to natural variations in the local populations at these locations. No impacts of the BVPS on the benthic community, as measured by differences between control and non-control zones, were evident in either May or September.

Substrate was probably the most important factor controlling the distribution and abundance of the benthic macroinvertebrates in the Ohio River near BVPS. Soft, mucky substrates that generally existed along the shoreline are conducive to oligochaete, chironomid, and mollusk habitation and limit species of macroinvertebrates that require a more stable bottom.

The density of macroinvertebrates in May and September 2012 fell within the range of densities of macroinvertebrates collected at BVPS in previous years (Table 5.7). ***The community structure has changed little since pre-operational years, and the available evidence does not indicate that BVPS operations have affected the benthic community of the Ohio River.***

5.4.2 Fish Sampling Program

In 2012, 125 fish representing 23 taxa were collected (i.e., handled) during BVPS surveys by electrofishing and seining (Table 5.8). All taxa collected in 2012 were previously encountered at BVPS. The most common species in the 2012 BVPS surveys that were collected by electrofishing and seining combined were gizzard shad (18.4% of the total catch), bluegill sunfish (14.4%), smallmouth bass (8.8%), shorthead redhorse sucker (8.8%), smallmouth buffalo (8.8%), spottail shiner (7.2%), golden redhorse sucker (6.4%), and white bass (5.6%). None of the remaining 15 species contributed to more than 5 percent of the total handled catch. The most frequently observed but not handled fish in 2012 were small gizzard shad that were present in the hundreds in July (Table 5.15). Game fish collected in 2012 included black crappie, channel catfish, bluegill, largemouth bass, white bass, smallmouth bass, sauger, walleye, rock bass, and spotted bass. Game fish represented 36% of the total handled catch.

A total of 88 fish, representing 18 taxa, was collected by electrofishing in 2012 (Table 5.9) compared to 151 fish representing 22 species in 2011. The relatively fewer fish collected in 2012 may have been caused by the need to electrofish during the day in three of the four sampling months. Nighttime electrofishing has been demonstrated to be more productive than during the day in riverine systems. Movements of fish into shallower water at night to feed, makes them more susceptible to the electrofishing technique. Gizzard shad, shorthead redhorse suckers, and smallmouth buffalo accounted for the greatest portion of the 2012 electrofishing catch (26.1%, 12.5%, and 12.5%, respectively) followed by smallmouth bass (11.4%), golden redhorse sucker (9.1%), and white bass (8.0%). No other species collected contributed to greater than five percent of the total catch. Fish observed and not collected in the 2012 electrofishing study are presented in Table 5.15.

A total of 37 fish representing seven taxa was collected in 2012 (Table 5.10) compared to 40 fish representing nine in 2011. The most abundant taxa collected in 2012 were bluegill and spottail shiner (representing 48.7% and 24.3% of the total catch, respectively), followed by emerald shiner (13.5%), and bluntnose minnow (5.4%). No other species collected contributed to greater than five percent of the total catch. Game species bluegill and smallmouth bass) were only collected as juveniles.

A total of 23 fish representing nine species was captured during the May (spring) 2012 sampling event (Table 5.11). All of the fish were collected during electrofishing none during seining. Shorthead redhorse sucker, gizzard shad, golden redhorse sucker (each representing 21.7% of the total catch), and smallmouth bass (13.0%) were the most common species boated during the electrofishing effort. No other species contributed to more than five percent of the May electrofishing catch. Channel catfish, rock bass, and smallmouth bass were the game species collected in May.

A total of 22 fish representing eight species was captured during the July (summer) 2012 sampling event (Table 5.12). A total of 18 fish representing five species was collected during electrofishing efforts. Gizzard shad was the most abundant species and represented 44.4% of the catch. Smallmouth buffalo (27.8% of the total catch) and smallmouth bass (16.7% of the catch) were the next most abundant species. Largemouth bass and common carp were the other species collected and each contributed to 5.6% of the catch (Table 5.12). Single specimens of bluegill, quillback, spotfin shiner, and smallmouth bass were the only fish collected during seining efforts in July.

During the September (fall) 2012 sampling event, 61 fish representing 17 taxa were collected (Table 5.13). A total of 37 fish representing 14 species was collected during electrofishing efforts. Gizzard shad and white bass were the most abundant species, contributing to 27.0% and 16.2% of the fish collected during electrofishing. Smallmouth buffalo (10.8%), golden redhorse sucker (8.1%), shorthead redhorse sucker (8.1%), common carp (5.4%), and smallmouth bass (5.4%) were the only other species that contributed to greater than (5%) of the total electrofishing catch. A total of 24 fish representing three taxa was collected during seining efforts. Juvenile bluegill (70.8% of the total catch) was the most abundant species in the seine catch. Black crappie, bluegill, sauger, smallmouth bass, largemouth bass, rock bass, and white bass were the game fish collected in September.

During the November (winter) 2012 sampling event, 18 fish representing seven taxa were captured (Table 5.14). A total of nine fish representing six species were collected during electrofishing. Shorthead redhorse sucker and smallmouth bass was the most abundant species collected by electrofishing and contributed to 33.3% and 22.2% of the total, respectively. An additional four fish that included smallmouth buffalo and unidentified black bass were also observed but not boated during electrofishing efforts (Table 5.15). Nine spottail shiners were the only fish collected during seine netting in 2012. Game species collected in November included smallmouth bass, white bass, and walleye.

Electrofishing catch rates are presented in Tables 5.16, 5.17, 5.18, and 5.19 for fish that were boated and handled during the 2009 through 2012 surveys by season (FENOC 2010, 2011, and

2012). In 2012, the annual catch rate was 0.59 fish per minute. The greatest catch rate in 2012 occurred in fall (September) when the catch rate was 0.92 fish per minute. Gizzard shad and white bass contributed to the majority of this total. The lowest catch rate occurred in winter (November) with a rate of 0.33 fish per electrofishing minute. The annual catch rate in 2012 (0.59 fish per minute) was lower than in the previous three years (1.27 fish per minute in 2009, 1.09 in 2010, and 0.93 in 2011). This is probably caused by the need to electrofish during the day in May, July, and November 2012 rather than at night as in all previous years. The 2012 catch rates in spring and winter were the lowest of the four years and the second lowest in summer and fall. Over the four years, the highest seasonal catch rates occurred in May 2010 (2.20 fish per minute). The lowest seasonal catch rates occurred in November 2011 (0.33 fish per minute) and July 2010 (0.32 fish per minute).

The results of the electrofishing sampling effort (Table 5.9) did not indicate any major differences in species composition between the control station (1) and the non-control Stations 2A, 2B, and 3. A greater number of fish representing more species was captured at non-control stations than control station. This was most likely due to the extra effort expended at non-control stations versus control station (i.e., there are three non-control stations and only one control station). In 2012, a comparable number of individual, but fewer species were collected by seines at the control station compared to the non-control station, where sampling effort is equal (Table 5.10).

In 2012, species composition remained comparable among stations. Common taxa collected in the 2012 surveys by all methods included redhorse sucker species, bluegill, smallmouth bass, and gizzard shad. Little difference in the species composition of the catch and relative composition was observed between the control (1) and non-control stations (2A, 2B, and 3). Habitat preference and availability were probably the most important factors affecting where and when different species of fish are collected.

The results of the 2012 fish surveys indicated that there is a normal community structure in the Ohio River in the vicinity of BVPS based on species composition and relative abundance of fish observed during the surveys. Benthivores (bottom feeders including suckers and buffalo) and forage species (e.g, gizzard shad, emerald shiners) were generally collected in the highest numbers. The numbers of forage species were comparable to those present in 2011 but less than in some of the past years. Variations in annual catch were probably attributable to normal fluctuations in the population size of the forage species and the predator populations that rely on them. Forage species, such as gizzard shad, minnow species, and shiner species that have high reproductive potentials, frequently respond to changes in natural environmental factors (competition, food availability, cover, and water quality) with large fluctuations in population size. This, in turn, influences their appearance in the sampled populations during annual surveys. Spawning/rearing success due to abiotic factors is usually the determining factor of the size and composition of a fish community.

In addition, differences in electrofishing catch rate can be attributed to environmental conditions that prevail during sampling efforts. High water, increased turbidity, and swift currents that occur during electrofishing efforts in some years can affect the collection efficiency in any given month. In 2012, increased water clarity was apparent during all months sampled. A direct result

of the increased clarity was the abundance of rooted submerged aquatic vegetation throughout the study reach. The amount of rooted vegetation was much more than in any other year sampled. It is likely the result of an increased photic zone due to zebra mussels filtering organic and inorganic particulates from the water and redistributes them to the benthic layer. The presence of rooted vegetation and increased water clarity can change the distribution of many of the fish species present in the study reach.

The impact of needing to electrofish during the day in three of the four months sampled in 2012 is also a factor that contributed to the 2012 catch. As previously discussed, shoreward fish movements at night generally increase catch rates. The avoidance of the majority of fish species from bright light conditions during the day was likely acerbated by the increased water clarity.

5.4.3 *Corbicula* Monitoring Program

In 2012, no settled live *Corbicula* were collected from the Unit 1 cooling tower basin during monthly reservoir sampling (Table 5.20 and Figure 5.5). Two dead *Corbicula* that ranged in size from 6.3mm to 9.49mm were collected, however. No *Corbicula* were collected in the scraping samples. *Corbicula* juveniles however, were collected in monthly pump samples collected in the Unit 1 cooling tower reservoir from May through October, except in August when none were present. The highest density of juvenile *Corbicula* occurred in October when a density of 430 *Corbicula*/m^3 was present.

In 2012, one live settled *Corbicula* was collected from the Unit 2 cooling tower reservoir during March (Table 5.21 and Figure 5.6). It was in the 2.00mm to 3.34mm size range that indicates that it was spawned in 2011. No *Corbicula* were collected in the scraping samples. *Corbicula* juveniles however, were collected in monthly pump samples collected in the Unit 2 cooling tower reservoir from June through September. The highest density of juvenile *Corbicula* occurred in July when a density of 420 *Corbicula*/m^3 was present.

In 2012, BVPS continued its *Corbicula* control program (Year 18), which included the use of a molluscicide (CT-1) to prevent the proliferation of *Corbicula* within BVPS. BVPS was granted permission by the Pennsylvania Department of Environmental Protection to use CT-1 to target the Unit 1 river water system and the Unit 2 service water system.

In 1990 through 1993, the molluscicide applications (CT-1) focused on reducing the *Corbicula* population throughout the entire river water system of each BVPS plant (Units 1 and 2). In 1994 and 1995, the CT-1 applications targeted the internal water systems; therefore, the CT-1 concentrations in the cooling towers were reduced during CT-1 applications. Consequently, adult and juvenile *Corbicula* in the cooling towers often survived the CT-1 applications. Reservoir sediment samples taken after CT-1 applications represent mortality of *Corbicula* in the cooling tower only and do not reflect mortality in BVPS internal water systems.

The monthly reservoir sediment samples and pump samples collected in Units 1 and 2 Cooling Towers in recent years demonstrated that *Corbicula* were entering and colonizing the reservoirs. Only one live and two dead settled *Corbicula* were collected in the cooling towers in 2012; however, their presence in the cooling tower pump samples indicates that they still are available for establishment in the cooling towers. The recent decrease of *Corbicula* at the BVPS returns densities to levels more consistent with densities in the Ohio River in the mid-1990's, but well below those present during the 1980's. Whether the low density of *Corbicula* in 2012 is indicative of decreasing levels in the environment or due to sampling variability is uncertain, however, continued monitoring of *Corbicula* densities is recommended.

5.4.4 *Corbicula* Juvenile Monitoring Program

Figure 5.7 presents the abundance and size distribution data for samples collected in the Ohio River near the intake structure by petite Ponar dredge in 2012. Nineteen live individuals were collected in 2012, five in May, three in July, four in September, and seven in November. They ranged in size from the 1.00-1.99 mm size range that were spawned in late 2011 and 2012 to greater than 9.50 mm that were spawned in prior years. The number of individuals collected in 2012 was somewhat more than in 2011 (12 individuals) but less than the three years prior to that, 27 individuals in 2010, 42 in 2009, and 23 in 2008. A spring/early-summer spawning period typically occurs in the Ohio River near BVPS each year when preferred spawning temperatures (60-65° F) are reached (Figure 5.8). The offspring from this spawning event generally begin appearing in the sample collections in June. The settled clams generally increase in size throughout the year. ***The overall low numbers of live Corbicula collected in the sample collected outside the intake and cooling towers in 2012, compared to levels in the 1980's, likely reflects a natural decrease in the density of Corbicula in the Ohio River near BVPS, although an increased density of live settled individuals and juveniles collected in the cooling towers may indicate that the population is beginning to increase again. Continued monitoring of Corbicula densities is recommended.***

5.4.5 Zebra Mussel Monitoring Program

Zebra mussels (*Dreissena polymorpha*) are exotic freshwater mollusks that have ventrally flattened shells generally marked with alternating dark and lighter bands. They are believed to have been introduced into North America through the ballast water of ocean-going cargo vessels probably from Eastern Europe. They were first identified in Lake St. Clair in 1988 and rapidly spread to other Great Lakes and the Mississippi River drainage system, and have become increasingly abundant in the lower, middle, and upper Ohio River. They use strong adhesive byssal threads, collectively referred to as their byssus, to attach themselves to any hard surfaces (e.g., intake pipes, cooling water intake systems, and other mussels). Responding to NRC Notice No. 89-76 (Biofouling Agent-Zebra Mussel, November 21, 1989), BVPS instituted a Zebra Mussel Monitoring Program in January 1990. Studies have been conducted each year since then.

Zebra mussels were detected in both pump samples (Figures 5.9 and 5.10) and substrate samples (Figure 5.11 and 5.12) in 2012. Zebra mussel veliger pump samples were collected from April through October 2012 (Figures 5.9 and 5.10). Veligers were collected at all of the six sites that were sampled in 2012. At most sample sites, densities of veligers generally increased through

the year, peaked in August or September, and then were less abundant for the balance of the sampling year. This seasonal pattern is typical for zebra mussels in the northeastern United States. Spawning begins as water temperature reach approximately 14^{O} C and peaks at water temperatures of 21^{O} C. Veligers densities usually peak about two weeks after the optimum water temperature for spawning is reached. Veliger densities then fall off as veligers mature and settle. The greatest density of veligers was present in the sample collected from the Emergency Outfall Basin in August (34,628/m^3). This was comparable to the peak density of veligers collected in 2011 (33,160/m^3 at the same location in June). In April, low densities of veligers were collected at every site sampled except the barge slip. In April of prior years, veligers were present only in the thermally enhanced Cooling Tower Reservoirs. Due to an unusually warm spring, ambient river water temperatures were at the zebra mussel spawning threshold by late March. Thereafter, veligers were present in every sample collected at all locations, except at the Splash Pool in October. Overall, veliger densities in 2012 were lower than in 2010 and 2011. Although consistently present earlier in 2012 than in the previous two years, veliger densities in 2012 did not peak until a month or two later. This is likely due to annual variability in numbers of veligers in the Ohio River.

In 2012, settled zebra mussels were collected only in scrape samples at the barge slip and the intake structure (Figures 5.11 and 5.12). The highest density of settled mussels in any sample collected was at the barge slip (28 mussels/m^2) in April. The mussels collected at each of the sites included individuals that were capable of reproducing. The density of collected adult zebra mussels in 2012 was somewhat higher than densities that occurred in 2008- 2011.

Overall, both the number of observations and densities of settled mussels in 2012 were somewhat higher to those recorded in 2008-2011, and much higher than the preceding five years. Although densities of settled mussels are low compared to other populations such as the Lower Great Lakes, densities comparable to those in the Ohio River are sufficient to cause problems in the operation of untreated cooling water intake systems. ***Whether the population of zebra mussels in this reach of the Ohio River is resurging or only yearly fluctuations are present cannot be determined. In any case, the densities of mussels that presently exist are more than sufficient to impact the BVPS, if continued prudent monitoring and control activities are not conducted.***

6.0 ZEBRA MUSSEL AND *CORBICULA* CONTROL ACTIVITIES

In 2012, BVPS continued its *Corbicula* and zebra mussel control program (19th year), which included the use of a molluscicide Nalco H150M and sodium hypochlorite to prevent the proliferation of *Corbicula* within BVPS. BVPS was granted permission by the Pennsylvania Department of Environmental Protection to use Nalco H150M to target the Unit 1 river water system and the Unit 2 service water system.

In 1990 through 1993, the molluscicide applications focused on reducing the *Corbicula* population throughout the entire river water system of each BVPS plant (Units 1 and 2). In 1994 through 2010, the applications targeted zebra mussels and *Corbicula* in the internal water systems; therefore the molluscicide concentrations in the cooling towers were reduced during molluscicide applications. Consequently, adult and juvenile *Corbicula* in the cooling towers often survived the applications. Reservoir sediment samples taken after applications represented mortality of *Corbicula* in the cooling tower only and do not reflect mortality in BVPS internal water systems.

In addition to clamicide treatments, preventive measures were taken that included quarterly cleaning of the Intake Bays. The bay cleanings are intended to minimize the accumulation and growth of mussels within the bays. This practice prevents creating an uncontrolled internal colonization habitat.

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8.0

TABLES

TABLE 5.1
BEAVER VALLEY POWER STATION (BVPS)
SAMPLING DATES FOR 2012

Study	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Benthic Macroinvertebrate						20			20			
Fish					23		25		20		12	
Corbicula and Zebra Mussel			29	26	23	20	25	27	20	25	12	
Corbicula CT Density												
Zebra Mussel Veliger				26	23	20	25	27	20	25		

Table 5.2

Systematic List of Macroinvertebrates Collected From 1973 Through 2012 in The Ohio River Near BVPS

Phylum	Class	Family Sub-Family	Genus and Species	Previous Collections	Collected in 2012	New in 2012
Porifera						
			Spongilla fragilis	X		
Cnidaria						
	Hydrozoa					
		Clavidae				
			Cordylophora lacustris	X		
		Hydridae				
			Craspedacusta sowerbii	X		
			Hydra sp.	X		
Platyhelminthes						
	Tricladida			X		
	Rhabdocoela			X		
Nemertea				X		
Nematoda				X	X	
Entoprocta						
			Urnatella gracilis	X		
Ectoprocta						
			Fredericella sp.	X		
			Paludicella articulata	X		
			Pectinatella sp.	X		
			Plumatella sp.	X		
Annelida						
	Oligochaeta			X	X	
		Aeolosomatidae		X		
		Enchytraeidae		X		
		Naididae		X		
			Allonais pectinata	X		
			Amphichaeta leydigi	X		
			Amphichaeta sp.	X		
			Arcteonais lomondi	X		
			Aulophorus sp.	X		
			Chaetogaster diaphanus	X		
			C. diastrophus	X		
			Dero digitata	X		
			Dero flabelliger	X		
			D. nivea	X		
			Dero sp.	X		
			Nais barbata	X		
			N. behningi	X		
			N. bretscheri	X		
			N. communis	X	X	
			N. elinguis	X	X	
			N. pardalis	X		
			N. pseudobtusa	X		
			N. simplex	X		
			N. variabilis	X		
			Nais sp.	X		
			Ophidonais serpentina	X		
			Paranais frici	X		
			Paranais litoralis	X		
			Paranais sp.	X	X	
			Piguetiella michiganensis	X		
			Pristina idrensis	X		
			Pristina longisoma	X		
			Pristina longiseta	X		
			P. osborni	X		
			P. sima	X		
			Pristina sp.	X		
			Pristinella sp.	X		

Table 5.2 (continued)

Systematic List of Macroinvertebrates Collected From 1973 Through 2012 in The Ohio River Near BVPS

Phylum	Class	Family / Sub-Family	Genus and Species	Previous Collections	Collected in 2012	New in 2012
Annelida	**Oligochaeta**	Naididae	*Pristinella jenkinae*	X		
			Pristinella idrensis	X		
			Pristina osborni	X		
			Ripistes parasita	X		
			Slavina appendiculata	X		
			Specaria josinae	X		
			Stephensoniana trivandrana	X		
			Stylaria fossularis	X		
			S. lacustris	X		
			Uncinais uncinata	X		
			Vejdovskyella comata	X		
			Vejdovskyella intermedia	X		
			Vejdovskyella sp.	X		
	Tubificida			X		
		Tubificidae		X	X	
			Aulodrilus limnobius	X		
			A. pigueti	X		
			A. pluriseta	X		
			Aulodrilus sp.	X	X	
			Bothrioneurum vejdovskyanum	X		
			Branchiura sowerbyi	X	X	
			Ilyodrilus templetoni	X		
			Limnodrilus cervix	X		
			L. cervix (variant)	X		
			L. claparedianus	X	X	
			L. hoffmeisteri	X	X	
			L. maumeensis	X		
			L. profundicla	X		
			L. spiralis	X		
			L. udekemianus	X	X	
			Limnodrilus sp.	X		
			Peloscolex multisetosus longidentus	X		
			P. m. multisetosus	X		
			Potamothrix moldaviensis	X		
			Potamothrix sp.	X		
			P. vejdovskyi	X		
			Psammoryctides curvisetosus	X		
			Tubifex tubifex	X		
			Unidentified immature forms:			
			with hair chaetae	X	X	
			without hair chaetae	X	X	
		Lumbriculidae		X		
		Hirudinae		X		
		Glossiphoniidae		X		
			Helobdella elongata	X		
			H. stagnalis	X		
			Helobdella sp.	X		
		Erpobdellidae				
			Erpobdella sp.	X		
			Mooreobdella microstoma	X		
		Haplotaxidae				
			Stylodrilus sp.	X		
	Lumbricina			X		
		Lumbricidae		X		

Table 5.2 (continued) Systematic List of Macroinvertebrates Collected From 1973 Through 2012 in The Ohio River Near BVPS						
Phylum	**Class**	**Family / Sub-Family**	**Genus and Species**	**Previous Collections**	**Collected in 2012**	**New in 2012**
Arthropoda						
	Acarina			X		
			Oxus sp.	X	X	
	Ostracoda			X		
	Isopoda					
			Asellus sp.	X		
Arthropoda						
	Amphipoda					
		Talitridae				
			Hyalella azteca	X		
		Gammaridae				
			Crangonyx pseudogracilis	X		
			Crangonyx sp.	X		
			Gammarus fasciatus	X		
			Gammarus sp.	X	X	
		Pontoporeiidae				
			Monoporeia affinis	X		
		Corophididae		X		
Decapoda				X		
Collembola				X	X	
Ephemeroptera				X		
		Heptageniidae		X		
			Stenacron sp.	X		
			Stenonema sp.	X		
		Ephemeridae				
			Ephemera sp.	X		
			Hexagenia sp.	X	X	
			Ephron sp.	X		
		Baetidae				
			Baetis sp.	X		
		Caenidae				
			Caenis sp.	X	X	
			Serattella sp.	X		
		Tricorythidae				
			Tricorythodes sp.	X		
Megaloptera						
			Sialis sp.	X		
Odonata						
		Gomphidae				
			Argia sp.	X		
			Dromogomphus spoliatus	X		
			Dromogomphus sp.	X		
			Gomphus sp.	X	X	
		Lestidae				
			Lestes sp.	X	X	
		Libellulidae				
			Libellula sp.	X		
Plecoptera				X		
Trichoptera				X	X	
		Hydropsychidae				
			Cheumatopsyche sp.	X		
			Hydropsyche sp.	X		
			Parapsyche sp.	X		
		Hydroptilidae				
			Hydroptila sp.	X	X	
			Orthotrichia sp.	X		
			Oxyethira sp.	X	X	
		Leptoceridae				
			Ceraclea sp.	X		
			Oecetis sp.	X	X	
		Polycentropodidae				
			Cyrnellus sp	X		
		Polycentropodidae	*Polycentropus* sp.	X		

Table 5.2 (continued)
Systematic List of Macroinvertebrates Collected From 1973 Through 2012 in The Ohio River Near BVPS

Phylum	Class	Family / Sub-Family	Genus and Species	Previous Collections	Collected in 2012	New in 2012
Coleoptera						
		Hydrophilidae		X		
Coleoptera		Elmidae	*Ancyronyx variegatus*	X		
			Dubiraphia sp.	X		
			Helichus sp.	X		
			Optioserus sp.	X		
			Stenelmis sp.	X		
		Psephenidae		X		
Diptera						
			Unidentified Diptera	X		
		Psychodidae		X		
			Pericoma sp.	X		
			Psychoda sp.	X		
			Telmatoscopus sp.	X		
			Unidentified Psychodidae pupae	X		
		Chaoboridae				
			Chaoborus sp.	X		
		Simuliidae				
			Similium sp.	X		
		Chironomidae		X		
		Chironominae		X		
			Tanytarsini pupa	X		
			Chironominae pupa	X	X	
			Axarus sp.	X		
			Chironomus sp.	X	X	
			Cladopelma sp.	X		
			Cladotanytarsus sp.	X	X	
			Cryptochironomus sp.	X	X	
			Dicrotendipes nervosus	X		
			Dicrotendipes sp.	X	X	
			Glyptotendipes sp.	X		
			Harnischia sp.	X		
			Microchironomus sp.	X		
			Micropsectra sp.	X		
			Microtendipes sp.	X		
			Parachironomus sp.	X		
			Paracladopelma sp.	X		
			Paratanytarsus sp.	X		
			Paratendipes sp.	X		
			Phaenopsectra sp.	X	X	
			Polypedilum (s.s.) convictum type	X		
			P. (s.s.) simulans type	X		
			Polypedilum sp.	X	X	
			Pseudochironomis sp.	X	X	
			Rheotanytarsus sp.	X		
			Stempellina sp.	X		
			Stenochironomus sp.	X		
			Stictochironomus sp.	X	X	
			Tanytarsus coffmani	X		
			Tanytarsus sp.	X	X	
			Tribelos sp.	X		
			Xenochironomus sp.	X		
		Tanypodinae		X		
			***Tanypodinae* pupae**	X		
			Ablabesmyia sp.	X	X	
			Clinotanypus sp.	X		
			Coelotanypus scapularis	X		
			Coelotanypus sp.	X	X	
			Djalmabatista pulcher	X		
			Djalmabatista sp.	X		
			Procladius sp.	X	X	
			Tanypus sp.	X		

Table 5.2 (continued)

Systematic List of Macroinvertebrates Collected From 1973 Through 2012 in The Ohio River Near BVPS

Phylum	Class	Family / Sub-Family	Genus and Species	Previous Collections	Collected in 2012	New in 2012
Diptera		Tanypodinae	*Thienemannimyia* group	X	X	
			Zavrelimyia sp.	X		
		Orthocladiinae		X		
			***Orthocladiinae* pupae**	X		
			Cricotopus bicinctus	X		
			C. (s.s.) trifascia	X		
			Cricotopus (Isocladius)-sylvestris Group	X		
			C. (Isocladius) sp.	X		
			Cricotopus (s.s.) sp.	X	X	
			Eukiefferiella sp.	X		
			Hydrobaenus sp.	X		
			Limnophyes sp.	X		
			Nanocladius (s.s.) distinctus	X		
			Nanocladius sp.	X		
			Orthocladius sp.	X		
			Parametriocnemus sp.	X		
			Paraphaenocladius sp.	X		
			Psectrocladius sp.	X	X	
			Pseudorthocladius sp.	X		
			Pseudosmittia sp.	X		
			Smittia sp.	X		
			Theinemannimyia sp.	X		
		Diamesinae				
			Diamesa sp.	X		
			Potthastia sp.	X		
		Ceratopogonidae		X		
			Probezzia sp.	X	X	
			Bezzia sp.	X		
			Culicoides sp.	X	X	
		Dolichopodidae		X		
		Empididae		X		
			Clinocera sp.	X		
			Wiedemannia sp.	X		
		Ephydridae		X		
		Muscidae		X		
		Rhagionidae		X		
		Tipulidae		X	X	
		Stratiomyidae		X		
		Syrphidae		X		
Lepidoptera				X		
Hydracarinidia				X		
			Oxus sp.	X		
Mollusca						
	Gastropoda			X		
		Hydrobiidae		X		
		Amnicolinae				
			Amnicola sp.	X	X	
			Aminicola binneyana	X		
			Amnicola limosa	X		
			Stagnicola elodes	X		
		Bithynidae				
			Bithynia sp.	X		
	Physacea			X		
		Pleuroceridae				
			Pleurocera acuta	X	X	
			Goniobasis sp.	X		
		Physidae		X		
			Physa sp.	X	X	
			Physa ancillaria	X		
			Physa integm	X		

Table 5.2 (continued)						
Systematic List of Macroinvertebrates Collected From 1973 Through 2012 in The Ohio River Near BVPS						
Phylum	**Class**	**Family** **Sub-Family**	**Genus and Species**	**Previous Collections**	**Collected in 2012**	**New in 2012**
Mollusca	**Physacea**	Ancylidae		X		
			Ferrissia sp.	X	X	
		Planorbidae				
			Gillia atilis	X		
			Gyraulus sp.		X	X
		Valvatidae		X		
			Valvata perdepressa	X		
			Valvata piscinalis	X		
			Valvata sincera	X		
			Valvata sp.	X		
Pelecypoda				X		
	Sphaeriacea			X		
		Corbiculidae				
			Corbicula fluminea	X		
			Corbicula sp.	X	X	
		Sphaeriidae		X		
			Pisidium ventricosum	X		
			Pisidium sp.	X	X	
			Sphaerium sp.	X	X	
			Unidentified immature Sphaeriidae	X		
		Dreissenidae				
			Dreissena polymorpha	X	X	
		Unionidae		X		
			Anodonta grandis	X		
			Anodonta (immature)	X		
			Elliptio sp.	X		
			Quadrula pustulosa	X		
			Unidentified immature Unionidae	X		

TABLE 5.3

BENTHIC MACROINVERTEBRATE COUNTS FOR TRIPLICATE SAMPLES
TAKEN AT EACH SAMPLE STATION FOR MAY AND SEPTEMBER 2012

Scientific name	May							Sept							
	Location						May	Location						Sept	2012
	1	2A	2B1	2B2	2B3	3	Total	1	2A	2B1	2B2	2B3	3	Total	Total
Ablabesmyia sp.	0	0	0	0	0	0	0	1	6	29	0	2	2	40	40
Amnicola sp.	0	0	0	0	0	0	0	0	1	2	4	0	2	9	9
Aulodrilus sp	0	0	0	0	0	0	0	0	0	3	0	1	0	4	4
Branchiura sowerbyi	0	0	2	0	1	0	3	2	0	0	0	3	0	5	8
Caenis sp.	0	0	0	0	0	0	0	0	5	223	0	0	0	228	228
Chironomid pupae	0	0	1	0	1	0	2	1	4	1	0	0	0	6	8
Chironomus sp.	0	0	0	3	9	0	12	2	0	2	0	0	0	4	16
Cladotanytarsus sp	0	0	0	0	0	0	0	14	72	100	0	0	0	186	186
Coelotanypus sp.	0	0	0	0	0	0	0	0	0	2	3	9	18	32	32
Collembola	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
Corbicula sp.	0	0	0	1	0	1	2	12	37	17	12	0	12	90	92
Cricotopus (s.s.) sp.	0	2	0	0	0	0	2	6	3	1	0	1	1	11	13
Cryptochironomus sp.	0	1	0	0	3	0	4	4	14	15	3	4	0	40	44
Culicoides sp.	0	0	0	0	0	0	0	0	0	3	0	0	0	3	3
Dicrotentipides sp	0	0	0	0	0	0	0	26	8	23	0	0	7	64	64
Dreissena polymorpha	0	0	0	0	0	0	0	69	1	5	49	1	186	311	311
Ferrissia sp.	0	0	0	0	0	0	0	26	2	3	0	0	0	31	31
Gammarus sp.	0	0	0	1	0	0	1	0	0	0	0	0	4	4	5
Gyraulus sp	0	0	0	0	0	0	0	0	0	2	0	0	0	2	2
Gomphus sp.	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2
Hexagenia sp.	0	0	0	0	1	0	1	0	0	0	6	2	1	9	10
Hydroptila sp	0	0	0	0	0	0	0	4	0	0	0	0	0	4	4
Immature tubificid without	20	6	32	9	63	141	271	5	25	3	1	45	3	82	353
Immature tubificid with hair	0	0	0	0	0	2	2	0	0	0	0	0	1	1	3
Lestes sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Limnodrilus claparedianus	0	0	1	1	0	1	3	0	0	0	0	0	0	0	3
Limnodrilus hoffmeisteri	0	0	2	2	3	1	8	1	7	0	2	0	0	10	18
Limnodrilus udemekianus	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Nais communis	0	6	0	0	0	0	6	0	0	0	0	0	0	0	6
Nais elinguis	0	0	0	0	0	2	2	0	0	0	0	0	0	0	2
Nematoda	0	0	0	0	0	0	0	1	0	1	0	0	1	3	3
Ocetis sp.	0	0	0	0	0	0	0	0	0	10	1	0	1	12	12
Oligochaeta	0	0	0	0	0	1	1	1	2	1	0	0	1	5	6
Oxus sp (Hydracarina)	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
Oxyethira sp (Tricoptera)	0	0	0	0	0	0	0	1	1	2	0	0	0	4	4
Paranais sp	0	0	0	0	0	7	7	0	0	0	0	0	0	0	7
Phaenopsectra sp.	0	0	0	1	0	0	1	1	0	0	0	0	0	1	2
Physa sp	0	0	0	0	0	0	0	26	1	14	0	0	1	42	42
Pisidium sp.	0	0	0	11	1	0	12	19	26	11	7	1	21	85	97
Pleurocera acuta	0	0	0	0	0	0	0	0	0	0	2	0	1	3	3
Polypedilum sp.	0	0	0	0	10	0	10	21	99	29	1	2	2	154	164
Probezzia sp.	0	0	1	0	0	0	1	0	1	6	1	2	0	10	11
Procladius sp.	0	0	0	0	0	0	0	0	1	11	0	2	0	14	14
Psectocladius sp	0	0	0	0	0	0	0	0	0	5	0	0	2	7	7
Pseudochironomis sp.	0	0	0	0	0	0	0	0	9	15	0	0	0	24	24
Sphaerium sp.	0	0	0	0	0	0	0	0	12	2	0	0	0	14	14
Stictochironomus	0	0	0	0	0	0	0	1	0	0	0	0	1	2	2
Tanytarsus sp.	0	0	0	0	0	0	0	8	8	19	0	0	0	35	35
Thienemannimyia group	0	0	0	0	0	0	0	10	0	0	0	0	0	10	10
Tipulidae	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Trichoptera	0	0	0	0	0	0	0	16	0	2	0	0	2	20	20
Tubificidae	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Valvata sincera	0	0	0	0	0	0	0	0	0	1	0	0	2	3	3
Total	21	15	39	29	92	156	352	281	345	563	94	77	273	1633	1985

TABLE 5.4

MEAN NUMBER OF MACROINVERTEBRATES (NUMBER/M²) AND PERCENT COMPOSITION OF OLIGOCHAETES, CHIRONOMIDS, MOLLUSKS, AND OTHER ORGANISMS, 2012 BVPS

May	Station													
	1 (Control)		2A		2B1 (Non-control)		2B2 (Non-control)		2B3 (Non-control)		3		Total Mean	
	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%
Oligochaetes	287	95	172	80	531	95	172	41	960	73	2222	99	729	87
Chironomids	0	0	43	20	14	3	57	14	330	25	0	0	69	8
Mollusks	0	0	0	0	0	0	172	41	14	1	14	1	33	4
Others	14	5	0	0	14	3	14	3	14	1	0	0	10	1
Total	301	100	215	100	559	100	415	100	1318	100	2236	100	841	100

September	Station													
	1 (Control)		2A		2B1 (Non-control)		2B2 (Non-control)		2B3 (Non-control)		3		Total Mean	
	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%	$\#/m^2$	%
Oligochaetes	129	3	487	10	100	1	43	3	731	66	86	2	263	7
Chironomids	1362	34	3211	65	3612	45	100	7	287	26	459	12	1505	39
Mollusks	2179	54	1147	23	817	10	1061	79	29	3	3225	82	1409	36
Others	358	9	100	2	3540	44	143	11	57	5	143	4	724	19
Total	4028	100	4945	100	8069	100	1347	100	1104	100	3913	100	3901	100

TABLE 5.5

MEAN NUMBER OF MACROINVERTEBRATES (NUMBER/M^2) AND PERCENT COMPOSITION OF OLIGOCHAETA, CHIRONOMIDAE, MOLLUSCA, AND OTHER ORGANISMS FOR THE CONTROL STATION (1) AND THE AVERAGE FOR NON-CONTROL STATIONS (2B1, 2B2, AND 2B3), 2012 BVPS

May	Control Station (Mean)		Non-Control Station (Mean)	
	#/m^2	%	#/m^2	%
Oligochaeta	287	95	554	73
Chironomidae	0	0	134	17
Mollusca	0	0	62	8
Others	14	5	14	2
TOTAL	301	100	764	100

September	Control Station (Mean)		Non-Control Station (Mean)	
	#/m^2	%	#/m^2	%
Oligochaeta	129	3	291	8
Chironomidae	1362	34	1333	38
Mollusca	2179	54	636	18
Others	358	9	1247	36
TOTAL	4028	100	3507	100

TABLE 5.6

SHANNON-WEINER DIVERSITY, EVENNESS AND RICHNESS INDICES
FOR BENTHIC MACROINVERTEBRATES COLLECTED IN THE OHIO RIVER, 2012

	Station					
May	1	2A	2B1	2B2	2B3	3
No. of Taxa	2	4	6	8	9	8
Shannon-Weiner Index	0.08	0.51	0.33	0.70	0.50	0.20
Evenness	0.28	0.85	0.42	0.78	0.52	0.23
Richness	0.33	1.11	1.36	2.08	1.77	1.39

	Station					
September	1	2A	2B1	2B2	2B3	3
No. of Taxa	26	23	32	14	15	23
Shannon-Weiner Index	1.13	1.00	0.99	0.77	0.72	0.61
Evenness	0.80	0.73	0.66	0.67	0.61	0.45
Richness	4.43	3.76	4.89	2.86	3.22	3.92

Table 5.7. Benthic Macroinvertebrate Densities for Stations 1 (Control) and 2B (Noncontrol), BVPS, 1973-2012.

	Preoperational					
	1973		1974		1975	
	1	2B	1	2B	1	2B
May	248	508	1116	2197		
August	99	244	143	541	1017	1124
Mean	**173**	**376**	**630**	**1369**	**1017**	**1124**

	Operational					
	1976		1977		1978	
	1	2B	1	2B	1	2B
May	927	3660	674	848	351	126
August	851	785	591	3474	601	1896
Mean	**889**	**2223**	**633**	**2161**	**476**	**1011**

	Operational					
	1979		1980		1981	
	1	2B	1	2B	1	2B
May	1004	840	1041	747	209	456
Aug/Sept	1185	588	1523	448	2185	912
Mean	**1095**	**714**	**1282**	**598**	**1197**	**684**

	Operational					
	1982		1983		1984	
	1	2B	1	2B	1	2B
May	3490	3026	3590	1314	2741	621
September	2958	3364	4172	4213	1341	828
Mean	**3223**	**3195**	**3881**	**2764**	**2041**	**725**

	Operational					
	1985		1986		1987	
	1	2B	1	2B	1	2B
May	2256	867	601	969	1971	2649
September	1024	913	849	943	2910	2780
Mean	**1640**	**890**	**725**	**956**	**2440**	**2714**

Table 5.7. Benthic Macroinvertebrate Densities for Stations 1 (Control) and 2B (Noncontrol), BVPS, 1973-2012 (Continued).

	Operational					
	1988		1989		1990	
	1	2B	1	2B	1	2B
May	1804	1775	3459	2335	15135	5796
September	1420	1514	1560	4707	5550	1118
Mean	**1612**	**1645**	**2510**	**3274**	**10343**	**3457**

	Operational					
	1991		1992		1993	
	1	2B	1	2B	1	2B
May	7760	6355	7314	10560	8435	2152
September	3588	2605	2723	4707	4693	2143
Mean	**5808**	**4480**	**5019**	**7634**	**6564**	**2148**

	Operational					
	1994		1995		1996	
	1	2B	1	2B	1	2B
May	6980	2349	8083	9283	1987	1333
September	1371	2930	1669	3873	1649	2413
Mean	**4176**	**2640**	**4876**	**6578**	**1814**	**1873**

	Operational					
	1997		1998		1999	
	1	2B	1	2B	1	2B
May	1411	2520	6980	2349	879	1002
September	1944	2774	1371	2930	302	402
Mean	**1678**	**2647**	**4176**	**2640**	**591**	**702**

	Operational					
	2000		2001		2002	
	1	2B	1	2B	1	2B
May	2987	2881	3139	5232	1548	2795
September	3092	2742			8632	14663
Mean	**3040**	**2812**	**3139**	**5232**	**5090**	**8729**

Table 5.7. Benthic Macroinvertebrate Densities for Stations 1 (Control) and 2B (Noncontrol), BVPS, 1973-2012 (Continued).

	Operational					
	2003		**2004**		**2005**	
	1	**2B**	**1**	**2B**	**1**	**2B**
May	7095	10750	2752	4558	516	1146
September	2193	6464	10062	7604	4773	6435
Mean	**4644**	**8607**	**6407**	**6181**	**2645**	**3791**

	Operational					
	2006		**2007**		**2008**	
	1	**2B**	**1**	**2B**	**1**	**2B**
May	143	1242	559	912	158	1252
September	229	2199	560	3794	1161	2150
Mean	**186**	**1721**	**560**	**2353**	**660**	**1701**

	Operational					
	2009		**2010**		2011	
	1	**2B**	**1**	**2B**	1	2B
May	71	1462	1763	2527	115	1700
September	903	1902	1720	1256	874	1233
Mean	**487**	**1682**	**1742**	**1892**	**495**	**1467**

	Operational					
	2012		**2013**			
	1	**2B**	**1**	**2B**	1	2B
May	71	1462	301	764		
September	903	1902	4028	3507		
Mean	**487**	**1682**	**1265**	**2136**		

TABLE 5.8

TOTAL FISH CATCH; ELECTROFISHING AND SEINE NET COMBINED DURING THE BVPS 2012 FISHERIES SURVEY

Common Name	Scientific Name	Number	Percent
Smallmouth buffalo	*Ictiobus bubalus*	11	**8.80**
Black crappie	*Pomoxis nigromaculatus*	1	**0.80**
Bluegill	*Lepomis macrochirus*	18	**14.40**
Bluntnose minnow	*Pimephales notatus*	2	**1.60**
Channel catfish	*Ictalurus punctatus*	1	**0.80**
Common carp	*Cyprinus carpio*	4	**3.20**
Emerald shiner	*Notropis atherinoides*	5	**4.00**
Freshwater drum	*Aplodinotus grunniens*	2	**1.60**
Gizzard shad	*Dorosoma cepedianum*	23	**18.40**
Golden redhorse sucker	*Moxostoma erythrurum*	8	**6.40**
Golden shiner	*Notemigonus crysoleucas*	1	**0.80**
Largemouth bass	*Micropterus salmoides*	2	**1.60**
Longnose gar	*Lepisosteus osseus*	1	**0.80**
Quillback	*Carpiodes cyprinus*	2	**1.60**
Rock Bass	*Ambloplites rupestris*	2	**1.60**
Sauger	*Sander canadense*	1	**0.80**
Shorthead redhorse sucker	*Moxostoma macrolepidotum*	11	**8.80**
Spottail shiner	*Notropis hudsonius*	9	**7.20**
Smallmouth bass	*Micropterus dolomieu*	11	**8.80**
Spotfin shiner	*Notropis spilopterus*	1	**0.80**
Spotted bass	*Micropterus punctulatus*	1	**0.80**
Walleye	*Sander vitreum*	1	**0.80**
White bass	*Morone chrysops*	7	**5.60**
Total Fish Collected in 2012		**125**	**100.00**

TABLE 5.9

COMPARISON OF CONTROL VS. NON-CONTROL ELECTROFISHING CATCHES DURING THE BVPS 2012 FISHERIES SURVEY

Common Name	Control	%	Non-control	%	Total fish	%
Smallmouth buffalo	5	20.83	6	9.4	11	12.50
Black crappie			1	1.6	1	1.14
Channel catfish			1	1.6	1	1.14
Common carp	4	16.67			4	4.55
Freshwater drum	1	4.17	1	1.6	2	2.27
Gizzard shad	2	8.33	21	32.8	23	26.14
Golden redhorse sucker	1	4.17	7	10.9	8	9.09
Golden shiner			1	1.6	1	1.14
Largemouth bass			2	3.1	2	2.27
Longnose gar			1	1.6	1	1.14
Quillback	1	4.17			1	1.14
Rock bass			2	3.1	2	2.27
Sauger			1	1.6	1	1.14
Shorthead redhorse sucker	5	20.83	6	9.4	11	12.50
Smallmouth bass	3	12.50	7	10.9	10	11.36
Spotted bass			1	1.6	1	1.14
Walleye			1	1.6	1	1.14
White bass	2	8.33	5	7.8	7	7.95
Total	**24**	**100.00**	**64**	**100.0**	**88**	**100.00**

TABLE 5.10

COMPARISON OF CONTROL VS. NON-CONTROL SEINE CATCHES DURING THE BVPS 2012 FISHERIES SURVEY

Common Name	Control	%	Non-control	%	Total fish	%
Bluegill	0	0.00	18	81.82	18	48.65
Bluntnose minnow	0	0.00	2	9.09	2	5.41
Emerald shiner	5	33.33	0	0.00	5	13.51
Quillback	0	0.00	1	4.55	1	2.70
Spottail shiner	9	60.00	0	0.00	9	24.32
Smallmouth bass	1	6.67	0	0.00	1	2.70
Spotfin shiner	0	0.00	1	4.55	1	2.70
Total	**15**	**100.00**	**22**	**100.00**	**37**	**100.00**

TABLE 5.11

FISH SPECIES COLLECTED DURING THE MAY 2012 (SPRING) SAMPLING
OF THE OHIO RIVER IN THE VICINITY OF BVPS

Common Name	Sample locations *						Seine		Electrofishing	
	S-1	S-2	E-1	E-2A	E-2B	E-3	Total	%	Total	%
Smallmouth buffalo				1			0	-	1	4.35
Black crappie							0	-	0	0.00
Bluegill							0	-	0	0.00
Bluntnose minnow							0	-	0	0.00
Channel catfish					1		0	-	1	4.35
Common carp			1				0	-	1	4.35
Emerald shiner							0	-	0	0.00
Freshwater drum							0	-	0	0.00
Gizzard shad			2	2	1		0	-	5	21.74
Golden redhorse sucker				2	2	1	0	-	5	21.74
Golden shiner							0	-	0	0.00
Largemouth bass							0	-	0	0.00
Longnose gar				1			0	-	1	4.35
Quillback							0	-	0	0.00
Rock bass					1		0	-	1	4.35
Sauger							0	-	0	0.00
Shorthead redhorse sucker			3		2		0	-	5	21.74
Spottail shiner							0	-	0	0.00
Smallmouth bass			2			1	0	-	3	13.04
Spotfin shiner							0	-	0	0.00
Spotted bass							0	-	0	0.00
Walleye							0	-	0	0.00
White bass							0	-	0	0.00
Total	**0**	**0**	**8**	**6**	**7**	**2**	**0**	**-**	**23**	**100.00**

* Gear = (E) Fish captured by electrofishing; (S) captured by seining

TABLE 5.12

FISH SPECIES COLLECTED DURING THE JULY (SUMMER) 2012 SAMPLING OF THE OHIO RIVER IN THE VICINITY OF BVPS

	Sample locations *						Seine		Electrofishing	
Common Name	**S-1**	**S-2**	**E-1**	**E-2A**	**E-2B**	**E-3**	**Total**	**%**	**Total**	**%**
Smallmouth buffalo			3		2		0	0.00	5	27.78
Black crappie							0	0.00	0	0.00
Bluegill		1					1	25.00	0	0.00
Bluntnose minnow							0	0.00	0	0.00
Channel catfish							0	0.00	0	0.00
Common carp			1				0	0.00	1	5.56
Emerald shiner							0	0.00	0	0.00
Freshwater drum							0	0.00	0	0.00
Gizzard shad						8	0	0.00	8	44.44
Golden redhorse sucker							0	0.00	0	0.00
Golden shiner							0	0.00	0	0.00
Largemouth bass					1		0	0.00	1	5.56
Longnose gar							0	0.00	0	0.00
Quillback		1					1	25.00	0	0.00
Rock Bass							0	0.00	0	0.00
Sauger							0	0.00	0	0.00
Shorthead redhorse sucker							0	0.00	0	0.00
Spottail shiner							0	0.00	0	0.00
Smallmouth bass	1		1		2		1	25.00	3	16.67
Spotfin shiner		1					1	25.00	0	0.00
Spotted bass							0	0.00	0	0.00
Walleye							0	0.00	0	0.00
White bass							0	0.00	0	0.00
Total	**1**	**3**	**5**	**0**	**5**	**8**	**4**	**100.00**	**18**	**100.00**

* Gear = (E) Fish captured by electrofishing; (S) captured by seining

TABLE 5.13

FISH SPECIES COLLECTED DURING THE SEPTEMBER (FALL) 2012 SAMPLING OF THE OHIO RIVER IN THE VICINITY OF BVPS

	Sample locations *						Seine		Electrofishing	
Common Name	**S-1**	**S-2**	**E-1**	**E-2A**	**E-2B**	**E-3**	**Total**	**%**	**Total**	**%**
Smallmouth buffalo			1	2		1	0	0.00	4	10.81
Black crappie				1			0	0.00	1	2.70
Bluegill		17					17	70.83	0	0.00
Bluntnose minnow		2					2	8.33	0	0.00
Channel catfish							0	0.00	0	0.00
Common carp			2				0	0.00	2	5.41
Emerald shiner	5						5	20.83	0	0.00
Freshwater drum				1			0	0.00	1	2.70
Gizzard shad				2		8	0	0.00	10	27.03
Golden redhorse sucker			1	1		1	0	0.00	3	8.11
Golden shiner							0	0.00	0	0.00
Largemouth bass				1			0	0.00	1	2.70
Longnose gar							0	0.00	0	0.00
Quillback			1				0	0.00	1	2.70
Rock bass					1		0	0.00	1	2.70
Sauger				1			0	0.00	1	2.70
Shorthead redhorse sucker			1	1		1	0	0.00	3	8.11
Spottail shiner							0	0.00	0	0.00
Smallmouth bass					2		0	0.00	2	5.41
Spotfin shiner							0	0.00	0	0.00
Spotted bass					1		0	0.00	1	2.70
Walleye							0	0.00	0	0.00
White bass			1	5			0	0.00	6	16.22
Total	**5**	**19**	**7**	**15**	**4**	**11**	**24**	**100.00**	**37**	**100.00**

* Gear = (E) Fish captured by electrofishing; (S) captured by seining

TABLE 5.14

FISH SPECIES COLLECTED DURING THE NOVEMBER (WINTER) 2012 SAMPLING OF THE OHIO RIVER IN THE VICINITY OF BVPS

	Sample locations *						Seine		Electrofishing	
Common Name	**S-1**	**S-2**	**E-1**	**E-2A**	**E-2B**	**E-3****	**Total**	**%**	**Total**	**%**
Smallmouth buffalo			1			-	0	0.00	1	11.11
Black crappie						-	0	0.00	0	0.00
Bluegill						-	0	0.00	0	0.00
Bluntnose minnow						-	0	0.00	0	0.00
Channel catfish						-	0	0.00	0	0.00
Common carp						-	0	0.00	0	0.00
Emerald shiner						-	0	0.00	0	0.00
Flathead catfish						-	0	0.00	0	0.00
Gizzard shad						-	0	0.00	0	0.00
Golden redhorse sucker						-	0	0.00	0	0.00
Golden shiner					1	-	0	0.00	1	11.11
Largemouth bass						-	0	0.00	0	0.00
Longnose gar						-	0	0.00	0	0.00
Quillback						-	0	0.00	0	0.00
Rock bass						-	0	0.00	0	0.00
Sauger						-	0	0.00	0	0.00
Shorthead redhorse sucker			1	1	1	-	0	0.00	3	33.33
Spottail shiner	9					-	9	100.00	0	0.00
Smallmouth bass				1	1	-	0	0.00	2	22.22
Spotfin shiner						-	0	0.00	0	0.00
Spotted bass						-	0	0.00	0	0.00
Walleye					1	-	0	0.00	1	11.11
White bass			1			-	0	0.00	1	11.11
Total	**9**	**0**	**3**	**2**	**4**	**-**	**9**	**100.00**	**9**	**100.00**

* Gear = (E) Fish captured by electrofishing; (S) captured by seining
**Not sampled due to safety issues

TABLE 5.15

ESTIMATED NUMBER OF FISH OBSERVED * DURING ELECTROFISHING OPERATIONS, 2012

Common Name	May	July	Sept	Nov	Total
Unidentified redhorse suckers	4				**4**
Unidentified black bass	2	2	1	2	**7**
Smallmouth buffalo		2		2	**4**
Carp		1	3		**4**
Longnose gar	1		1		**2**
Unidentified suckers					**0**
Sauger					**0**
Gizzard shad	3	100's	20		**100's**
Total	**10**	**100's**	**25**	**4**	**100's**

* = Not boated or handled

Table 5.16

CATCH PER UNIT EFFORT (CPUE AS FISH/ELECTROFISHING MINUTE) BY SEASON DURING THE BVPS 2009 FISHERIES SURVEY

Season	Effort (min)	Common Name	Number Collected	CPUE (fish/min)
Spring	40.3	Smallmouth buffalo	7	0.1737
		Flathead catfish	1	0.0248
		Freshwater drum	1	0.0248
		Gizzard shad	2	0.0496
		Golden redhorse sucker	8	0.1985
		Longnose gar	4	0.0993
		Quillback	5	0.1241
		River carpsucker	2	0.0496
		Shorthead redhorse sucker	15	0.3722
		Silver redhorse	1	0.0248
		Smallmouth bass	9	0.2233
		Spotted bass	1	0.0248
		Walleye	1	0.0248
		White bass	1	0.0248
		Season Total	**58**	**1.4392**
Season	**Effort (min)**	**Common Name**	**Number Collected**	**CPUE (fish/min)**
Summer	40.0	Smallmouth buffalo	4	0.1000
		Carp	3	0.0750
		Channel catfish	1	0.0250
		Gizzard shad	2	0.0500
		Golden redhorse sucker	1	0.0250
		Mooneye	2	0.0500
		Quillback	3	0.0750
		Sauger	6	0.1500
		Shorthead redhorse sucker	13	0.3250
		Smallmouth bass	2	0.0500
		Spotted bass	2	0.0500
		Season Total	**39**	**0.9750**

Table 5.16 (continued)

CATCH PER UNIT EFFORT (CPUE AS FISH/ELECTROFISHING MINUTE) BY SEASON DURING THE BVPS 2009 FISHERIES SURVEY

Season	Effort (min)	Common Name	Number Collected	CPUE (fish/min)
Fall	40.5	Smallmouth buffalo	1	0.0247
		Black crappie	1	0.0247
		Bluegill	3	0.0741
		Carp	3	0.0741
		Gizzard shad	1	0.0247
		Golden redhorse sucker	6	0.1481
		Quillback	1	0.0247
		Sauger	13	0.3210
		Shorthead redhorse sucker	4	0.0988
		Silver redhorse	1	0.0247
		Smallmouth bass	3	0.0741
		Spotted bass	4	0.0988
		White bass	8	0.1975
		Season Total	**49**	**1.2099**
Season	**Effort (min)**	**Common Name**	**Number Collected**	**CPUE (fish/min)**
Winter	40.0	Smallmouth buffalo	5	0.1250
		Carp	4	0.1000
		Channel catfish	1	0.0250
		Flathead catfish	1	0.0250
		Golden redhorse sucker	4	0.1000
		Longnose gar	3	0.0750
		Mooneye	1	0.0250
		Quillback	3	0.0750
		Sauger	11	0.2750
		Shorthead redhorse sucker	12	0.3000
		Smallmouth bass	6	0.1500
		Spotted bass	1	0.0250
		Walleye	3	0.0750
		White bass	3	0.0750
		Season Total	**58**	**1.4500**
2009	**160.8**		**204**	**1.2687**

Table 5.17

CATCH PER UNIT EFFORT (CPUE AS FISH/ELECTROFISHING MINUTE) BY SEASON DURING THE BVPS 2010 FISHERIES SURVEY

Season	Effort (min)	Common Name	Number Collected	CPUE (fish/min)
Spring	41.0	Smallmouth buffalo	4	0.0976
		Channel catfish	3	0.0732
		Freshwater drum	1	0.0244
		Gizzard shad	3	0.0732
		Golden redhorse sucker	11	0.2683
		Longnose gar	4	0.0976
		Mooneye	2	0.0488
		Sauger	16	0.3902
		Shorthead redhorse sucker	22	0.5366
		Silver redhorse	4	0.0976
		Smallmouth bass	13	0.3171
		Spotted bass	2	0.0488
		Walleye	3	0.0732
		White bass	2	0.0488
		Season Total	**90**	**2.1951**
Season	**Effort (min)**	**Common Name**	**Number Collected**	**CPUE (fish/min)**
Summer	40.4	Smallmouth buffalo	4	0.0990
		Channel catfish	1	0.0248
		Flathead catfish	1	0.0248
		Golden shiner	1	0.0248
		Mooneye	1	0.0248
		Quillback	2	0.0495
		Shorthead redhorse sucker	2	0.0495
		Silver redhorse	1	0.0248
		Season Total	**13**	**0.3218**

Table 5.17 (continued)

CATCH PER UNIT EFFORT (CPUE AS FISH/ELECTROFISHING MINUTE) BY SEASON DURING THE BVPS 2010 FISHERIES SURVEY

Season	Effort (min)	Common Name	Number Collected	CPUE (fish/min)
Fall	40.2	Smallmouth buffalo	1	0.0249
		Gizzard shad	6	0.1493
		Golden redhorse sucker	2	0.0498
		Sauger	1	0.0249
		Shorthead redhorse sucker	2	0.0498
		Silver redhorse	1	0.0249
		Smallmouth bass	3	0.0746
		Spotted bass	4	0.0995
		White bass	6	0.1493
		Season Total	**26**	**0.6468**
Season	**Effort (min)**	**Common Name**	**Number Collected**	**CPUE (fish/min)**
Winter	40.4	Smallmouth buffalo	1	0.0248
		Freshwater drum	3	0.0743
		Gizzard shad	4	0.0990
		Golden redhorse sucker	2	0.0495
		Mooneye	1	0.0248
		Pumpkinseed	0	0.0000
		Quillback	2	0.0495
		River carpsucker	1	0.0248
		Sauger	3	0.0743
		Shorthead redhorse sucker	7	0.1733
		Silver redhorse	5	0.1238
		Smallmouth bass	3	0.0743
		Spotted bass	2	0.0495
		White bass	13	0.3218
		Season Total	**47**	**1.1634**
2010	**162.0**		**176**	**1.08642**

Table 5.18

CATCH PER UNIT EFFORT (CPUE AS FISH/ELECTROFISHING MINUTE) BY SEASON DURING THE BVPS 2011 FISHERIES SURVEY

Season	Effort (min)	Common Name	Number Collected	CPUE (fish/min)
Spring	40.5	Smallmouth buffalo	2	0.0494
		Channel catfish	1	0.0247
		Gizzard shad	1	0.0247
		Golden redhorse sucker	2	0.0494
		Longnose gar	1	0.0247
		Quillback	5	0.1235
		Shorthead redhorse sucker	12	0.2963
		Smallmouth bass	5	0.1235
		White bass	2	0.0494
		Season Total	**31**	**0.7654**
Season	**Effort (min)**	**Common Name**	**Number Collected**	**CPUE (fish/min)**
Summer	40.3	Bluegill	2	0.0496
		Freshwater drum	1	0.0248
		Gizzard shad	3	0.0744
		Golden redhorse sucker	1	0.0248
		Longnose gar	1	0.0248
		Quillback	3	0.0744
		Shorthead redhorse sucker	3	0.0744
		Smallmouth bass	2	0.0496
		Spotted bass	3	0.0744
		Season Total	**19**	**0.4715**

Table 5.18 (continued)

CATCH PER UNIT EFFORT (CPUE AS FISH/ELECTROFISHING MINUTE) BY SEASON DURING THE BVPS 2011 FISHERIES SURVEY

Season	Effort (min)	Common Name	Number Collected	CPUE (fish/min)
Fall	40.2	Smallmouth buffalo	1	0.0249
		Black crappie	1	0.0249
		Bluegill	1	0.0249
		Channel catfish	1	0.0249
		Common carp	1	0.0249
		Flathead catfish	2	0.0498
		Freshwater drum	1	0.0249
		Gizzard shad	3	0.0746
		Golden redhorse sucker	5	0.1244
		Longnose gar	3	0.0746
		Mooneye	2	0.0498
		Sauger	5	0.1244
		Shorthead redhorse sucker	10	0.2488
		Silver redhorse	2	0.0498
		Smallmouth bass	8	0.1990
		Spotted bass	5	0.1244
		Walleye	3	0.0746
		White bass	3	0.0746
		Season Total	57	1.4179
Season	**Effort (min)**	**Common Name**	**Number Collected**	**CPUE (fish/min)**
Winter	40.5	Smallmouth buffalo	4	0.0988
		Bluegill	3	0.0741
		Common carp	1	0.0247
		Freshwater drum	2	0.0494
		Gizzard shad	1	0.0247
		Largemouth bass	1	0.0247
		Pumpkinseed	1	0.0247
		Sauger	11	0.2716
		Shorthead redhorse sucker	9	0.2222
		Smallmouth bass	7	0.1728
		Spotted bass	2	0.0494
		White bass	1	0.0247
		Yellow perch	1	0.0247
		Season Total	**44**	**1.0864**
2011	**161.5**		**151**	**0.93498**

Table 5.19

CATCH PER UNIT EFFORT (CPUE AS FISH/ELECTROFISHING MINUTE) BY SEASON DURING THE BVPS 2012 FISHERIES SURVEY

Season	Effort (min)	Common Name	Number Collected	CPUE (fish/min)
Spring	40.1	Smallmouth buffalo	1	0.0249
		Channel catfish	1	0.0249
		Common carp	1	0.0249
		Gizzard shad	5	0.1247
		Golden redhorse sucker	5	0.1247
		Longnose gar	1	0.0249
		Rock bass	1	0.0249
		Shorthead redhorse sucker	5	0.1247
		Smallmouth bass	3	0.0748
		Season Total	23	0.5736
Season	**Effort (min)**	**Common Name**	**Number Collected**	**CPUE (fish/min)**
Summer	40.1	Smallmouth buffalo	5	0.1247
		Common carp	1	0.0249
		Gizzard shad	8	0.1995
		Largemouth bass	1	0.0249
		Smallmouth bass	3	0.0748
		Season Total	**18**	0.4489

Table 5.19 (continued)

CATCH PER UNIT EFFORT (CPUE AS FISH/ELECTROFISHING MINUTE) BY SEASON DURING THE BVPS 2012 FISHERIES SURVEY

Season	Effort (min)	Common Name	Number Collected	CPUE (fish/min)
Fall	40.1	Smallmouth buffalo	4	0.0998
		Black crappie	1	0.0249
		Common carp	2	0.0499
		Freshwater drum	1	0.0249
		Gizzard shad	10	0.2494
		Golden redhorse sucker	3	0.0748
		Largemouth bass	1	0.0249
		Quillback	1	0.0249
		Rock bass	1	0.0249
		Sauger	1	0.0249
		Shorthead redhorse sucker	3	0.0748
		Smallmouth bass	2	0.0499
		Spotted bass	1	0.0249
		White bass	6	0.1496
		Season Total	**37**	0.9227
Season	**Effort (min)**	**Common Name**	**Number Collected**	**CPUE (fish/min)**
Winter	30	Smallmouth buffalo	1	0.0333
		Freshwater drum	1	0.0333
		Golden shiner	1	0.0333
		Shorthead redhorse sucker	3	0.1000
		Smallmouth bass	2	0.0667
		Walleye	1	0.0333
		White bass	1	0.0333
		Season Total	**10**	0.3333
2012	**150.3**		**88**	**0.58550**

TABLE 5.20

UNIT 1 COOLING RESERVOIR MONTHLY SAMPLING
CORBICULA DENSITY DATA FOR
2012 FROM BVPS

Collection Date	Area Sampled (sq ft)	Live or Dead	Count	Maximum Length Range (mm)	Minimum Length Range(mm)	Estimated Number (per sq m)
3/29/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
4/26/2012	---*	Dead	---	---	---	---
		Live	---	---	---	---
5/23/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
6/20/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
7/25/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
8/27/2012	0.25	Dead	2	9.50+	6.30-9.49	86
		Live	0	---	---	0
9/20/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
10/25/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
11/12/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
Unit summary		Dead	2	---	---	11
		Live	0	---	---	0

*Not sampled due to outage

TABLE 5.21

UNIT 2 COOLING RESERVOIR MONTHLY SAMPLING <u>CORBICULA</u> DENSITY DATA FOR 2012 FROM BVPS

Collection Date	Area Sampled (sq ft)	Live or Dead	Count	Maximum Length Range (mm)	Minimum Length Range(mm)	Estimated Number (per sq m)
3/29/2012	0.25	Dead	0	---	---	0
		Live	1	2.00-3.34	2.00-3.34	43
4/26/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
5/23/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
6/20/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
7/25/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
8/27/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
9/20/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
10/25/2012	---*	Dead	---	---	---	---
		Live	---	---	---	---
11/12/2012	0.25	Dead	0	---	---	0
		Live	0	---	---	0
Unit summary		Dead	0	---	---	0
		Live	1	---	---	5

*Not sampled; reservoir was dry

9.0

FIGURES

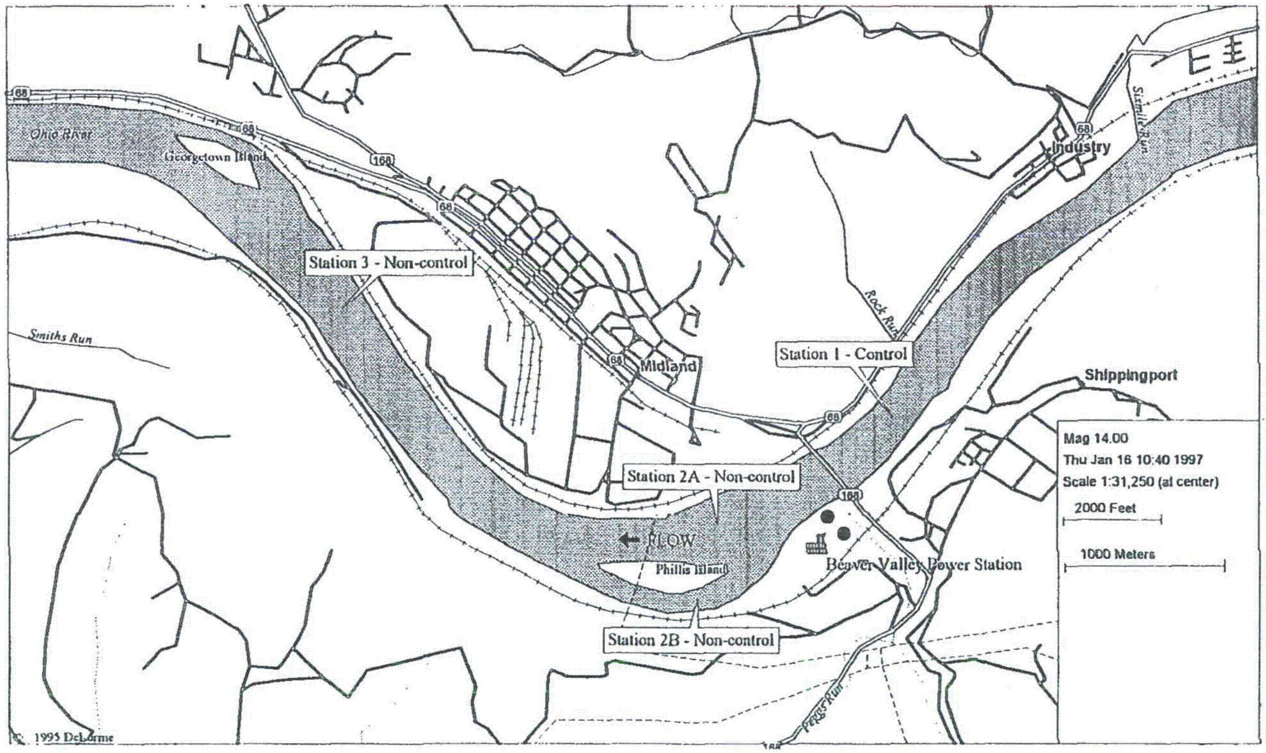


Figure 5.1 Location Map for 2012 Beaver Valley Power Station Aquatic Monitoring Program Sampling Control and Non-Control Sampling Stations

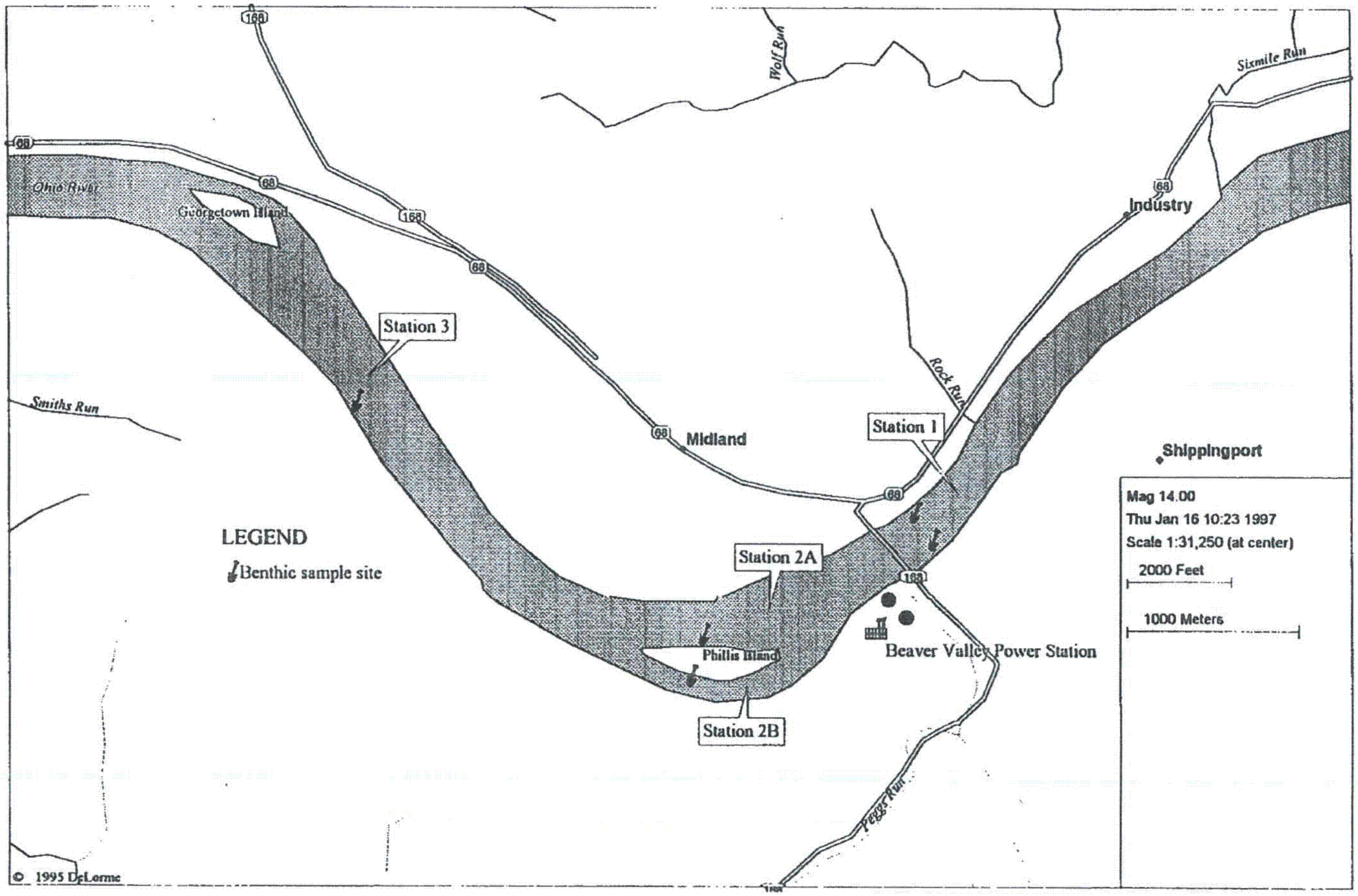


Figure 5.2 Location Map for Beaver Valley Power Station Benthic Organism Survey Sampling Sites for the 2012 Study

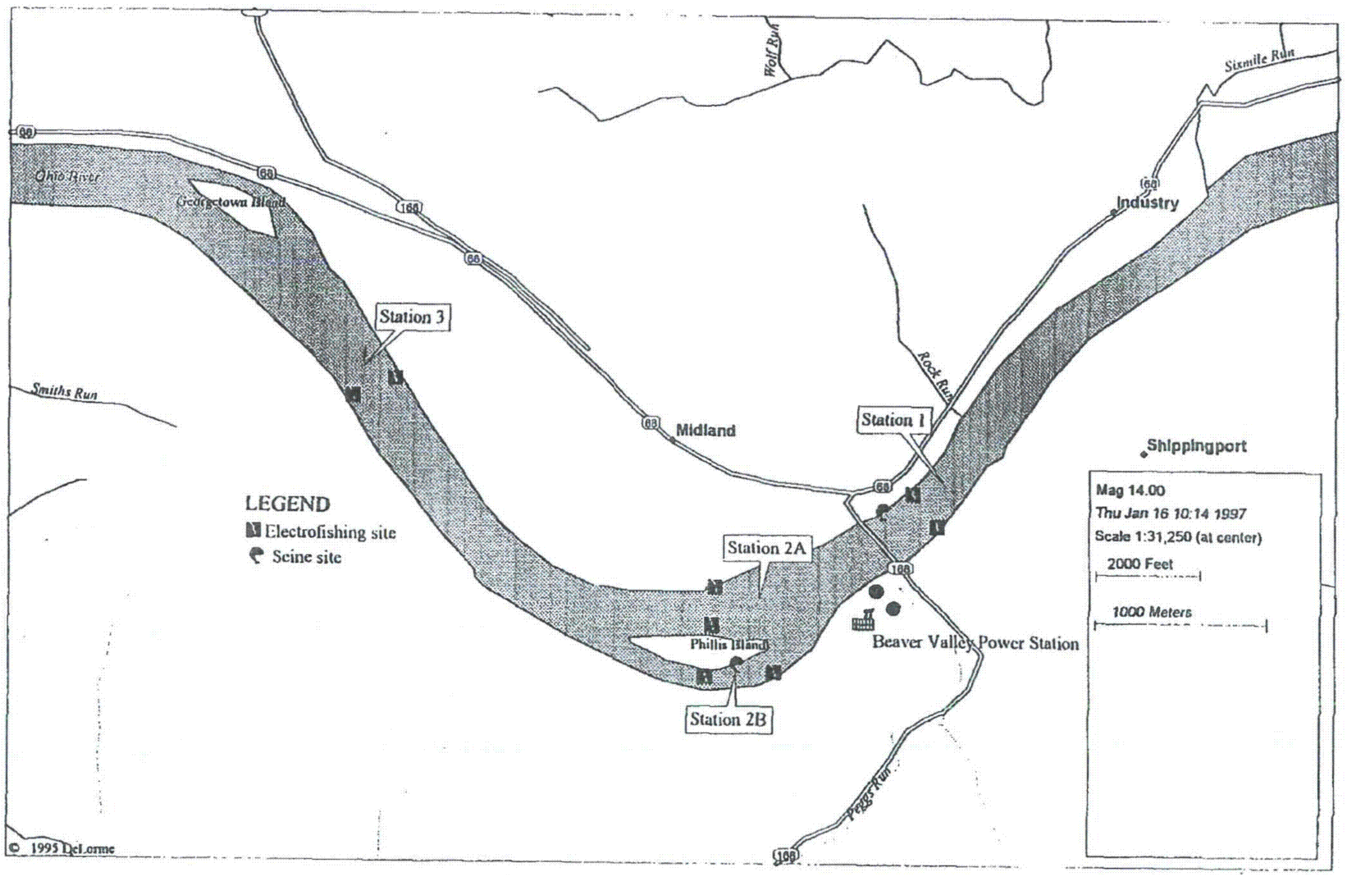


Figure 5.3 Location Map for Beaver Valley Power Station Fish Population Survey Fish Sampling Sites for the 2012 Study

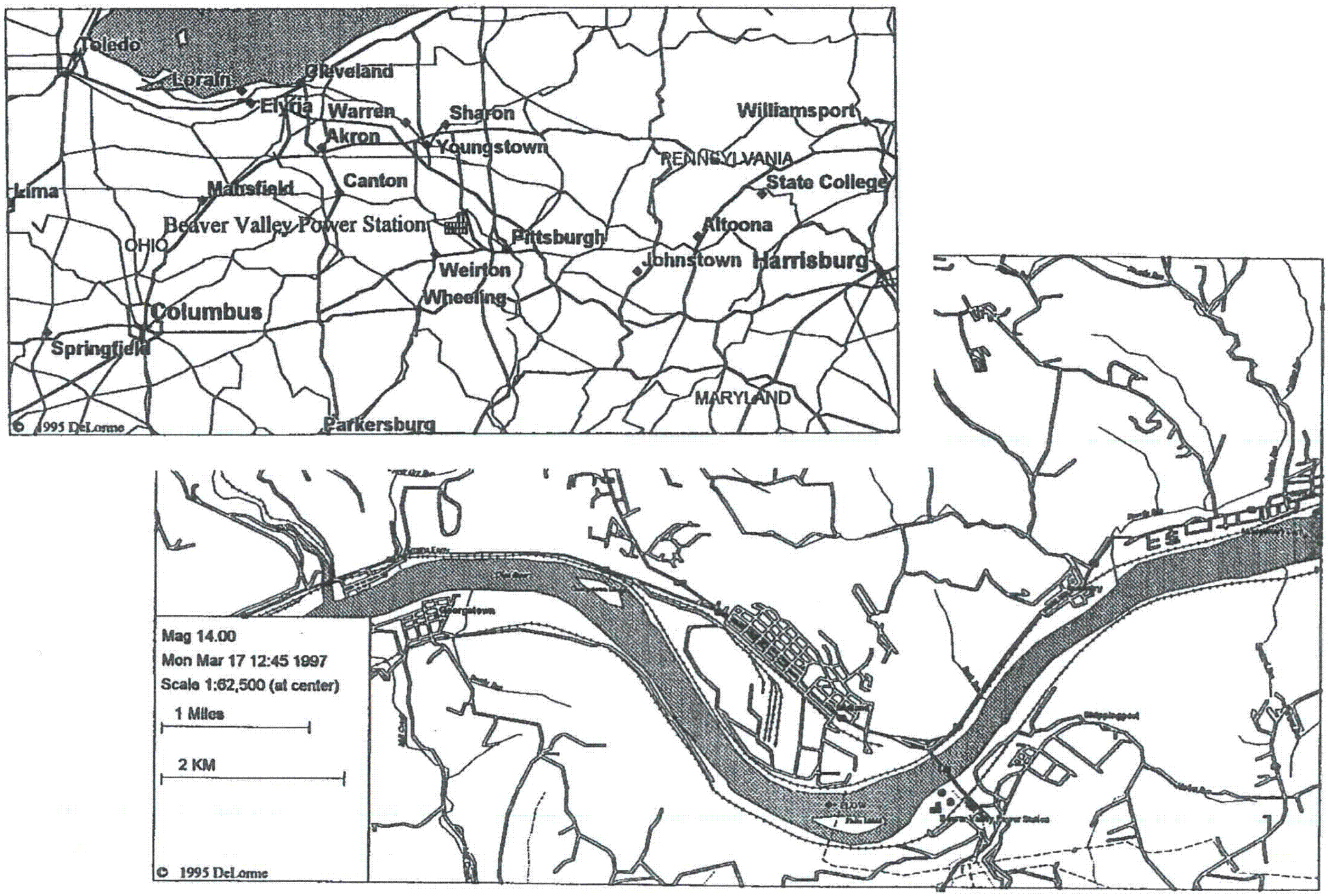
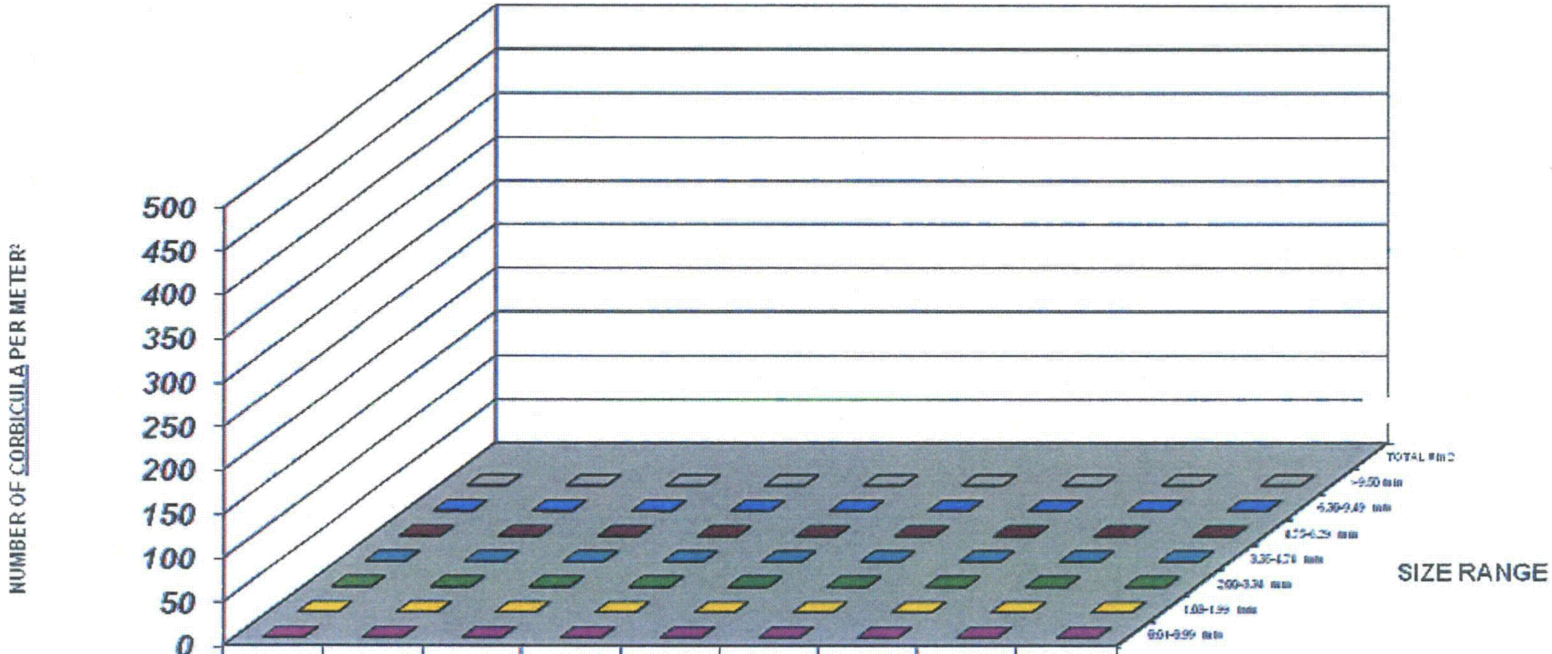


Figure 5.4 Location of Study Area, Beaver Valley Power Station Shippingport, Pennsylvania

Comparison of live Corbicula clam density estimates among 2012 BVPS Unit 1 cooling tower reservoir events, for various clam shell groups.

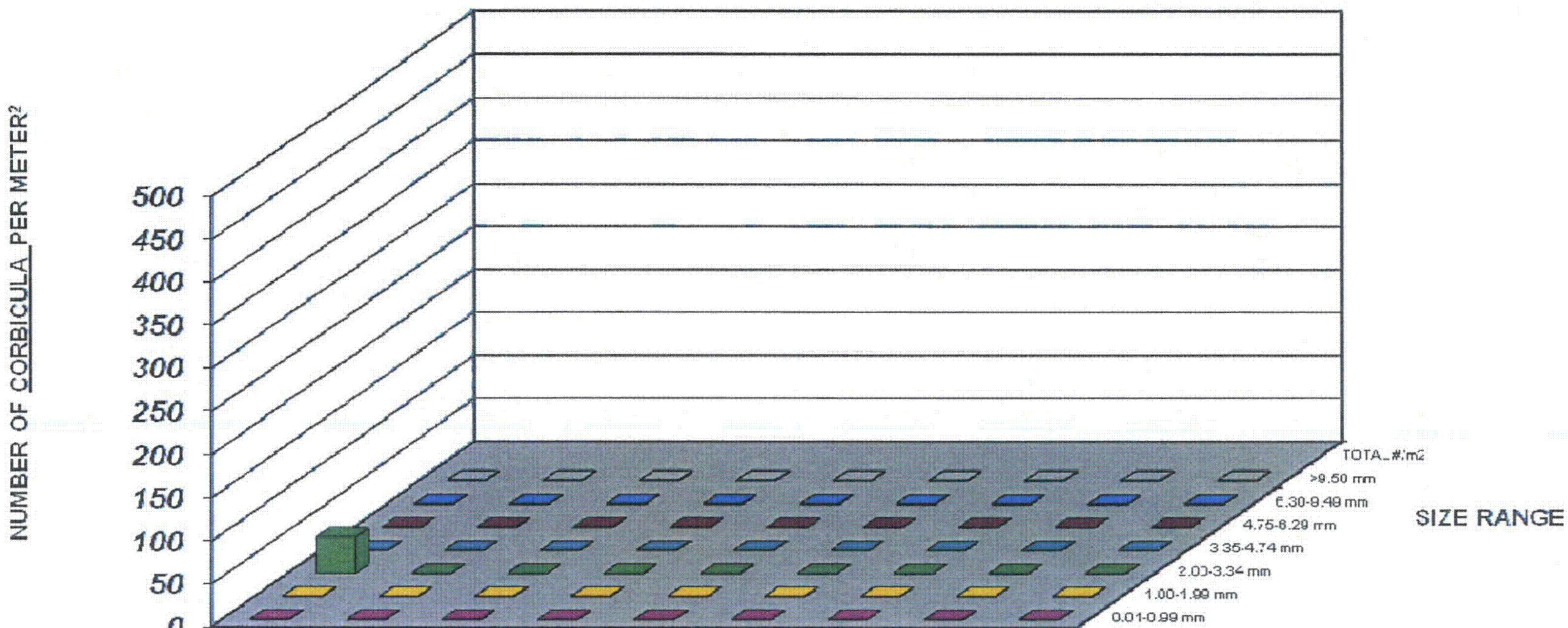


	3/29	4/26*	5/23	6/20	7/25	8/27	9/20	10/25	11/12
0.01-0.99 mm	0	0	0	0	0	0	0	0	0
1.00-1.99 mm	0	0	0	0	0	0	0	0	0
2.00-3.34 mm	0	0	0	0	0	0	0	0	0
3.35-4.74 mm	0	0	0	0	0	0	0	0	0
4.75-6.29 mm	0	0	0	0	0	0	0	0	0
6.30-9.49 mm	0	0	0	0	0	0	0	0	0
>9.50 mm	0	0	0	0	0	0	0	0	0
TOTAL #/m2	0	0	0	0	0	0	0	0	0

Figure 5.5

*Unit 1 not sampled in April due to outage

Comparison of live Corbicula clam density estimates among 2012 BVPS Unit 2 cooling tower reservoir events, for various clam shell groups.

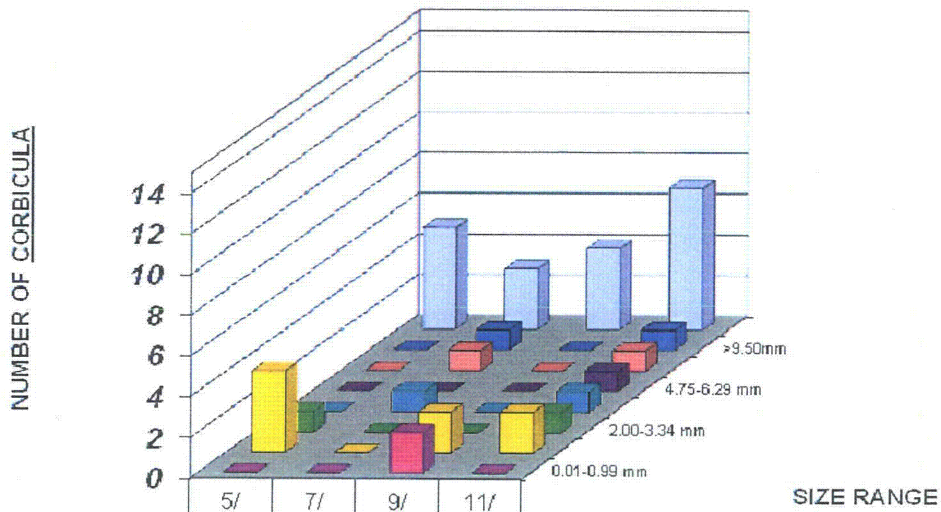


	3/29	4/26	5/23	6/20	7/25	8/27	9/20	10/25*	11/12
0.01-0.99 mm	0	0	0	0	0	0	0	0	0
1.00-1.99 mm	0	0	0	0	0	0	0	0	0
2.00-3.34 mm	43	0	0	0	0	0	0	0	0
3.35-4.74 mm	0	0	0	0	0	0	0	0	0
4.75-6.29 mm	0	0	0	0	0	0	0	0	0
6.30-9.49 mm	0	0	0	0	0	0	0	0	0
>9.50 mm	0	0	0	0	0	0	0	0	0
TOTAL #/m2	43	0	0	0	0	0	0	0	0

Figure 5.6

*Unit 2 not sampled in October due to access restrictions

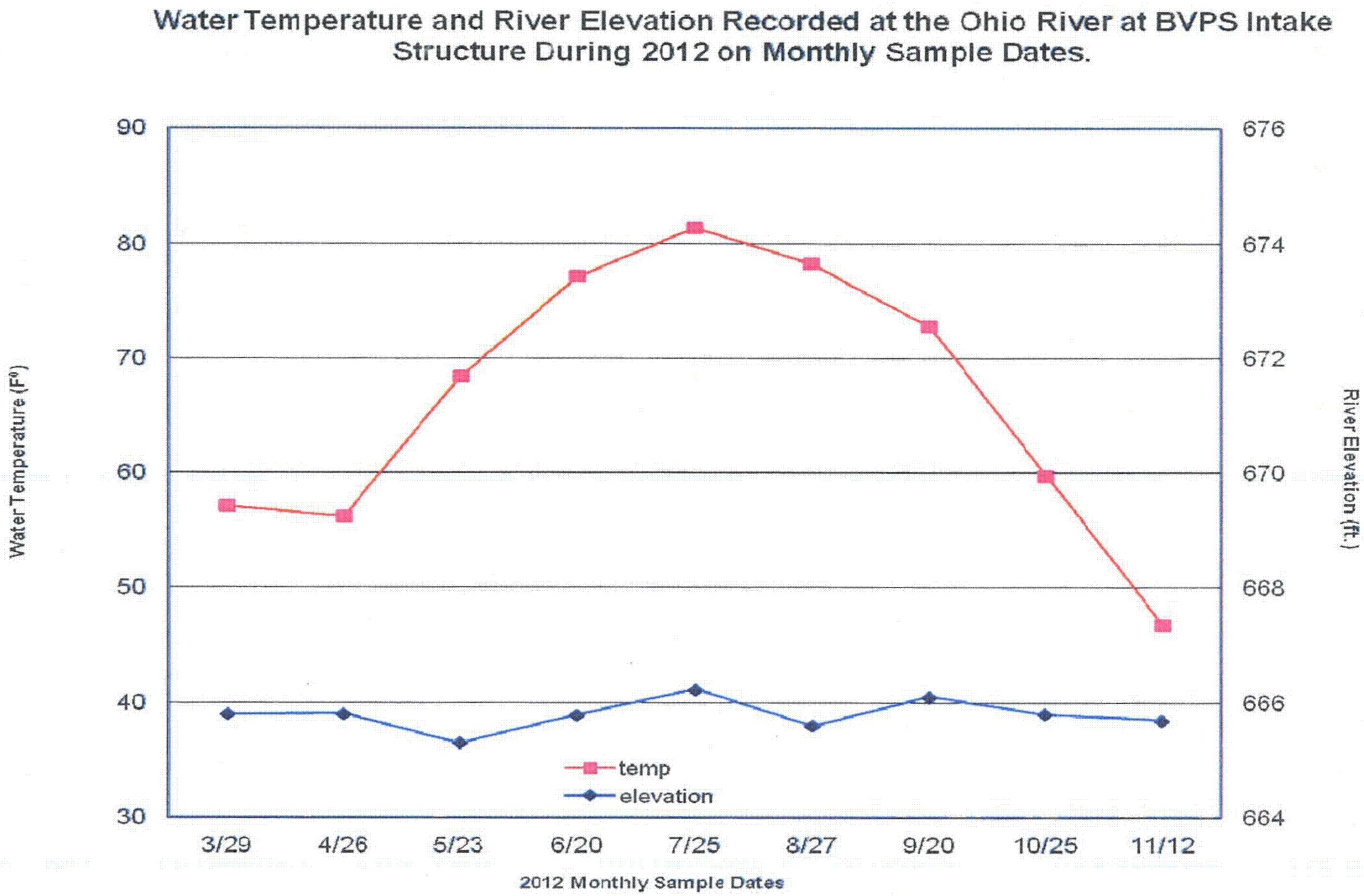
Comparison of live Corbicula clam density estimates among 2012 BVPS Intake Structure sample events, for various clam shell groups.



	5/23	7/25	9/20	11/12
0.01-0.99 mm	0	0	2	0
1.00-1.99 mm	4	0	2	2
2.00-3.34 mm	1	0	0	1
3.35-4.74 mm	0	1	0	1
4.75-6.29 mm	0	0	0	1
6.30-9.49 mm	0	1	0	1
>9.50mm	0	1	0	1
TOTAL	5	3	4	7

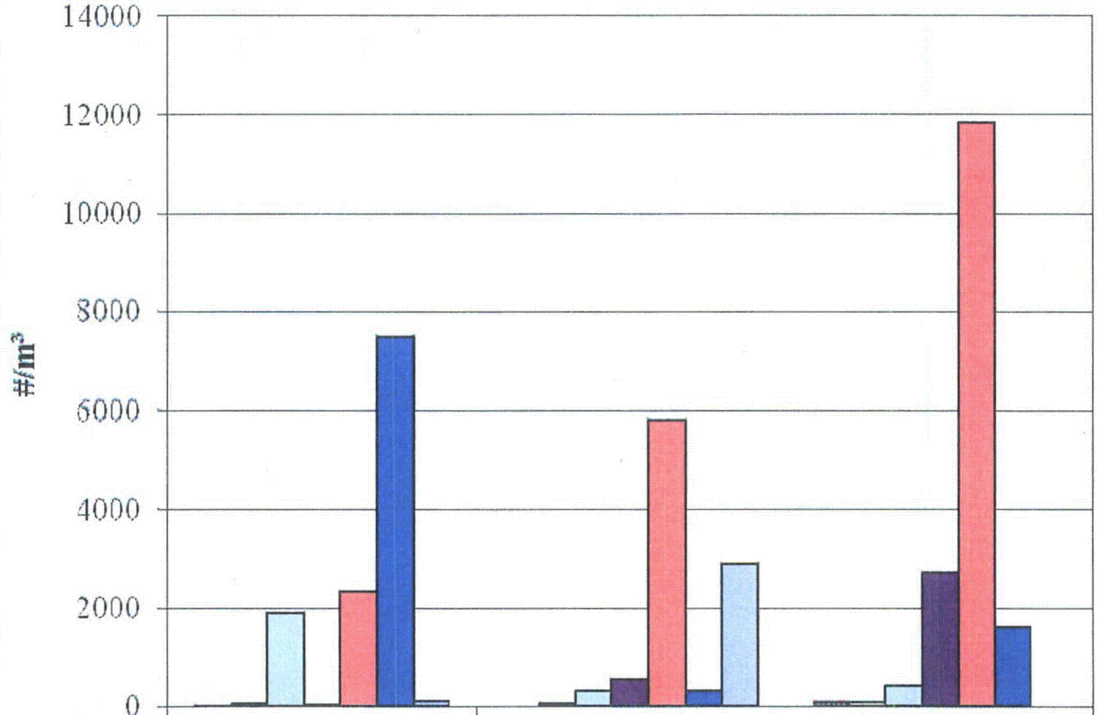
Intake structure bottom samples are collected from the Ohio River at the Intake Building.

Figure 5.7



Water Temperature and River Elevation Recorded at the Ohio River at BVPS Intake Structure During 2012 on Monthly Sample Dates.
90
80
70
60
50
40
30
Water Temperature (F°)
676
674
672
670
668
666
664
River Elevation (ft.)
temp
elevation
3/29
4/26
5/23
6/20
7/25
8/27
9/20
10/25
11/12
2012 Monthly Sample Dates

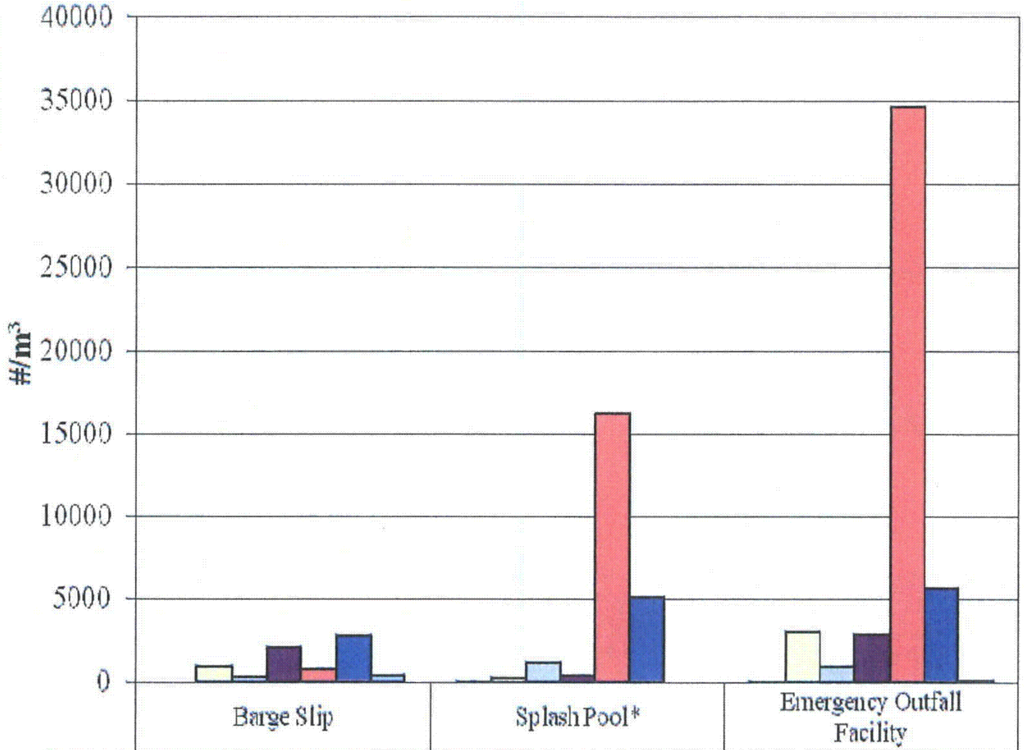
Figure 5.8



	Intake Structure/Open Water	Unit 1 Cooling Tower Reservoir*	Unit 2 Cooling Tower Reservoir**
4/25	30	0	70
5/23	48	50	80
6/20	1910	310	410
7/25	20	560	2730
8/27	2340	5807	11840
9/20	7480	320	1620
10/25	110	2908	0

Sample location

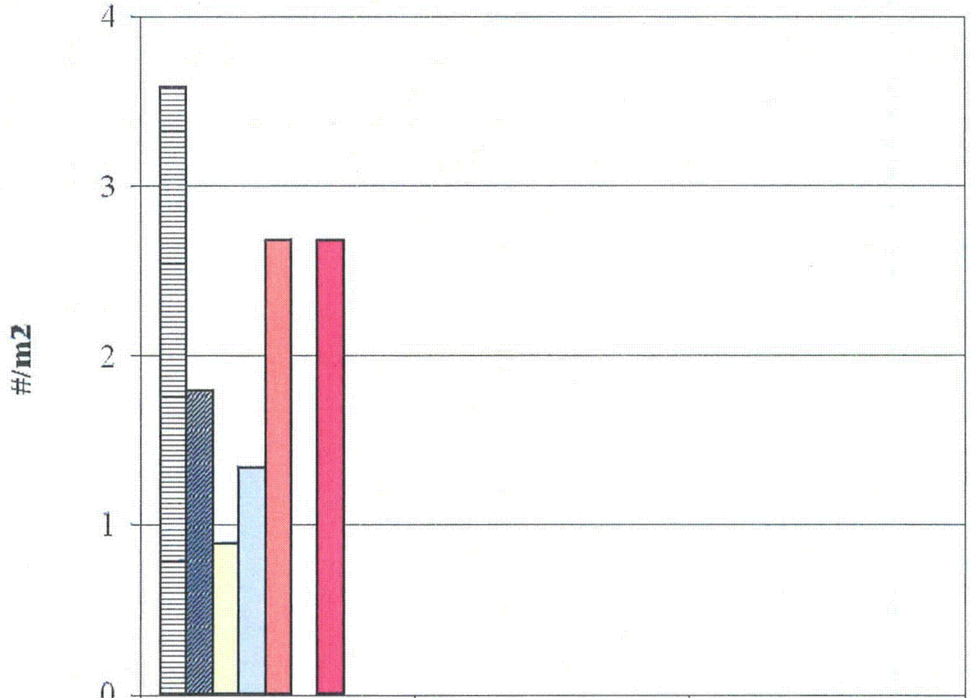
Figure 5.9. Density of zebra mussel veligers collected at Beaver Valley Power Station, 2012.
*Unit 1 Cooling Tower not sampled in April due to outage
**Unit 2 Cooling Tower not sampled in October due to outage



	Barge Slip	Splash Pool*	Emergency Outfall Facility
4/26	0	50	10
5/23	920	250	3030
6/20	300	1200	960
7/25	2070	420	2880
8/27	830	16248	34628
9/20	2768	5100	5610
10/25	370	0	30

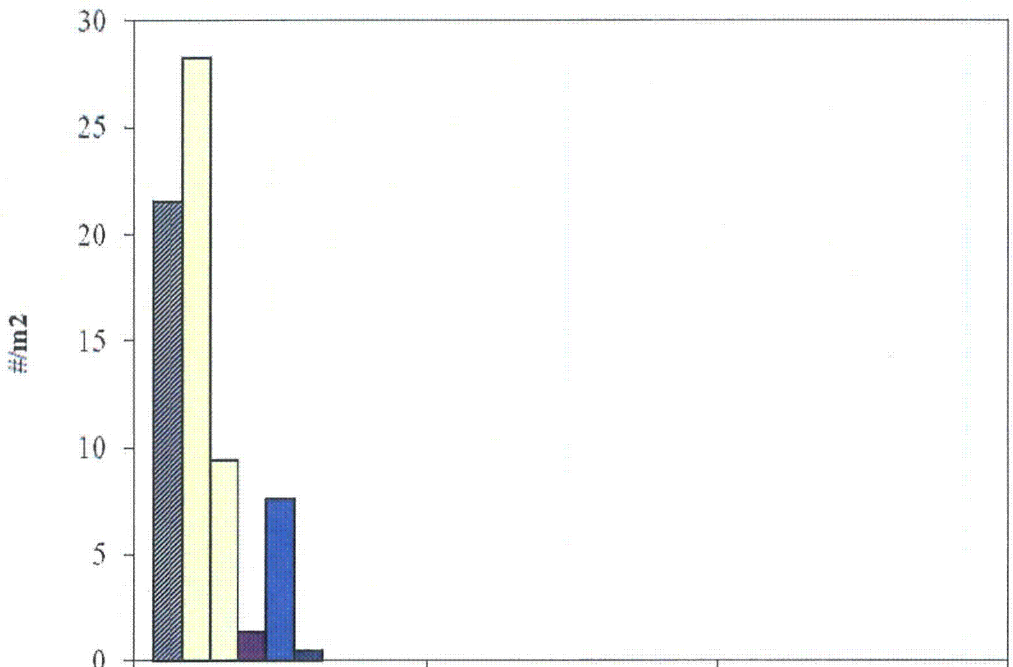
Sample location

Figure 5.10. Density of zebra mussel veligers collected at Beaver Valley Power Station, 2012.
*Not sampled in October due to access restriction



	Intake Structure/Open Water	Unit 1 Cooling Tower Reservoir*	Unit 2 Cooling Tower Reservoir**
3/29	4	0	0
4/26	2	0	0
5/23	1	0	0
6/20	1	0	0
7/25	3	0	0
8/27	0	0	0
9/20	3	0	0
10/25	0	0	0
11/12	0	0	0

Figure 5.11. Density of settled zebra mussels at Beaver Valley Power Station, 2012.
*Unit I Cooling Tower not sampled in April due to outage
**Unit 2 Cooling Tower not sampled in October due to outage



	Barge Slip	Splash Pool*	Emergency Outfall Facility
3/29	22	0	0
4/26	28	0	0
5/23	9	0	0
6/20	1	0	0
7/25	8	0	0
8/27	0	0	0
9/20	0	0	0
10/25	0	0	0
11/12	0	0	0

Figure 5. 12 Density of settled zebra mussels at Beaver Valley Power Station, 2012.

*Splash pool not sampled in October due to access restrictions

10.0

PERMITS

Attachment 10.1: PERMITS & CERTIFICATES FOR ENVIRONMENTAL COMPLIANCE

Registration Number	Regulator/Description	Expiration
PAR000040485	BVPS EPA generator identification Resource Conservation & Recovery Act (RCRA) Identification number for regulated waste activity. Also used by PA DEP to monitor regulated waste activity under the Pennsylvania Solid Waste Management Act (SWMA).	Indefinite
04-02474	BVPS EPA Facility Identification Number for CERCLA/EPCRA/SARA. Used for SARA Tier II reporting and emergency planning.	Indefinite
04-02475	FE Long Term Distribution Center/Warehouse (22) EPA Facility Identification Number for CERCLA/EPCRA/SARA. Used for SARA Tier II reporting and emergency planning.	Indefinite
PA0025615	BVPS NPDES Permit number under US EPA and PA DEP.	12/27/2006 *Continued pending approval of renewal application.*
04-13281	BVPS Unit 1 PA DEP Facility Identification & certificate number for regulated storage tanks.	Indefinite
04-13361	BVPS Unit 2 PA DEP Facility Identification & certificate number for regulated storage tanks.	Indefinite
OP-04-00086	PA DEP State Only Synthetic Minor Permit for emergency auxiliary boilers, emergency diesel generators, paint shop and other miscellaneous sources.	10/12/2012 *Continued pending approval of renewal application.*
N/A	PA DEP Open Burning Permit for operation of the BVPS Fire School- annual application and renewal	01/01/2014
042009 450 002RT	US Department of Transportation Hazardous Materials Registration	06/30/2015
200100242	US Army Permit for maintenance dredging (With Encroachment/Submerged Lands Agreement #0477705, this allows maintenance dredging.).	12/31/2021
0477705	Encroachment Permit/Submerged Lands Agreement for construction and maintenance of current barge slip. (With US Army Permit #200100242, this allows maintenance dredging.)	Indefinite
06786A	Encroachment Permit/Submerged Lands Agreement for transmission line over Ohio River @ Mile 34.5	Indefinite
18737	Encroachment Permit/Submerged Lands Agreement for Unit 1 intake and discharge (main combined intake and outfall structures)	Indefinite
0475711	Encroachment Permit/Submerged Lands Agreement for construction and maintenance of Unit 2 auxiliary intake	Indefinite
GP020409201	For construction and maintenance of boat ramp near barge slip.	Indefinite
	- End Table -	

APPENDIX A

SCIENTIFIC AND COMMON NAME[1] OF FISH COLLECTED IN THE NEW CUMBERLAND POOL OF THE OHIO RIVER, 1970 THROUGH 2012 BVPS

[1]Nomenclature follows Robins, et al. (1991)

Appendix A

Family and Scientific Name	Common Name
Lepisosteidae (gars)	
Lepisosteus osseus	Longnose gar
Hiodontidae (mooneyes)	
Hiodon alosoides	Goldeye
H. tergisus	Mooneye
Clupeidae (herrings)	
Alosa chrysochloris	Skipjack herring
A. pseudoharengus	Alewife
Dorosoma cepedianum	Gizzard shad
Cyprinidae (carps and minnows)	
Campostoma anomalum	Central stoneroller
Carassius auratus	Goldfish
Ctenopharyngodon idella	Grass carp
Notropis spilopterus	Spotfin shiner
Cyprinus carpio	Common carp
C. carpio x C. auratus	Carp-goldfish hybrid
Luxilus chrysocephalus	Striped shiner
Macrhybopsis storeriana	Silver chub
Nocomis micropogon	River chub
Notemigonus crysoleucas	Golden shiner
Notropis atherinoides	Emerald shiner
N. buccatus	Silverjaw minnow
N. hudsonius	Spottail shiner
N. rubellus	Rosyface shiner
N. stramineus	Sand shiner
N. volucellus	Mimic shiner
Pimephales notatus	Bluntnose minnow
P. promelas	Fathead minnow
Rhinichthys atratulus	Blacknose dace
Semotilus atromaculatus	Creek chub
Catostomidae (suckers)	
Carpiodes carpio	River carpsucker
C. cyprinus	Quillback
C. velifer	Highfin carpsucker
Catostomus commersonii	White sucker
Hypentelium nigricans	Northern hogsucker
Ictiobus bubalus	Smallmouth buffalo
I. niger	Black buffalo
Minytrema melanops	Spotted sucker

Appendix A
(Continued)

Family and Scientific Name	Common Name
Moxostoma anisurum	Silver redhorse
M. carinatum	River redhorse
M. duquesnei	Black redhorse
M. erythrurum	Golden redhorse
M. macrolepidotum	Shorthead redhorse
Ictaluridae (bullhead catfishes)	
Ameiurus catus	White catfish
A. furcatus	Blue catfish
A. melas	Black bullhead
A. natalis	Yellow bullhead
A. nebulosus	Brown bullhead
Ictalurus punctatus	Channel catfish
Noturus flavus	Stonecat
Pylodictis olivaris	Flathead catfish
Esocidae (pikes)	
Esox lucius	Northern pike
E. masquinongy	Muskellunge
E. lucius x E. masquinongy	Tiger muskellunge
Salmonidae (trouts)	
Oncorhynchus mykiss	Rainbow trout
Percopsidae (trout-perches)	
Percopsis omiscomaycus	Trout-perch
Cyprinodontidae (killifishes)	
Fundulus diaphanus	Banded killifish
Atherinidae (silversides)	
Labidesthes sicculus	Brook silverside
Percichthyidae (temperate basses)	
Morone chrysops	White bass
M. saxatilis	Striped bass
M. saxatilis x M. chrysops	Striped bass hybrid
Centrarchidae (sunfishes)	
Ambloplites rupestris	Rock bass
Lepomis cyanellus	Green sunfish
L. gibbosus	Pumpkinseed
L. macrochirus	Bluegill
L. microlophus	Redear sunfish
L. gibbosus x L. microlophus	Pumpkinseed-redear sunfish hybrid
Micropterus dolomieu	Smallmouth bass
M. punctulatus	Spotted bass
M. salmoides	Largemouth bass
Pomoxis annularis	White crappie
P. nigromaculatus	Black crappie

Appendix A (Continued)

Family and Scientific Name	Common Name
Percidae (perches)	
Etheostoma blennioides	Greenside darter
E. nigrum	Johnny darter
E. zonale	Banded darter
Perca flavescens	Yellow perch
Percina caprodes	Logperch
P. copelandi	Channel darter
Sander canadense	Sauger
S. vitreum	Walleye
S. canadense x *S. vitreum*	Saugeye
Sciaenidae (drums)	
Aplodinotus grunniens	Freshwater drum