

**SUMMARY OF UPSTREAM AND DOWNSTREAM  
FISH PASSAGE AT THE  
YORK HAVEN HYDROELECTRIC PROJECT  
IN 2012**

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## TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY .....	ES-1
1.0 INTRODUCTION.....	1
2.0 YORK HAVEN FISHWAY OPERATIONS.....	1
2.1 Project Operation .....	1
2.2 Fishway Design and Operation .....	2
2.2.1 Fishway Design .....	2
2.2.2 Fishway Operation .....	2
2.3 Fish Counts .....	2
2.4 Results .....	3
2.4.1 Spring Fishway Operation.....	3
3.0 DOWNSTREAM FISH PASSAGE.....	4
3.1 Adult Passage .....	4
3.2 Juvenile Passage .....	4
4.0 LITERATURE CITED .....	5

### LIST OF TABLES

Table 1	Summary of the daily number of fish that passed by the York Haven Hydroelectric Project through the serpentine vertical notch ladder at the East Channel Dam in 2012.
Table 2	Summary of daily average river flow (USGS, Harrisburg Gage), average flow in the East Channel, sum of average flow from the power station and Main dam, water temperature, secchi, stop gate position, and East Channel and Fishway water elevations during operation of the York Haven Fishway in 2012.
Table 3	Summary of surface water elevations recorded during operation of the York Haven Fishway in 2012.
Table 4	Hourly summary of American shad passage through the vertical notch fish ladder at the York Haven Hydroelectric Project in 2012.

### LIST OF FIGURES

Figure 1	General layout of the York Haven Hydroelectric Project showing the location of the Fishway.
Figure 2	General arrangement of the York Haven Fishway.
Figure 3	Plot of river flow (x 1000 cfs) and water temperature (F) at the York Haven Fishway in spring 2012.
Figure 4	Plot of river flow (x 1000 cfs) and East Channel flow (x 1000 cfs) at the York Haven Fishway in spring 2012.
Figure 5	Plot of river flow (x 1000 cfs) at the USGS Harrisburg Station (#01570500) on the Susquehanna River and Average Daily Water Temperature at the York Haven Power Station, 10 September to 16 November, 2012.

## EXECUTIVE SUMMARY

The fish ladder was opened on 1 April allowing volitional (unmanned) passage for 24 days prior to initiating manned Fishway operation. In 2012, the Fishway was manned on a total of 43 days between 25 April and 6 June. Some 97,990 fish of 23 taxa were enumerated as they passed upstream into Lake Frederic. Gizzard shad (87,068) was the dominant fish species passed and comprised almost 89% of the fish passed. Other predominant fishes passed included quillback (4,104), channel catfish (2,858), shorthead redhorse (1,491), carp (669) walleye (602) and smallmouth bass (553). Passage varied daily and ranged from 103 fish on 25 April to 8,002 fish on 12 May when 8.2% of the season total was passed.

A total of 224 American shad passed upstream through the ladder in 2012. Some 71 shad passed in April and 153 shad passed in May. No shad passed in June. Peak shad passage occurred on 26 April when some 68 shad (30.4% of season total) passed.

American shad were collected and passed at water temperatures of 50.9°F to 76.1°F, River flows of 25,600 cfs to 94,900 cfs and East Channel flows of 3,100 cfs to 16,000 cfs. Passage during April occurred at Rivers flows that varied from 32,100 cfs to 38,800 cfs. Water temperature during this period ranged from 50.9°F to 57.2°F and East Channel flows varied 2,133 cfs to 5,240 cfs. Passage during May occurred at Rivers flows that increased from 26,300 cfs to 94,900 cfs before declining to 28,600 on 26 May. Water temperature during this period ranged from 59.9°F to 76.1°F and East Channel flows varied from 3,100 cfs to 16,000 cfs.

Over 41% of the shad (93) passed between 0800 hrs and 1059 hrs; hourly passage varied from no shad to 9 shad. Some 78 shad passed from 1100 to 1359 hrs. A total of 53 shad passed between 1400 hrs and the end of manned operation each day (1600 and/or 1700 hrs). The peak hourly passage of shad (18) occurred on 26 April between 1400 hrs and 1459 hrs.

As in previous years YHPC agreed to make periodic observations for adult shad in the forebay and open the sluice gate if/when large numbers of adults were observed. No adult shad were observed by Station Personnel that made periodic observations of the forebay area from June through August.

The station also planned to implement the juvenile Downstream Passage Protocol that was developed in concert with the FPTAC. Daily monitoring of the York Haven forebay for the presence of juvenile shad began on 10 September when water temperature was 74.0°F. Monitoring continued through 16 November. During this period River flows ranged from 5,850 cfs to 108,000 cfs. The detection of fish activity during this period was noted as being generally non-existent and/or extremely light by station personnel that monitored the forebay nightly for fish activity. Given fish activity was non-existent there was no need to implement "Downstream Operation".

## **1.0 INTRODUCTION**

In 1993, York Haven Power Company (YHPC), the licensees of the Safe Harbor and Holtwood Projects, the U.S. Department of the Interior represented by the Fish and Wildlife Service (“USFWS”), the Susquehanna River Basin Commission (“SRBC”), the states of Maryland and Pennsylvania and their involved agencies – Maryland Department of Natural Resources (“MDNR”), Pennsylvania Fish and Boat Commission (“PFBC”) and Pennsylvania Department of Environmental Resources (“PADEP”), and two other parties signed the Susquehanna River Fish Passage Settlement Agreement.

This agreement established for each project a Fish Passage Technical Advisory Committee (“FPTAC”) comprised of representatives of the affected licensee, USFWS, PFBC and MDNR. Each FPTAC is responsible for reviewing and monitoring the design, construction, maintenance and operation of the fish passage facilities at the respective project, preparing an annual report, and recommending studies and/or modifications to improve upstream and downstream passage.

Although the FPTAC did not schedule a specific meeting to discuss Fishway operation to discuss Fishway operation, committee members had the opportunity to discuss Fishway operation with Station personnel during project relicensing meetings. As in previous years, objectives of 2012 operation were to monitor passage of migratory and resident fishes through the Fishway and continue to assess operation.

## **2.0 YORK HAVEN FISHWAY OPERATIONS**

The installation and operation of the Fishway are part of a cooperative private, state and federal effort to restore American shad (*Alosa sapidissima*) and other migratory fish to the Susquehanna River. In 1997, YHPC and the resource agencies reached a new settlement agreement to revise the type and location of the York Haven fish passage facility. The Fishway is located in Dauphin County, PA at the Three Mile Island end of the East Channel Dam at the York Haven Hydroelectric Project (FERC No. 1888). The Fishway was placed in service by YHPC in April 2000.

Fishway operation coincides with a springtime minimum flow release. As part of the 1997 agreement, YHP agreed to maintain a spill of up to 4,000 cfs over the Main Dam and a minimum release of approximately 2,000 cfs in the East Channel through the Fishway during spring operation. River flow in excess of spring minimum flow requirements and station capacity is spilled over the Main and East Channel Dams and through the Fishway. A nominal 2,100 cfs East Channel minimum flow is released through the fishway 24 hrs a day during the entire Fishway operating season. When River flows are less than 23,000 cfs, a nominal minimum spill of 4,000 cfs is maintained over the Main Dam during daily Fishway operation.

### **2.1 Project Operation**

The hydroelectric station located in York Haven, PA built in 1904, is situated on the River (river mile 55) in Dauphin and York counties, Pennsylvania (Figure 1). It is the fourth upstream hydroelectric facility on the River. The Project is a 20 unit run-of-river facility capable of producing approximately 19 MW and has an estimated hydraulic capacity of 17,000 cfs. It includes two dams that impound approximately 5 miles of the River forming Lake Frederic. The Main Dam is approximately 5,000-ft long, with a maximum height of 17-ft. The East Channel Dam is approximately 925-ft long with a maximum height of 9-ft. When River flow exceeds station hydraulic capacity (55% of the year), water is spilled over the two dams.

## **2.2 Fishway Design and Operation**

### **2.2.1 Fishway Design**

Fishway design incorporated numerous criteria established by the USFWS and the other resource agencies. The Fishway has an operating limit of 150,000 cfs River flow (East Channel flow limit of approximately 22,000 cfs). The Fishway includes two sections; a “weir cut” and a vertical notch fish ladder. Figure 2 provides the general arrangement of the Fishway. A detailed description of the Fishway and its major components is located in 2000 and 2001 summary reports (Kleinschmidt 2000 & 2002).

### **2.2.2 Fishway Operation**

Fishway preparations began in early March and volitional passage (unmanned) began on 1 April. Only the entrance and exit gate were open during a 24 day unmanned period of Fishway operation between 1 and 24 April.

Manned Fishway operation, commenced on Wednesday 25 April, 4 days after the Safe Harbor Fish Lift had passed 1,036 American shad. In 2012, the Fishway was manned on a total of 43 days between 25 April and 6 June. Normally, fish were counted and allowed to pass upstream between 0800 hrs and 1600 hrs. However, per the Fishway Operation Plan, counting was extended to 1700 hrs on 26 April as five shad had passed between 1600 hrs and 1700 hrs. Since no shad were observed passing the ladder between 30 May and 6 June, an 8 day period, manned Fishway operation ended at 1600 hrs on 6 June.

Between 25 April and 6 June both fixed wheel gates and the diffuser gate were opened. These gates remained opened throughout the spawning migration. The entrance gate was the only gate that was adjusted throughout the season. This gate was adjusted manually maintaining a 0.5-ft to 0.8-ft differential between the surface water elevation downstream of the entrance and the water elevation in the diffuser area of the fish ladder. This setting resulted in an average velocity of 4 ft/sec to 6 ft/sec at the entrance to the ladder. The 7-ft wide stop gate, located between the weir and the fish ladder entrance, remained closed during the entire period of operation.

Excluding the first and last day of manned operation, the Fishway was typically staffed by one person. This person, a biologist or technician, adjusted the position of the entrance gate, counted and recorded the number of fish that passed through the ladder hourly, removed debris from the exit of the ladder, made visual observations of fish activity and movement in and through the ladder, and made observations once each day below the Main Dam. These individuals also recorded water elevations several times each day on staff gauges located throughout the Fishway.

After manned Fishway operation ended on 6 June, the South fixed wheel gate was closed. On 7 June, the fish ladder and North fixed wheel gate were set to deliver a minimum flow of 400 cfs into the East Channel. Except for a short in early October (4 to 9 October) when the Fishway was closed to inspect the ladder’s diffuser chamber, the Fishway remained open through 28 November and was set to deliver a minimum stream flow of at least 400 cfs to the East Channel.

## **2.3 Fish Counts**

Fish that passed through the ladder were identified to species and enumerated as they passed the counting window by a biologist and/or technician. A description of the procedures used to count fish is described in prior annual operating reports (Kleinschmidt 2000 and 2002). Fish passage by the viewing window was controlled by opening or closing an aluminum grating

gate with an electric hoist that was controlled from inside the viewing room. The stop gate was opened each morning at 0800 hrs and closed nightly at 1600 hrs or 1700 hrs when the Fishway was manned. Occasionally, it was closed for brief periods of time as needed each day to enable personnel manning the Fishway to remove debris from screens and the fishway exit other conduct other activities. In addition, in an effort to improve viewing, the adjustable crowder screen was adjusted as needed to allow all fish that passed to be observed. Gate settings on the days the Fishway was manned varied from 6 in. to 24 in.

As in previous seasons, fish passage data was entered on a field data sheet and uploaded into a computer. Files were uploaded each evening, checked and corrected as necessary. Data reporting was PC-based and accomplished by program scripts, or macros, created within Microsoft Excel spreadsheets. Passage data and operational conditions were supplied electronically to YHPC's on-site coordinator/manager and other appropriate YHPC personnel on a daily basis. Passage information was subsequently provided electronically by YHPC personnel to members of the FPTAC.

## **2.4 Results**

### **2.4.1 Spring Fishway Operation**

#### **2.4.1.1 Relative Abundance**

The number of fish that passed through the York Haven fish ladder is presented in Table 1. Some 97,990 fish of 23 taxa were enumerated as they passed upstream into Lake Frederic. Gizzard shad (87,068) was the dominant fish species passed and comprised almost 89% of the fish passed. Some 224 American shad were counted as they passed through the ladder. Other predominant fishes passed included quillback (4,104), channel catfish (2,858), shorthead redhorse (1,491), carp (669) walleye (602) and smallmouth bass (553). Passage varied daily and ranged from 103 fish on 25 April to 8,002 fish on 12 May when 8.2% of the season total was passed.

#### **2.4.1.2 American Shad Passage**

A total of 224 American shad passed upstream through the ladder in 2012. Some 71 shad passed in April and 153 shad passed in May. No shad passed in June. Peak shad passage occurred on 26 April when some 68 shad (30.4% of season total) passed.

American shad were collected and passed at water temperatures of 50.9°F to 76.1°F, River flows of 25,600 cfs to 94,900 cfs and East Channel flows of 3,100 cfs to 16,000 cfs (Tables 2 and 3, Figures 3 and 4). Passage during April occurred at Rivers flows that varied from 32,100 to 38,800. Water temperature during this period ranged from 50.9° F to 57.2° F and East Channel flows varied 2,133 cfs to 5,240 cfs. Passage during May occurred at River flows that increased from 26,300 cfs to 94,900 cfs before declining to 28,600 on 26 May. Water temperature during this period ranged from 59.9°F to 76.1°F and East Channel flows varied from 3,100 cfs to 16,000 cfs

The hourly passage of American shad through the fish ladder is given in Table 4. Over 41% of the shad (93) passed between 0800 hrs and 1059 hrs; hourly passage varied from no shad to 9 shad. Some 78 shad passed from 1100 to 1359 hrs. A total of 53 shad passed between 1400 hrs and the end of manned operation each day (1600 and/or 1700 hrs). The peak hourly passage of shad (18) occurred on 26 April between 1400 hrs and 1459 hrs.

Per the FPOP, counting was extended hourly on 1 of 43 days that the fishway was manned. On 26 April, 2 shad passed between 1600 hrs and 1700 hrs.

### **2.4.1.3 Other Alosids**

No other alosids (alewife, blueback herring and hickory shad) were observed passing through the ladder (Table 1).

### **2.4.1.4 Observations**

Once each day, visual observations of fish activity were made on a random basis below the Main Dam. On several occasions several gizzard shad were observed and a few were observed trying to swim over the Main Dam. No shad or other alosids were observed below the Main Dam.

Observations were made at the “weir cut” several times each day in an attempt to see if American shad or other fishes passed upstream through this section of the Fishway. On several occasions carp, quillback and gizzard shad were observed trying to swim over the 67 ft. weir. However, no fish were observed trying to swim through the fixed wheel gates.

## **3.0 DOWNSTREAM FISH PASSAGE**

As in previous years, YHPC anticipated making periodic observations for adult shad in the forebay and opening the trash gate if/when large numbers of adults were observed. They also planned to implement the juvenile Downstream Passage Protocol that was developed in concert with the FPTAC.

### **3.1 Adult Passage**

In addition to the daily observations, a limited number of American Shad were tagged with radio transmitters this year and released near Harrisburg. In addition to physical observations, a detector was used to find the tagged Shad. No physical observations of post-spawned adult American shad were noted by Station personnel that made periodic observations of the forebay area between 26 April and 02 August 2012. During this period (26 April to 02 August) station personnel opened the trash sluice on 24 days. Although no adult shad were observed using the sluice gate, results obtained during the 2012 adult shad downstream passage radio telemetry study showed that 73% of the 59 shad that passed downstream of the project did not pass through the projects turbines. Thirty (50.8%) of the radio tagged shad passed over the Main Dam and 12 (20.3%) tagged shad passed downstream of the project passed through the sluice gate.

### **3.2 Juvenile Passage**

The Juvenile Downstream Passage Protocol provides for:

- Monitoring the forebay to determine when outmigrating juveniles arrive at the project
- Starting “Downstream Operation” when juveniles arrive at York Haven; Downstream Operation begins each evening at sunset and continue until about 11:30 p.m. Downstream Operation includes:
  - Turning on temporary lighting at the trash sluiceway and opening the sluiceway

- Operating only Units 1-6 when river flow is insufficient for operation of any of the remaining units
- Operating Units 7-20 only when river flow exceeds the hydraulic capacity of available Units 1-6; the operating priority for Units 7-20 is Unit 7, Unit 8, Unit 9 etc.
- Monitoring and sampling in the forebay as river water temperatures drop and/or River flows increase to determine when the juvenile shad emigration has ended for the season
- Ceasing “Downstream Operation” at the end of the run, in consultation with members of the FPTAC.

In accordance with the protocol, monitoring of the York Haven forebay for the presence of juvenile American shad began on 10 September when water temperature was 74.0°F and River flow at Harrisburg was 4,110 cfs (Figure 5). Monitoring continued through 16 November. River flows from 10 September to 29 October, were less than station capacity, averaged 10,155 cfs and ranged from 5,850 cfs to 16,700 cfs. Heavy rain from hurricane Sandy on 29 and 30 October caused River flows to increase; flows peaked at 108,000 cfs on 1 November. Between 2 November and 16 November River flows declined and ranged from 93,800 cfs to 18,400 cfs. Average daily water temperature during the observation period (10 September to 16 November) dropped a total of 30 degrees and ranged from a high of 74.0°F to a low of 44.0°F.

The detection of fish activity during this period was noted as being generally non-existent and/or extremely light by station personnel that typically monitored the forebay twice daily. Observations were typically made daily by station personnel between 0700 hrs and 0800 hrs and within one hour of dusk. In addition, cast netting was conducted and observations in the forebay were made at dusk by a Kleinschmidt biologist on 18 and 24 October that supported and verified observations made by station personnel. Weekly cast netting and observations by Kleinschmidt’s biologist were stopped after rains from hurricane Sandy pushed river flows to 108,000 cfs which resulted in heavy spill at York Haven.

Given that fish activity was non-existent there was no need to implement "Downstream Operation". As a means of ensuring the downstream migration wasn't occurring without being noticed routine contact was maintained with others conducting juvenile shad sampling programs in the lower River. According to personnel conducting these sampling programs juvenile shad abundance was low in 2012. Only a few juveniles were collected in the River, one juvenile shad were collected at Columbia and no juveniles were collected at City Island while haul seining in 2012.

#### **4.0 LITERATURE CITED**

Kleinschmidt. 2000. Summary of operation at the York Haven Fishway in 2000. Prepared for York Haven Power Company, GPU Energy by Kleinschmidt, Strasburg, Pennsylvania. 21 pp.

Kleinschmidt. 2002. Summary of operation at the York Haven Fishway in 2001. Prepared for York Haven Power Company, GPU Energy/FirstEnergy by Kleinschmidt, Strasburg, Pennsylvania. 21 pp.



## **TABLES**

**Table 1. Summary of the daily number of fish that passed by the York Haven Hydroelectric Project through the serpentine vertical notch ladder at the East Channel Dam in 2012.**

	Date	25-Apr	26-Apr	27-Apr	28-Apr	29-Apr	30-Apr	1-May	2-May	3-May	4-May
Observation Time (hrs.)	8.0	8.0	8.0	9.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Water Temperature (°F)	54.5	54.5	57.2	50.9	53.6	53.6	57.2	59.9	59.9	59.9	59.0
American shad			68	2	1				11	3	6
Alewife											
Blueback herring											
Gizzard shad	41	291	1,255	1,317	662	946	906	1,374	1,336	859	
Hickory shad											
Striped bass		2	1	1							
White perch											
American eel											
Rainbow trout											
Brown trout											
Brook trout											
Muskellunge											
Carp		6	7	2		11	15	35	25	14	
Quillback	24	799	186	10	5	52	205	416	287	505	
White sucker	4	21	2			2	8	3	2		
Shorthead redhorse	20	124	43	16	5	59	101	186	156	290	
White catfish											
Yellow bullhead											
Brown bullhead											
Channel catfish	5	61	44	11	4	6	32	155	100	109	
Rock bass							36				
Redbreast sunfish											
Green sunfish											
Pumpkinseed											
Bluegill											
Smallmouth bass		2	2			3		129	97	83	
Largemouth bass								2			
Yellow perch											
Walleye	9	60	17	3	4	18	34	79	61	118	
Northern hog sucker											
Fallfish											
Flathead catfish											
Striped bass hybrid			6	3	1	2	1	1			
Tiger muskie											
<b>TOTAL</b>		<b>103</b>	<b>1,434</b>	<b>1,565</b>	<b>1,364</b>	<b>681</b>	<b>1,099</b>	<b>1,330</b>	<b>2,396</b>	<b>2,068</b>	<b>1,986</b>

Table 1. (continued)

Date	5-May	6-May	7-May	8-May	9-May	10-May	11-May	12-May	13-May	14-May
Observation Time (hrs.)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Water Temperature (°F)	64.4	66.2	62.6	58.1	58.1	61.3	61.7	61.7	62.6	63.5
American shad	16	25	11	12	14	3	0	13	11	3
Alewife										
Blueback herring										
Gizzard shad	1,157	1,470	1,619	2,573	5,113	5,462	6,711	7,893	7,636	5,302
Hickory shad										
Striped bass	1									
White perch										
American eel										
Rainbow trout	1									
Brown trout				1	1				2	
Brook trout										
Muskellunge										
Carp	14	56	7	8		4	1	15	2	10
Quillback	769	116	28	88	122	5		21	39	30
White sucker	1	1						1		1
Shorthead redhorse	253	48	18	66	58	1	1	1	6	6
White catfish										
Yellow bullhead										
Brown bullhead	1									
Channel catfish	515	134	76	66	74	49	25	58	65	19
Rock bass										
Redbreast sunfish	1									
Green sunfish										
Pumpkinseed	1									
Bluegill	2									
Smallmouth bass	65	2		4	3				6	14
Largemouth bass										
Yellow perch										
Walleye	118	10	2	8	17				3	6
Northern hog sucker										
Fallfish										
Flathead catfish										
Striped bass hybrid	2		1	1	1					3
Tiger muskie										
<b>TOTAL</b>	<b>2,917</b>	<b>1,862</b>	<b>1,762</b>	<b>2,827</b>	<b>5,403</b>	<b>5,524</b>	<b>6,738</b>	<b>8,002</b>	<b>7,770</b>	<b>5,394</b>

Table 1. (continued)

	Date	15-May	16-May	17-May	18-May	19-May	20-May	21-May	22-May	23-May	24-May
Observation Time (hrs.)	8.0	8.0	8.0	8.0	8.0	8	8.0	8.0	8.0	8.0	8.0
Water Temperature (°F)	64.4	64.4	63.5	64.4	64.4	66.2	66.2	67.1	67.1	68.9	69.8
American shad	10	2		1	2	1	2			1	
Alewife											
Blueback herring											
Gizzard shad	2,513	602	1,546	6,739	4,041	2,148	874	871	617	203	
Hickory shad											
Striped bass											
White perch											
American eel											
Rainbow trout											
Brown trout									1		
Brook trout											
Muskellunge											
Carp	7	5	2	8	23	42	21	15	25	11	
Quillback	86	9	1	5		6	30	14	14	5	
White sucker								1			
Shorthead redhorse	13	1				1	1		2	2	5
White catfish											
Yellow bullhead											
Brown bullhead											
Channel catfish	26	59	25	28	25	15	14	4	14	9	
Rock bass											
Redbreast sunfish											
Green sunfish											
Pumpkinseed	1										
Bluegill							1	3		1	
Smallmouth bass	15						1		8	44	4
Largemouth bass											
Yellow perch											
Walleye	21			1	1	1	1			2	1
Northern hog sucker											
Fallfish											
Flathead catfish		15	30	10	2	1	1	23			
Striped bass hybrid		2				1					
Tiger muskie		1									
<b>TOTAL</b>	<b>2,692</b>	<b>696</b>	<b>1,604</b>	<b>6,792</b>	<b>4,096</b>	<b>2,217</b>	<b>947</b>	<b>938</b>	<b>720</b>	<b>238</b>	

Table 1. (continued)

Date	25-May	26-May	27-May	28-May	29-May	30-May	31-May	1-Jun	2-Jun	3-Jun
Observation Time (hrs.)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Water Temperature (°F)	72.0	72.0	74.3	74.3	76.1	76.1	76.1	73.5	69.8	69.8
American shad	1	1	2	1	1					
Alewife										
Blueback herring										
Gizzard shad	97	1,185	442	909	1,144	1,392	1,173	1,047	163	638
Hickory shad										
Striped bass										
White perch										
American eel										
Rainbow trout		1								
Brown trout										
Brook trout										
Muskellunge									1	
Carp	18	38	40	15	42	49	16	24	9	1
Quillback	3	88	22	25	48	3	3	32	3	
White sucker										
Shorthead redhorse		2			5		1			
White catfish										
Yellow bullhead										
Brown bullhead										
Channel catfish	4	67	37	171	377	151	60	75	33	19
Rock bass										
Redbreast sunfish		1								
Green sunfish					1		1			
Pumpkinseed				1	1		1	1		
Bluegill				1						
Smallmouth bass		26	30	9	6					
Largemouth bass										
Yellow perch										
Walleye			7							
Northern hog sucker										
Fallfish										
Flathead catfish		4	1	4	9	107	9	1	6	46
Striped bass hybrid										
Tiger muskie										
<b>TOTAL</b>	<b>123</b>	<b>1,413</b>	<b>581</b>	<b>1,136</b>	<b>1,634</b>	<b>1,702</b>	<b>1,264</b>	<b>1,180</b>	<b>215</b>	<b>704</b>

Table 1. (continued)

	Date	4-Jun	5-Jun	6-Jun	Total
Observation Time (hrs.)	8.0	8.0	8.0	8.0	281.0
Water Temperature (°F)	68.0	67.1	68.0		
American shad					224
Alewife					0
Blueback herring					0
Gizzard shad		2,665	1,583	553	87,068
Hickory shad					0
Striped bass					5
White perch					0
American eel					0
Rainbow trout					2
Brown trout					5
Brook trout					0
Muskellunge					1
Carp		15	2	9	669
Quillback					4,104
White sucker					47
Shorthead redhorse					1,491
White catfish					0
Yellow bullhead					0
Brown bullhead					1
Channel catfish		14	8	15	2,858
Rock bass					36
Redbreast sunfish					2
Green sunfish					2
Pumpkinseed			1		7
Bluegill					8
Smallmouth bass					553
Largemouth bass					2
Yellow perch					0
Walleye					602
Northern hog sucker					0
Fallfish					0
Flathead catfish		1	3	4	277
Striped bass hybrid					25
Tiger muskie					1
<b>TOTAL</b>		<b>2,695</b>	<b>1,597</b>	<b>581</b>	<b>97,990</b>

Table 2. Summary of daily average river flow (USGS, Harrisburg Gage), average flow in the East channel, sum of average flow from power station and main dam, water dam, water temperature and East channel and fishway water elevations during operation of the York Haven fishway complex in 2012.

Date	River Flow (cfs)	East Channel Flow (cfs)	Main Channel Flow (cfs)	Water Temp. (°F)	Secchi (in)			Stop log Gate	Elevation (ft)					
					Avg.	Min.	Max.		Head Pond			Tailwater		
									Avg.	Min.	Max.	Avg.	Min.	Max.
25-Apr	26,600	2,200	24,400	54.5	18	12	24	closed	279.0	279.0	279.1	273.5	273.5	273.6
26-Apr	40,800	4,000	36,800	54.5	13	8	18	closed	279.7	279.6	279.8	274.5	274.3	274.7
27-Apr	44,000	5,200	38,800	57.2	15	14	16	closed	280.0	280.0	280.0	275.0	275.0	275.1
28-Apr	40,900	4,300	36,600	50.9	24	24	24	closed	279.8	279.8	279.8	274.8	274.8	274.8
29-Apr	38,200	4,300	33,900	53.6	24	24	24	closed	279.8	279.8	279.8	274.6	274.5	274.6
30-Apr	35,400	3,300	32,100	53.6	24	24	24	closed	279.6	279.6	279.6	274.3	274.3	274.4
1-May	32,200	3,200	29,000	57.2	24	24	24	closed	279.5	279.5	279.5	274.2	274.2	274.2
2-May	29,400	3,100	26,300	59.9	24	24	24	closed	279.4	279.4	279.4	274.0	274.0	274.0
3-May	28,700	3,100	25,600	59.9	24	24	24	closed	279.4	279.4	279.5	274.0	274.0	274.0
4-May	30,200	3,000	27,200	59.0	24	24	24	closed	279.3	279.3	279.3	274.8	274.9	274.9
5-May	46,600	5,200	41,400	64.4	22	20	24	closed	280.0	280.0	280.1	275.0	275.0	275.1
6-May	47,400	5,000	42,400	66.2	24	24	24	closed	279.9	279.9	279.9	274.9	274.9	274.9
7-May	51,000	5,200	45,800	62.6	20	20	20	closed	280.0	280.0	280.1	275.4	275.4	275.4
8-May	44,400	5,200	39,200	58.1	24	24	24	closed	280.0	279.9	280.0	275.0	275.0	275.0
9-May	47,900	5,200	42,700	58.1	12	12	12	closed	280.0	280.0	280.0	275.0	275.0	275.0
10-May	59,700	6,200	53,500	61.3	8	8	8	closed	280.2	280.2	280.2	275.8	275.7	275.9
11-May	67,200	10,900	56,300	61.7	6	6	6	closed	280.7	280.7	280.7	276.5	276.5	276.5
12-May	62,500	9,000	53,500	61.7	8	8	8	closed	280.6	280.6	280.6	276.8	276.8	276.8
13-May	54,200	7,000	47,200	62.6	10	10	10	closed	280.3	280.3	280.3	275.7	275.7	275.7
14-May	46,600	5,200	41,400	63.5	16	16	16	closed	280.0	280.0	280.0	275.0	275.0	275.0
15-May	49,200	5,200	44,000	64.4	20	20	20	closed	280.0	280.0	280.1	275.0	275.0	275.1
16-May	94,900	16,000	78,900	64.4	8	8	8	closed	281.6	281.1	281.7	278.2	277.4	278.5
17-May	101,000	16,000	85,000	63.5	8	8	8	closed	281.6	281.6	281.7	278.3	278.2	278.4
18-May	83,400	13,000	70,400	64.4	8	8	8	closed	281.2	281.1	281.3	277.4	277.3	277.5
19-May	64,700	10,900	53,800	66.2	10	10	10	closed	280.7	280.7	280.8	276.8	276.8	276.9
20-May	52,300	6,200	46,100	66.2	12	12	12	closed	280.2	280.2	280.3	275.4	275.4	275.5
21-May	43,400	5,000	38,400	67.1	12	12	12	closed	279.9	279.8	280.0	275.0	274.9	275.0
22-May	38,600	4,300	34,300	67.1	18	18	18	closed	279.8	279.8	279.8	274.7	274.7	274.7
23-May	36,200	4,000	32,200	68.9	18	18	18	closed	279.7	279.7	279.7	274.6	274.6	274.6
24-May	38,000	4,000	34,000	69.8	18	18	18	closed	279.7	279.7	279.7	274.5	274.5	274.5
25-May	36,300	4,000	32,300	72.0	24	24	24	closed	279.7	279.7	279.7	274.5	274.5	274.5
26-May	32,300	3,700	28,600	72.0	24	24	24	closed	279.6	279.6	279.6	274.1	274.1	274.1
27-May	32,000	3,100	28,900	74.3	24	24	24	closed	279.4	279.4	279.4	274.1	274.1	274.1
28-May	44,100	5,000	39,100	74.3	24	24	24	closed	279.9	279.8	279.9	274.5	274.4	274.5
29-May	42,300	5,200	37,100	76.1	18	18	18	closed	280.0	280.0	280.0	274.8	274.8	274.8
30-May	41,200	5,000	36,200	76.1	15	12	12	closed	279.9	279.8	278.9	274.7	274.6	274.7
31-May	45,200	5,000	40,200	76.1	18	18	18	closed	279.9	279.9	280.0	274.8	374.8	274.9
1-Jun	36,900	4,000	32,900	73.5	18	18	18	closed	279.7	279.7	279.8	274.6	274.6	274.7
2-Jun	45,600	4,300	41,300	69.8	14	12	18	closed	279.8	279.7	280.0	274.9	274.6	275.1
3-Jun	57,700	8,300	49,400	69.8	8	8	8	closed	280.5	280.5	280.5	275.9	275.9	275.9
4-Jun	51,100	6,200	44,900	68.0	12	12	12	closed	280.2	280.2	280.2	275.4	275.4	275.4
5-Jun	46,900	5,600	41,300	67.1	18	18	18	closed	280.1	280.1	280.1	275.1	275.1	275.1
6-Jun	41,700	5,000	36,700	68.0	18	18	18	closed	279.9	279.9	279.9	274.8	274.8	274.8

Table 3. Summary of surface water elevations recorded during operation of the York Haven Fishway in 2012.

Date	River Flow (cfs)	Elevation (ft)																				
		Head Pond			Tailwater			Inside Fishway			Inside Weir			Above Counting Room			Below Fixed Wheel Gate			Counting Room		
		Avg.	Min.	Max.	Avg	Min.	Max.	Avg	Min.	Max.	Avg	Min.	Max.	Avg	Min.	Max.	Avg	Min.	Max.	Avg	Min.	Max.
25-Apr	26,600	279.0	279.0	279.1	273.5	273.5	273.6	274.2	274.1	274.3	277.4	277.3	277.5	278.6	278.4	278.8	277.3	277.3	277.4	278.3	278.4	278.5
26-Apr	40,800	279.7	279.6	279.8	274.5	274.3	274.7	275.0	274.8	275.2	277.9	277.8	277.9	279.4	29.3	279.5	277.5	277.5	277.6	279.3	279.3	279.4
27-Apr	44,000	280.0	280.0	280.0	275.0	275.0	275.1	275.5	275.4	275.5	278.1	278.0	278.2	279.7	279.6	279.7	277.9	277.8	277.9	279.5	279.5	279.5
28-Apr	40,900	279.8	279.8	279.8	274.8	274.8	274.8	275.3	275.3	275.3	278.0	278.0	278.0	279.5	279.5	279.5	277.8	277.8	277.8	279.3	279.3	279.3
29-Apr	38,200	279.8	279.8	279.8	274.6	274.5	274.6	275.1	275.0	275.1	278.0	277.9	278.0	279.5	279.4	279.5	277.8	277.8	277.9	279.3	279.2	279.3
30-Apr	35,400	279.6	279.6	279.6	274.3	274.3	274.4	274.9	274.9	275.0	277.9	277.8	277.9	279.3	279.3	279.3	277.6	277.6	277.6	279.2	279.2	279.2
1-May	32,200	279.5	279.5	279.5	274.2	274.2	274.2	274.9	274.8	274.9	277.8	277.8	277.9	279.2	279.2	279.2	277.6	277.6	277.7	279.0	279.0	279.1
2-May	29,400	279.4	279.4	279.4	274.0	274.0	274.0	274.6	274.6	274.6	277.7	277.7	277.7	279.0	279.0	279.0	277.4	277.4	277.4	278.8	278.8	278.8
3-May	28,700	279.4	279.4	279.5	274.0	274.0	274.0	274.6	274.5	274.6	277.8	277.7	277.9	279.0	279.0	279.1	277.6	277.5	277.6	278.8	278.8	278.9
4-May	30,200	279.3	279.3	279.3	274.8	274.9	274.9	274.4	274.3	274.5	277.7	277.7	277.8	278.9	278.9	279.0	277.5	277.4	277.5	278.9	278.9	278.9
5-May	46,600	280.0	280.0	280.1	275.0	275.0	275.1	275.5	275.5	275.6	278.0	278.0	278.1	279.9	279.9	280.0	280.1	277.8	277.8	277.9	279.6	279.7
6-May	47,400	279.9	279.9	279.9	274.9	274.9	274.9	275.5	275.5	275.5	278.2	278.0	278.3	279.7	279.7	279.7	277.9	277.8	277.9	279.6	279.6	279.6
7-May	51,000	280.0	280.0	280.1	275.4	275.4	275.4	275.7	275.7	275.7	278.4	278.3	278.4	280.1	280.0	280.0	278.0	278.0	278.0	279.8	279.8	280.0
8-May	44,400	280.0	279.9	280.0	275.0	275.0	275.0	275.5	275.5	275.5	278.1	278.1	278.2	279.8	279.7	279.8	278.0	278.0	278.0	279.5	279.5	279.5
9-May	47,900	280.0	280.0	280.0	275.0	275.0	275.0	275.5	275.5	275.5	278.2	278.1	278.3	279.8	279.7	279.8	277.8	277.8	277.8	279.6	279.6	279.6
10-May	59,700	280.2	280.2	280.2	275.8	275.7	275.9	276.3	276.2	276.4	278.6	278.5	278.7	280.2	280.2	280.2	278.0	278.0	278.0	280.1	280.1	280.1
11-May	67,200	280.7	280.7	280.7	276.5	276.5	276.5	277.0	277.0	277.0	278.9	278.7	278.9	280.5	280.5	280.5	278.5	278.5	278.5	280.4	280.4	280.4
12-May	62,500	280.6	280.6	280.6	276.8	276.8	276.8	276.8	276.8	276.8	278.6	278.6	278.6	280.4	280.4	280.4	278.3	278.3	278.3	280.2	280.2	280.3
13-May	54,200	280.3	280.3	280.3	275.7	275.7	275.7	276.4	276.4	276.4	278.4	278.4	278.4	280.1	280.0	280.1	278.1	278.1	278.2	280.0	280.0	280.0
14-May	46,600	280.0	280.0	280.0	275.0	275.0	275.0	275.7	275.7	275.7	278.1	278.1	278.1	279.8	279.8	279.8	278.0	278.0	278.0	279.7	279.7	279.7
15-May	49,200	280.0	280.0	280.1	275.0	275.0	275.1	275.7	275.7	275.8	278.3	278.3	278.4	279.8	279.8	279.8	278.0	278.0	278.0	279.7	279.7	279.7
16-May	94,900	281.6	281.1	281.7	278.2	277.4	278.5	278.4	277.9	279.0	279.5	279.0	279.8	281.4	281.0	281.6	279.2	278.8	279.4	281.2	280.8	281.5
17-May	101,000	281.6	281.6	281.7	278.3	278.2	278.4	279.0	278.9	279.0	279.6	279.5	279.7	281.4	281.4	281.5	279.3	279.2	279.4	281.4	281.3	281.4
18-May	83,400	281.2	281.1	281.3	277.4	277.3	277.5	277.0	277.8	278.0	279.1	279.0	279.2	281.1	281.1	281.2	278.7	278.6	278.9	280.9	280.9	281.0
19-May	64,700	280.7	280.7	280.8	276.8	276.8	276.9	276.8	277.8	276.8	278.4	278.4	278.5	280.4	280.4	280.5	278.3	278.3	278.4	280.3	280.3	280.4
20-May	52,300	280.2	280.2	280.3	275.4	275.4	275.5	275.9	275.9	276.0	278.7	278.7	278.8	280.0	280.0	280.1	278.0	277.9	278.0	279.9	279.8	279.9
21-May	43,400	279.9	279.8	280.0	275.0	274.9	275.0	275.6	275.5	275.6	278.2	278.1	278.3	279.7	279.7	279.7	277.8	277.8	277.8	279.6	279.5	279.5
22-May	38,600	279.8	279.8	279.8	274.7	274.7	274.7	275.4	275.4	275.4	278.0	278.0	278.0	279.5	279.5	279.5	277.8	277.8	277.8	279.4	279.4	279.4
23-May	36,200	279.7	279.7	279.7	274.6	274.6	274.6	275.3	275.3	275.3	277.9	277.9	277.9	279.4	279.4	279.4	277.6	277.6	277.6	279.3	279.3	279.3
24-May	38,000	279.7	279.7	279.7	274.5	274.5	274.5	272.3	272.3	272.3	278.0	278.0	278.0	279.5	279.5	279.5	277.7	277.7	277.7	279.5	279.5	279.5
25-May	36,300	279.7	279.7	279.7	274.5	274.5	274.5	275.4	275.4	275.4	278.0	278.0	278.0	279.5	279.5	279.5	277.7	277.7	277.7	279.5	279.5	279.5
26-May	32,300	279.6	279.6	279.6	274.1	274.1	274.1	275.3	275.3	275.3	277.9	277.9	277.9	279.4	279.4	279.4	277.6	277.6	277.6	279.3	279.3	279.3
27-May	32,000	279.4	279.4	279.4	274.1	274.1	274.1	275.0	275.0	275.0	277.7	277.6	277.7	279.1	279.1	279.1	277.5	277.5	277.5	279.1	279.0	279.1
28-May	44,100	279.9	279.8	279.9	274.5	274.4	274.5	275.5	275.4	275.5	278.1	278.0	278.1	279.4	279.4	279.4	277.8	277.8	277.8	279.4	279.4	279.4
29-May	42,300	280.0	280.0	280.0	274.8	274.8	274.8	275.6	275.6	275.6	278.1	278.1	278.1	279.6	279.5	279.6	277.8	277.8	277.8	279.4	279.4	279.4
30-May	41,200	279.9	279.8	278.9	274.7	274.6	274.7	275.6	275.5	275.6	278.1	278.0	278.1	279.6	279.5	279.6	277.8	277.7	277.8	279.4	279.3	279.4
31-May	45,200	279.9	279.9	280.0	274.8	374.8	274.9	275.6	275.6	275.7	277.9	277.9	278.0	279.8	279.8	279.9	277.7	277.7	277.8	279.6	279.6	279.7
1-Jun	36,900	279.7	279.7	279.8	274.6	274.6	274.7	275.3	275.3	275.4	278.0	277.9	278.0	279.5	279.4	279.6	277.0	277.7	277.7	279.4	279.4	279.5
2-Jun	45,600	279.8	279.7	280.0	274.9	274.6	275.1	275.6	275.3	275.8	278.0	277.9	278.1	279.6	279.4	279.7	277.8	277.7	278.0	279.5	279.3	279.7
3-Jun	57,700	280.5	280.5	280.5	275.9	275.9	275.9	276.4	276.4	276.4	278.5	278.5	278.5	280.3	280.3	280.3	278.2	278.2	278.2	280.2	280.2	280.2
4-Jun	51,100	280.2	280.2	280.2	275.4	275.4	275.4	275.9	275.9	276.0	278.3	278.3	278.3	280.0	280.0	280.0	278.0	278.0	278.0	279.9	279.9	279.9
5-Jun	46,900	280.1	280.1	280.1	275.1	275.1	275.1	275.8	275.7	275.8	278.2	278.2	278.2	279.9	279.8	279.9	278.0	278.0	278.0	279.8	279.7	279.8
6-Jun	41,700	279.9	279.9	279.9	274.8	274.8	274.8	275.5	275.5	275.5	278.1	278.1	278.1	279.7	279.7	279.7	277.8	277.8	277.8	279.6	279.6	279.6

**Table 4. Hourly summary of American shad passage through the serpentine vertical notch fish ladder at the York Haven Hydroelectric Project in 2012.**

	Date	25-Apr	26-Apr	27-Apr	28-Apr	29-Apr	30-Apr	1-May	2-May	3-May
<b>Observation Time (Start)</b>		0800	0800	0800	0800	0800	0800	0800	0800	0800
<b>Observation Time (End)</b>		1600	1700	1600	1600	1600	1600	1600	1600	1600
<b>Military Time (Hours)</b>										
0800 - 0859		0	3	0	0	0	0	0	6	1
0900 - 0959		0	9	0	0	0	0	0	2	0
1000 - 1059		0	4	1	0	0	0	0	0	0
1100 - 1159		0	10	0	0	0	0	0	1	0
1200 - 1259		0	2	0	1	0	0	0	0	0
1300 - 1359		0	6	0	0	0	0	0	0	2
1400 - 1459		0	18	1	0	0	0	0	1	0
1500 - 1559		0	14	0	0	0	0	0	1	0
1600 - 1700		-	2	-	-	-	-	-	-	-
<b>Total Catch</b>		<b>0</b>	<b>68</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>11</b>	<b>3</b>

	Date	4-May	5-May	6-May	7-May	8-May	9-May	10-May	11-May	12-May
<b>Observation Time (Start)</b>		0800	0800	0800	0800	0800	0800	0800	0800	0800
<b>Observation Time (End)</b>		1600	1600	1600	1600	1600	1600	1600	1600	1600
<b>Military Time (Hours)</b>										
0800 - 0859		2	4	6	3	5	6	2	0	1
0900 - 0959		1	0	5	1	2	2	1	0	0
1000 - 1059		1	2	2	3	1	3	0	0	2
1100 - 1159		0	5	3	0	3	1	0	0	1
1200 - 1259		2	3	3	2	1	0	0	0	2
1300 - 1359		0	1	3	1	0	2	0	0	4
1400 - 1459		0	1	3	1	0	0	0	0	2
1500 - 1559		0	0	0	0	0	0	0	0	1
1600 - 1700		-	-	-	-	-	-	-	-	-
<b>Total Catch</b>		<b>6</b>	<b>16</b>	<b>25</b>	<b>11</b>	<b>12</b>	<b>14</b>	<b>3</b>	<b>0</b>	<b>13</b>

Table 4. (continued)

Date	13-May	14-May	15-May	16-May	17-May	18-May	19-May	20-May	21-May
<b>Observation Time (Start)</b>	0800	0800	0800	0800	0800	0800	0800	0800	0800
<b>Observation Time (End)</b>	1600	1600	1600	1600	1600	1600	1600	1600	1600
<b>Military Time (Hours)</b>									
0800 - 0859	1	0	1	0	0	0	0	0	0
0900 - 0959	1	0	0	2	0	0	1	0	0
1000 - 1059	2	0	1	0	0	0	0	0	0
1100 - 1159	4	0	1	0	0	0	0	0	0
1200 - 1259	2	0	4	0	0	1	0	1	0
1300 - 1359	0	1	1	0	0	0	0	0	1
1400 - 1459	1	0	1	0	0	0	1	0	1
1500 - 1559	0	2	1	0	0	0	0	0	0
1600 - 1700	-	-	-	-	-	-	-	-	-
<b>Total Catch</b>	<b>11</b>	<b>3</b>	<b>10</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>

Date	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	30-May
<b>Observation Time (Start)</b>	0800	0800	0800	0800	0800	0800	0800	0800	0800
<b>Observation Time (End)</b>	1600	1600	1600	1600	1600	1600	1600	1600	1600
<b>Military Time (Hours)</b>									
0800 - 0859	0	0	0	0	0	0	0	0	0
0900 - 0959	0	0	0	1	0	0	0	1	0
1000 - 1059	0	1	0	0	0	0	0	0	0
1100 - 1159	0	0	0	0	1	0	0	0	0
1200 - 1259	0	0	0	0	0	1	0	0	0
1300 - 1359	0	0	0	0	0	0	1	0	0
1400 - 1459	0	0	0	0	0	1	0	0	0
1500 - 1559	0	0	0	0	0	0	0	0	0
1600 - 1700	-	-	-	-	-	-	-	-	-
<b>Total Catch</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>0</b>

**Table 4. (continued)**

	Date	31-May	1-Jun	2-Jun	3-Jun	4-Jun	5-Jun	6-Jun		
<b>Observation Time (Start)</b>		<b>0800</b>								
<b>Observation Time (End)</b>		<b>1600</b>	<b>Total</b>	<b>%</b>						
<hr/>										
<b>Military Time (Hours)</b>										
0800 - 0859		0	0	0	0	0	0	0	41	18.3
0900 - 0959		0	0	0	0	0	0	0	29	12.9
1000 - 1059		0	0	0	0	0	0	0	23	10.3
1100 - 1159		0	0	0	0	0	0	0	30	13.4
1200 - 1259		0	0	0	0	0	0	0	25	11.2
1300 - 1359		0	0	0	0	0	0	0	23	10.3
1400 - 1459		0	0	0	0	0	0	0	32	14.3
1500 - 1559		0	0	0	0	0	0	0	19	8.5
1600 - 1700		-	-	-	-	-	-	-	2	0.9
<b>Total Catch</b>		<b>0</b>	<b>224</b>	<b>100.0</b>						

## FIGURES

Figure 1. General Layout of the York Haven Hydroelectric Project Showing the Location of the Fishway.

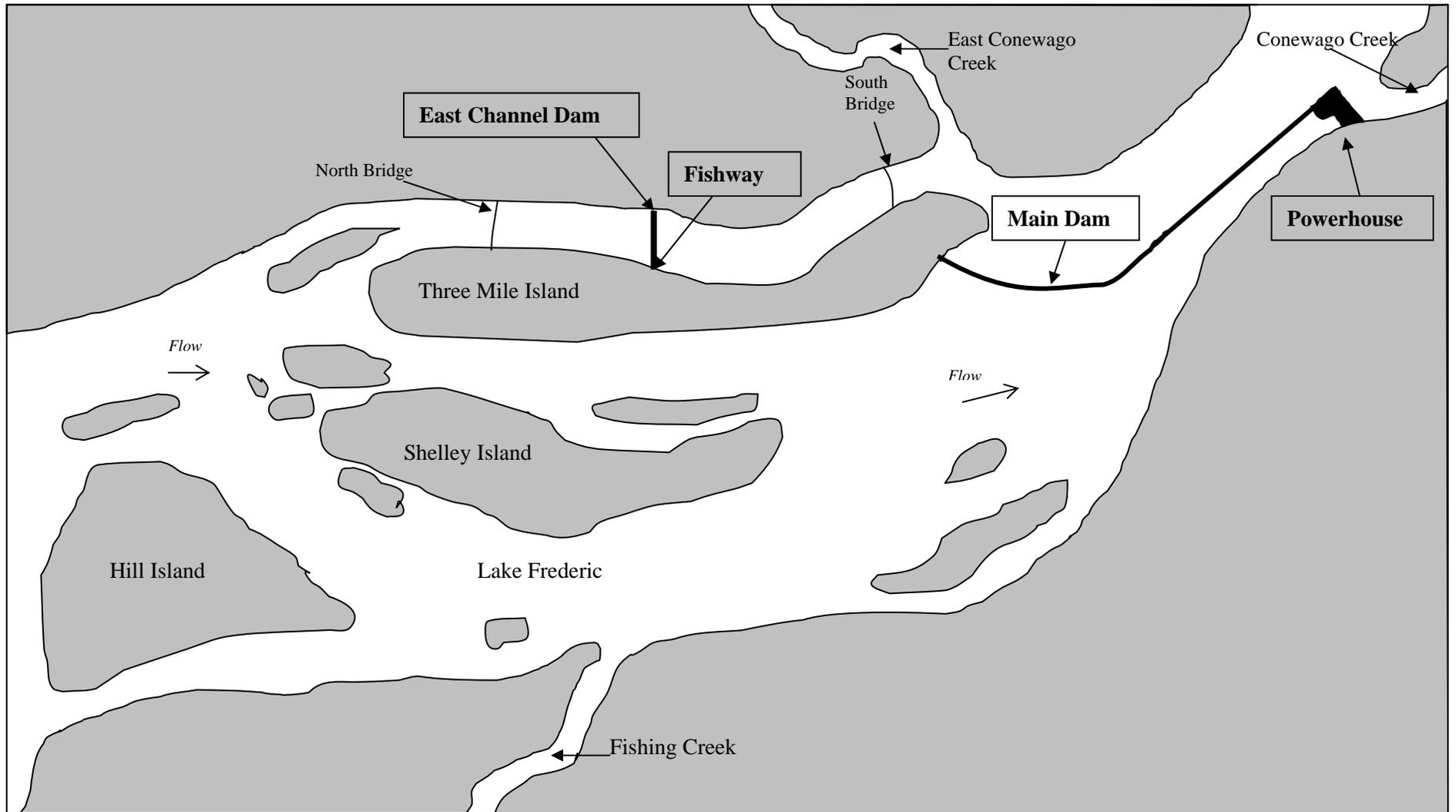
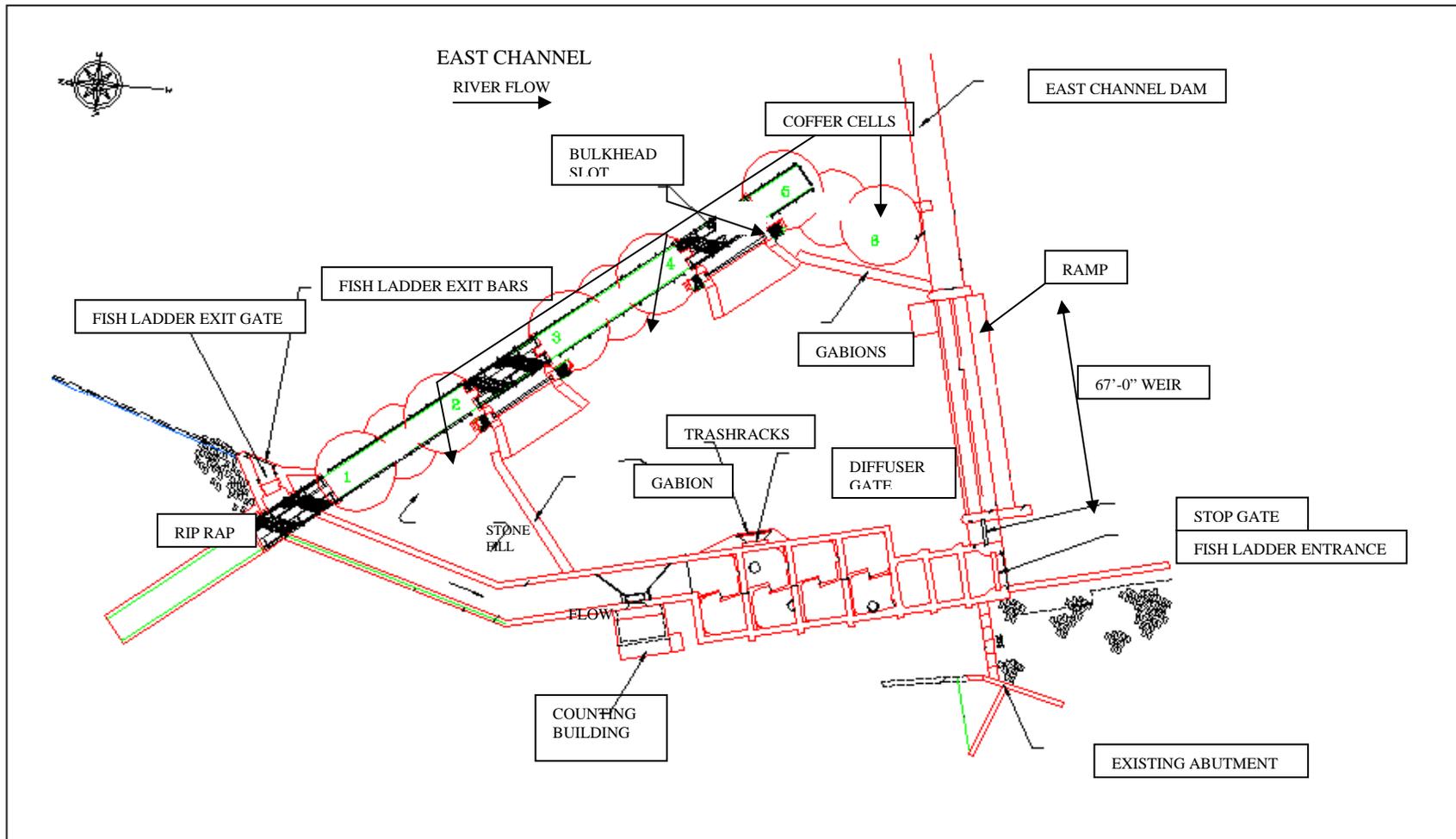
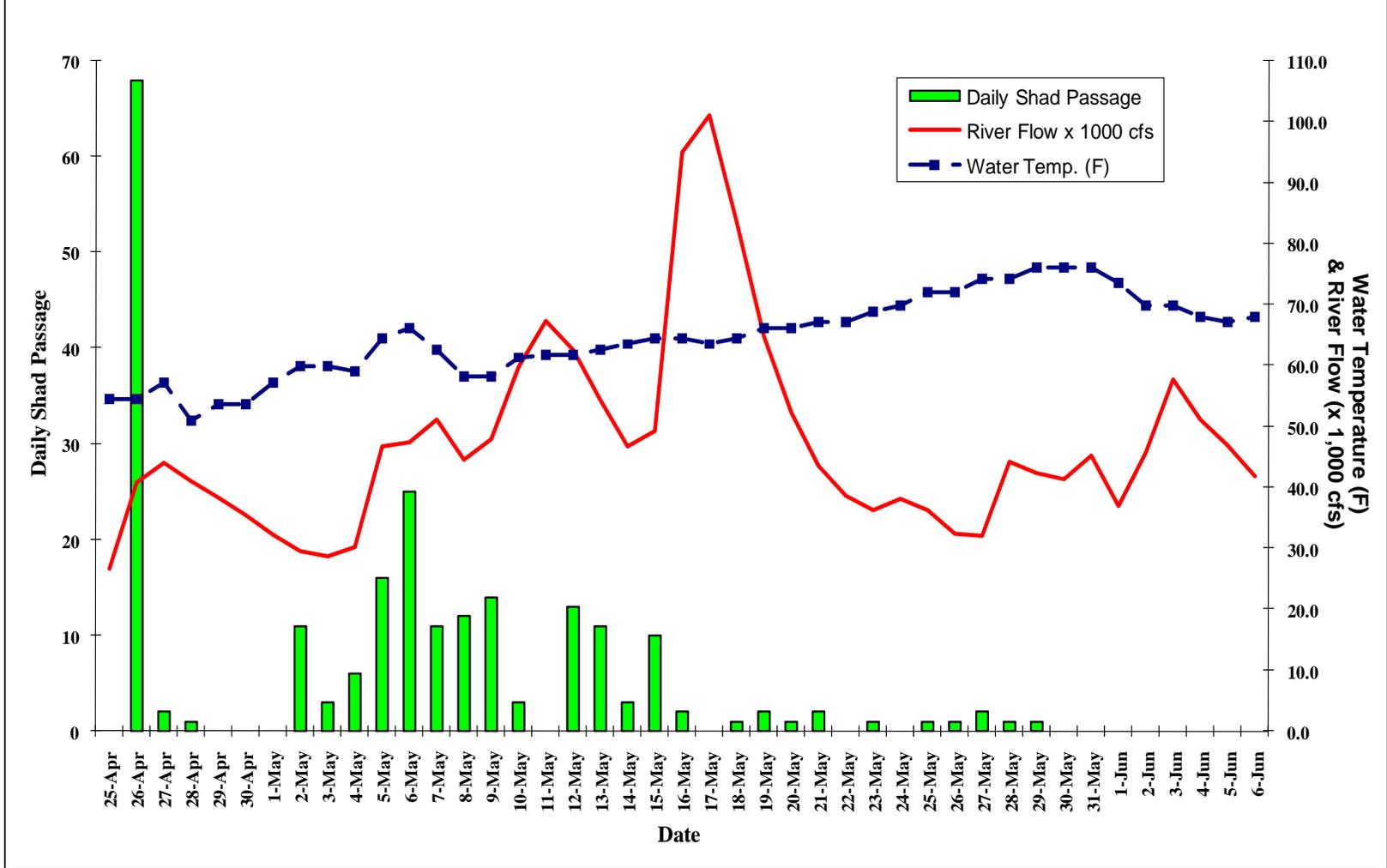


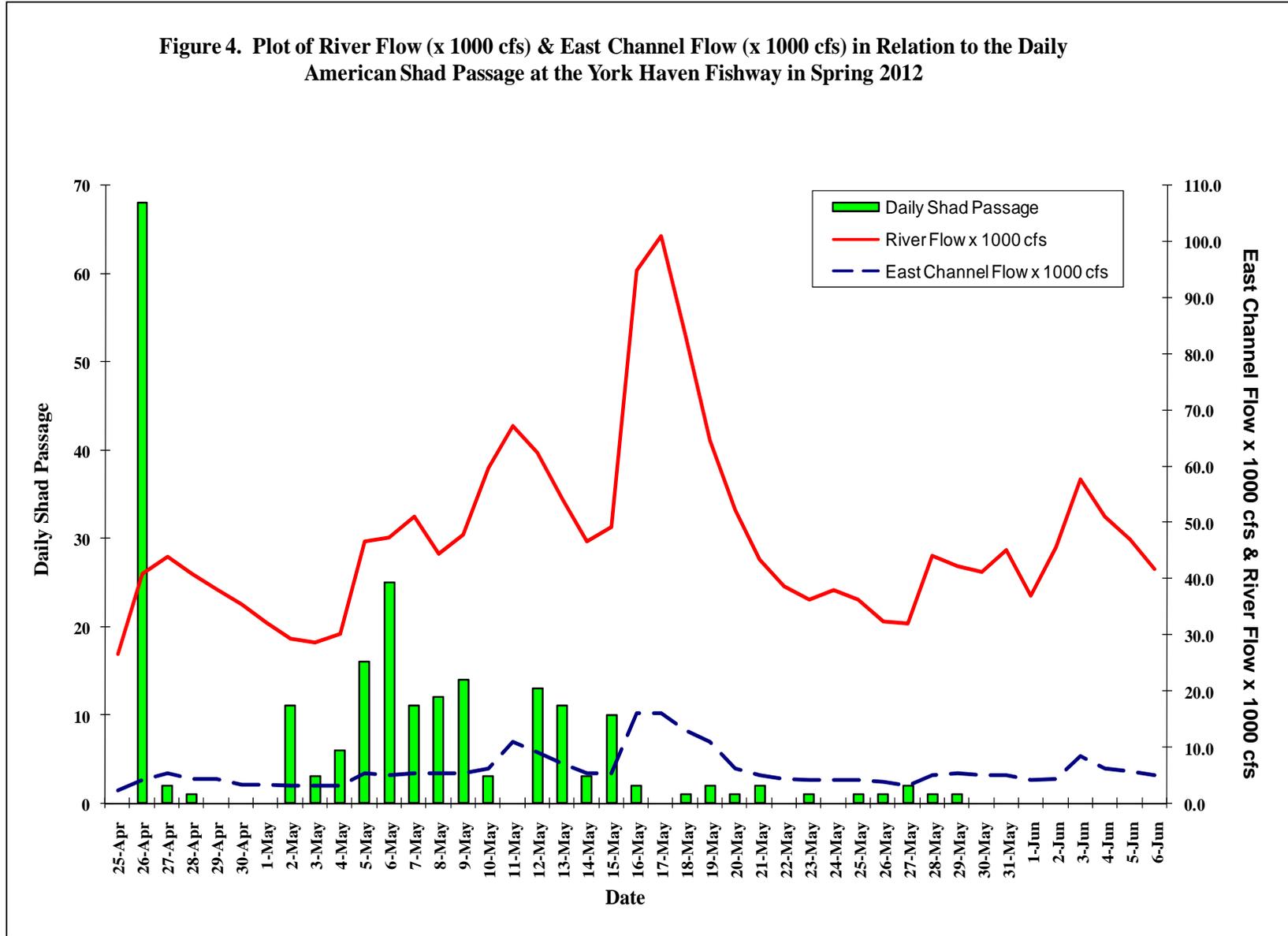
Figure 2. General Arrangement - York Haven Fishway.



**Figure 3. Plot of River Flow (x 1000 cfs) & Water Temperature (F) in Relation to the Daily American Shad Passage at the York Haven Fishway in Spring 2012**



**Figure 4. Plot of River Flow (x 1000 cfs) & East Channel Flow (x 1000 cfs) in Relation to the Daily American Shad Passage at the York Haven Fishway in Spring 2012**



**Figure 5. Plot of River Flow (cfs) at the USGS Harrisburg Station (#01570500) on the Susquehanna River and Average Daily Water Temperature at the York Haven Power Station, 10 September to 16 November, 2012**

