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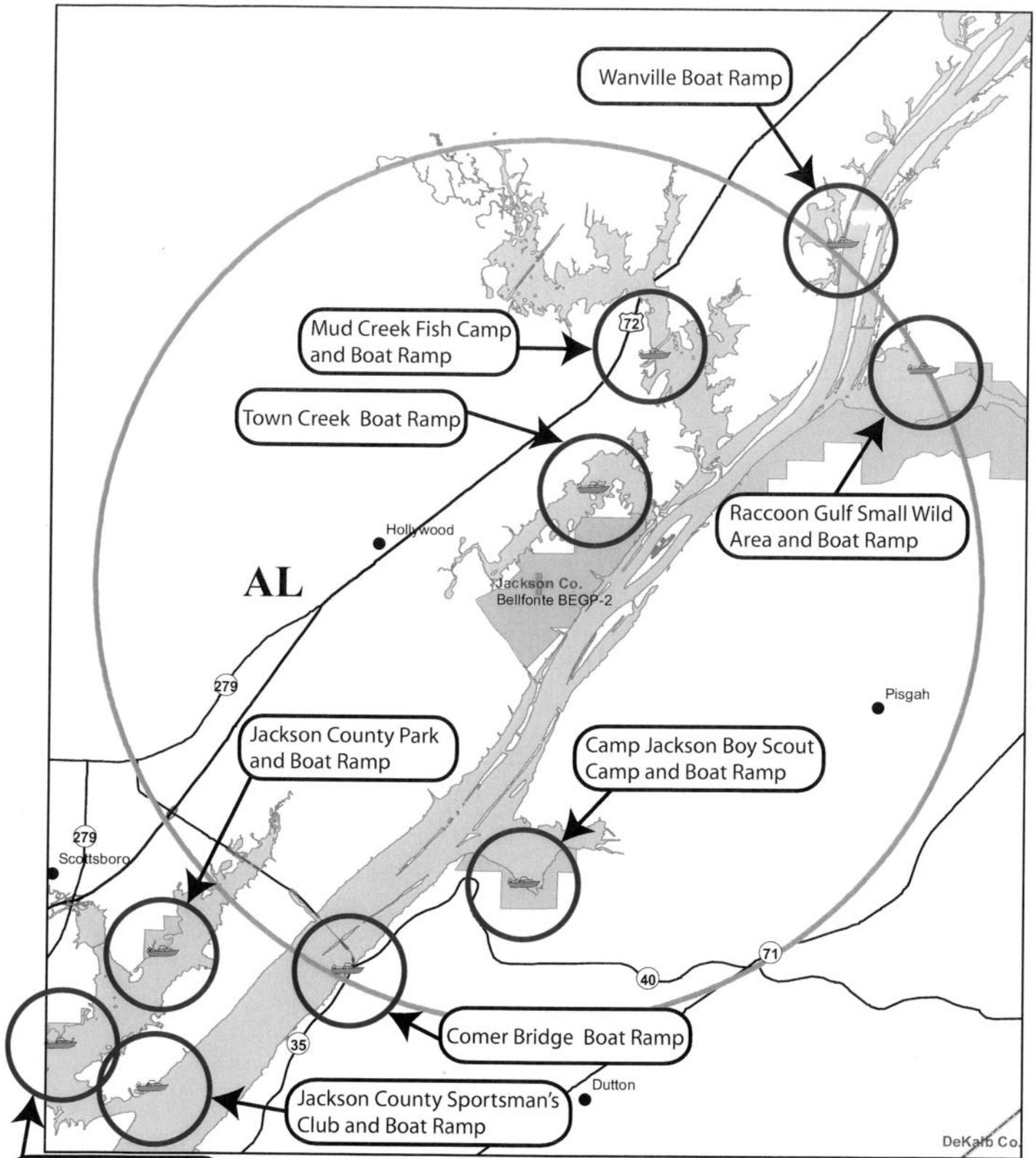
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**Bellefonte Nuclear Plant
COLA Part 3, Environmental Report
Figure 2.3-X1
Recreational Sites within a Six-Mile Radius**

**Tennessee Valley Authority
April 2008**



Scottsboro Municipal Park and Boat Ramp

Bellefonte Nuclear Plant Recreation Sites within a Six Mile Radius

⊕ PLANT CENTER

🚤 BOAT RAMP

■ RECREATION AREA

○ BELLEFONTE 6 MILE BUFFER



RESPONSE TO ENVIRONMENTAL REPORT SUFFICIENCY REVIEW

Attachment E1, Mussel Survey

May 2, 2008

**Mussel Survey between
Tennessee River Miles 390.8 – 392.4
for
TVA's Bellefonte Power Plant
in
Jackson County, Alabama**

Mainstream Commercial Divers

April 2007

**Mussel Survey between Tennessee River Miles 390.8 – 392.4
for TVA's Bellefonte Power Plant in Jackson County, Alabama**

Prepared for:

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Oklahoma City, OK**



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April 2007

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Mussel Survey between Tennessee River Miles 390.8 – 392.4 for TVA's Bellefonte Power Plant in Jackson County, Alabama

ABSTRACT

The Tennessee Valley Authority (TVA) has proposed to conduct maintenance activities at the Bellefonte Power Plant located at Tennessee River Mile 392. The Bellefonte Power plant is a potential site for a new nuclear plant in conjunction with Nustart Energy Development. Because the maintenance activities would potentially have an impact to the Tennessee River system, it was requested that a mussel survey be performed in the vicinity of the Bellefonte Power Plant. To complete the mussel survey, Enercon Services, Inc. retained the services of Mainstream Commercial Divers, Inc. of Murray, Kentucky. The mussel survey was conducted between TRM 390.8 – 392.4 in order to assess the current mussel fauna in the area and to determine if the potential exists for federally or state listed endangered or threatened mussel species to be present in the impact area. The particular species of concern for the mussel survey was the federally endangered Pink Mucket (*Lampsilis abrupta*). A total of 22 transects extended through the potential impact areas, including sixteen transects along the right descending bank, three transects in the center of the river within the navigation channel, and three transects along the left descending bank. During the survey, a total of 448 live mussels from 12 unionid species were encountered. Overall, *Megaloniaias nervosa* was the dominant species, representing 38.84% of the mussels in the area. *Potamilus alatus* also comprised a significant portion of the mussel community, representing 29.91% of the mussels collected. Several other species occurred in significant numbers including *Pleurobema cordatum* (9.60%), *Elliptio crassidens* (8.48%), *Quadrula pustulosa* (5.80%), *Obliquaria reflexa* (2.46%), *Ellipsaria lineolata* (1.79%), and *Quadrula metanevra* (1.34%). The other four species (*Amblema plicata*, *Cycloniaias tuberculata*, *Pyganodon grandis*, *Utterbackia imbecillis*) each comprised less than 1% of the sampled population and two species were only found as single individuals. The species diversity for the mussel concentration was 1.641957 and the evenness was 0.6607719. No zebra mussels were located during the survey. The areas along the right and left descending shorelines and within the navigation channel of the Tennessee River between TRM 390.8 and 392.4 contained a low density, patchy mussel community comprised of at least 12 species. The mussel community was dominated by two species, *Megaloniaias nervosa* and *Potamilus alatus*, which comprised 68.75% of the sampled population. Few juvenile mussels (< 5 years old) were located during the survey, although some juveniles were located for several species indicating that recruitment has been at least somewhat successful for those species in recent years. No federally or state listed threatened or endangered species were located during the survey.

INTRODUCTION

The Tennessee Valley Authority (TVA) has proposed to conduct maintenance activities at the Bellefonte Power Plant located at Tennessee River Mile 392 (Figure 1). The Bellefonte Power plant is a potential site for a new nuclear plant in conjunction with Nustart Energy Development. Because the maintenance activities would potentially have an impact to the Tennessee River system, it was requested that a mussel survey be performed in the vicinity of the Bellefonte Power Plant. To complete the mussel survey, Enercon Services, Inc. retained the services of Mainstream Commercial Divers, Inc. of Murray, Kentucky. The mussel survey was conducted between TRM 390.8 – 392.4 in order to assess the current mussel fauna in the area and to determine if the potential exists for federally or state listed endangered or threatened mussel species to be present in the impact area. The particular species of concern for the mussel survey was the federally endangered Pink Mucket (*Lampsilis abrupta*).

METHODS

The purpose of the mussel survey was to determine if concentrations of mussels exist and if the potential exists for federally or state listed endangered or threatened mussel species to be present in the proposed maintenance construction area at the Bellefonte Power Plant. A total of 22 transects extended through the potential impact areas between TRM 390.8 – 392.4 (Figure 2). Based on a mussel survey plan developed by TVA and Enercon Services, Inc., sixteen transects were surveyed along the right descending bank, three transects were surveyed in the center of the river within the navigation channel, and three transects were surveyed along the left descending bank. The transects were spaced either 100 meters or 200 meters apart through the impact area and extended 100 meters into the river. Transects were set perpendicular to shore. Table 1 indicates the coordinates of the near shore end of each transect line along the right and left descending banks, and at each end of the transects within the river channel. These coordinates are approximate and may be accurate to only 30' since they were determined from a 7.5 minute topographic map using ArcView© software. Transect positions were located in the field using ArcPad GIS software connected to a Trimble AG132 DGPS giving sub meter position accuracy. Each transect was divided into 10 meter segments and the mussels from each section were recorded separately. Mussels were collected by a professional dive crew with considerable

experience in mussel survey techniques that was certified to meet ADCI and OSHA requirements. The diver searched an area one meter wide along one side of each transect and all mussels located within the 10 meter segments were sent to the surface for identification. Substrate information and depth were recorded at each 10 meter increment. Substrate information was based on a visual description of the surface material provided by the diver. Depth readings were obtained from the diver's pneumofathometer (accuracy $\pm 6''$).

Each mussel was identified to species and recorded on data sheets by M.C.D.I.'s malacologist. A general age range of mussels was noted to give an indication of whether recruitment was successful in recent years. Mussels were returned to near the area from which they were collected.

Species diversity (Shannon-Weiner Index) and evenness were determined for the area. Species diversity was based on the following formula: $[H' = -\sum p_i \log_e p_i]$ where p_i is the proportion of the i^{th} species in the sample. Results were based on the natural logarithm. Evenness was based on the following formula: $[\text{Evenness} = H'/H_{\text{max}} = H'/\ln(\# \text{ species})]$.

RESULTS AND DISCUSSION

The Tennessee River was surveyed for freshwater mussels between river miles 390.8 and 392.4 from April 10 –12, 2007. The water temperature was 60°F at the time of the survey and the flow was minimal. Water elevation during the survey was approximately 595 feet above mean sea level. Visibility was greater than one meter during the mussel survey.

During the survey, a total of 448 live mussels from 12 unionid species were encountered (Table 2, Photo 1, 2). Table 2 lists the scientific and common names of the species found, the number of each species, and their percent composition. The species diversity for the mussel community was 1.641957 and the evenness was 0.6607719. No zebra mussels were located during the survey. No federal or state threatened or endangered species of freshwater mussels were located during the survey.

Overall, *Megaloniais nervosa* was the dominant species, representing 38.84% of the mussels in the area (Table 2). *Potamilus alatus* also comprised a significant portion of the mussel community, representing 29.91% of the mussels collected (Table 2). Several other species occurred in significant numbers including *Pleurobema cordatum* (9.60%), *Elliptio*

crassidens (8.48%), *Quadrula pustulosa* (5.80%), *Obliquaria reflexa* (2.46%), *Ellipsaria lineolata* (1.79%), and *Quadrula metanevra* (1.34%) (Table 2). The other four species (*Amblema plicata*, *Cyclonaias tuberculata*, *Pyganodon grandis*, *Utterbackia imbecillis*) each comprised less than 1% of the sampled population and two species were only found as single individuals (Table 2).

Right Descending Bank

Transects E-01 – E-16 were sampled along the right descending bank of the Tennessee River (Figure 2). During the survey along the right descending bank, a total of 430 mussels were encountered throughout the entire length of the survey area in patchy, low density concentrations (Table 3). The mussels were found in low abundance between 0m – 10m (2%), 10m – 20m (6%), and 90m – 100m (5%) (Table 4). Mussels were not consistently distributed along the survey lines and 28.75% of the 10-meter sections contained no mussels (Table 3). Along the right descending bank, 87% of the mussels were located between 20m – 90m along the transects (Table 4).

Total estimated density along the right descending bank transect lines ranged from 0.08 – 0.48 mussels per square meter (Table 3). Maximum density per 10 meter section ranged from 0.20 – 2.40 mussels per square meter (Table 3). The number of mussels per 100 meter transect line ranged from 8 – 48 individuals (Table 5). The number of species collected per transect line ranged from 2 – 9 (Table 5).

In the area from normal pool shoreline out to approximately 20 – 30 meters along the transect lines, the substrate was primarily composed of a layer of soft silt over hard clay (Table 6). In some areas the silt was over top of a layer of hard packed fine sand (Table 6). Once the diver proceeded past the 20 – 30 meter mark the substrate typically began to transition to a light layer of silt over gravel (Table 6). As the diver moved out further, there was cobble mixed with the gravel (Table 6). Overall, the substrate was variable along the transect lines, with the diver encountering varying compositions of silt, sand, gravel, and cobble, as well as encountering areas of boulders and bedrock (Table 6). Water depths were typically shallow at the beginning of the transects until the diver went over the first main drop off from the shoreline into the river channel (Table 6). Water depths past the drop off along the transect lines ranged from 19 – 28 feet (approximate bottom elevation 576 – 567 feet) (Table 6).

Navigation Channel

Transects E-17 – E-19 were sampled within the navigation channel of the Tennessee River (Figure 2). The navigation channel transects were sampled beginning at the end of the line nearest to the right descending bank. During the survey along the navigation channel, a total of eight mussels were encountered sporadically along transects E-17 and E-18 in very low numbers and no mussels were located along transect E-19 (Table 3). The mussels were found in very low abundance with no more than two mussels found per 10-meter section (Table 3, 4). Mussels were not consistently distributed along the survey lines and 76.67% of the 10-meter sections contained no mussels (Table 3).

Total estimated density along the channel transect lines ranged from 0.00 – 0.26 mussels per square meter (Table 3). Maximum density per 10 meter section ranged from 0.00 – 0.20 mussels per square meter (Table 3). The number of mussels per 100 meter transect line ranged from 0 – 6 individuals (Table 5). The number of species collected per transect line ranged from 0 – 4 (Table 5).

Substrate within the navigation channel was variable along the transect lines (Table 6). The substrate was typically a light layer of silt with a few inches of gravel over a layer of bedrock. In several areas there was cobble mixed with the gravel (Table 6). Water depth along the channel transect lines ranged from 23 – 29 feet and approximate bottom elevation ranged from 572 – 566 feet (Table 6).

Left Descending Bank

Transects E-20 – E-22 were sampled along the left descending bank of the Tennessee River (Figure 2). During the survey along the left descending bank, a total of 10 mussels were encountered sporadically along the transects (Table 3, 4). No mussels were found along the transect sections from 0m – 10m or from 40m – 50m and were in very low abundance between all of the other transect sections (Table 4). Mussels were not consistently distributed along the survey lines and 70.00% of the 10-meter sections contained no mussels (Table 3).

Total estimated density along the left descending bank transect lines ranged from 0.02 – 0.05 mussels per square meter (Table 3). Maximum density per 10 meter section ranged from 0.10 – 0.20 mussels per square meter (Table 3). The number of mussels per 100 meter transect

line ranged from 2 – 5 individuals (Table 5). The number of species collected per transect line ranged from 2 – 3 (Table 5).

In the area from normal pool shoreline out to approximately 20 meters along the transect lines, the substrate was primarily composed of either hard packed fine sand or a layer of soft silt over hard clay (Table 6). Once the diver proceeded past the 20 meter mark the substrate typically began to transition to a light layer of silt over gravel (Table 6). Overall, the substrate was variable along the transect lines, with the diver encountering varying compositions of silt and gravel, as well as encountering areas with sand, cobble, and bedrock (Table 6). Water depths were typically shallow at the beginning of the transects until the diver went over the first main drop off from the shoreline into the river channel (Table 6). Water depths past the drop off along the transect lines ranged from 19 – 25 feet (approximate bottom elevation 576 – 570 feet) (Table 6).

CONCLUSIONS

The areas along the right and left descending shorelines and within the navigation channel of the Tennessee River between TRM 390.8 and 392.4 contained a low density, patchy mussel community comprised of at least 12 species. The mussel community was dominated by two species, *Megalonaias nervosa* and *Potamilus alatus*, which comprised 68.75% of the sampled population. Few juvenile mussels (< 5 years old) were located during the survey, although some juveniles were located for several species indicating that recruitment has been at least somewhat successful for those species in recent years. No federally or state listed threatened or endangered species were located during the survey.

ACKNOWLEDGMENTS

I would like to thank the divers from Mainstream Commercial Divers, Inc. for conducting a professional survey.

Disclaimer:

Depth measurements are approximate and sediment types are subjective and are neither intended nor provided for engineering purposes. They are intended only to provide a description of mussel habitat.



Figure 1. Survey area location for Enercon Services at Tennessee River Miles 390.8 - 392.4 in Jackson County, Alabama.



Figure 2. Mussel survey layout at Tennessee River Miles 390.8 - 392.4 along the left and right descending banks and within the navigation channel.

Table 1. Site coordinates for the shoreline end of the transect lines along the right and left descending banks, and the end coordinates of the transects in the channel between Tennessee River Miles 390.8 - 392.4. Coordinates are provided in Alabama State Plane East (Feet) NAD83 and Geographic (Degrees-Decimal Minutes) NAD83 or WGS84.

Tennessee River - Right Descending Bank

Transect	River Mile	AL State Plane East (Feet)		Geographic	
		Easting	Northing	Latitude	Longitude
E-01	392.40	633349	1531873	34 42.6285066	85 54.5553279
E-02	392.27	632939	1531366	34 42.5448713	85 54.6371026
E-03	392.21	632685	1531140	34 42.5075807	85 54.6877754
E-04	392.05	632214	1530666	34 42.4293763	85 54.7817287
E-05	391.87	631762	1530186	34 42.3501840	85 54.8718851
E-06	391.74	631309	1529709	34 42.2714851	85 54.9622388
E-07	391.62	630850	1529226	34 42.1917951	85 55.0537864
E-08	391.51	630419	1528726	34 42.1093052	85 55.1397389
E-09	391.39	630054	1528185	34 42.0200644	85 55.2125067
E-10	391.33	629903	1527890	34 41.9714092	85 55.2425976
E-11	391.26	629755	1527600	34 41.9235786	85 55.2720899
E-12	391.20	629589	1527313	34 41.8762398	85 55.3051752
E-13	391.14	629420	1527033	34 41.8300545	85 55.3388598
E-14	391.02	629094	1526469	34 41.7370256	85 55.4038314
E-15	390.89	628771	1525895	34 41.6423481	85 55.4681999
E-16	390.77	628509	1525289	34 41.5424036	85 55.5203847

Tennessee River - Navigation Channel

Transect	River Mile	AL State Plane East (Feet)		Geographic	
		Easting	Northing	Latitude	Longitude
E-17a	391.55	631092	1528523	34 42.0759318	85 55.0053614
E-17b	391.55	631372	1528336	34 42.0451411	85 54.9494378
E-18a	391.36	630506	1527733	34 41.9456115	85 55.1222038
E-18b	391.36	630793	1527582	34 41.9207576	85 55.0648897
E-19a	391.17	630029	1526879	34 41.8047538	85 55.2172719
E-19b	391.17	630316	1526722	34 41.7789114	85 55.1599578

Tennessee River - Left Descending Bank

Transect	River Mile	AL State Plane East (Feet)		Geographic	
		Easting	Northing	Latitude	Longitude
ECS-20	391.44	631562	1527651	34 41.9322376	85 54.9113993
ECS-21	391.26	631062	1526849	34 41.7999522	85 55.0110727
ECS-22	391.06	630588	1525983	34 41.6571180	85 55.1055403

Table 2. Number of mussels collected and species percent abundance along the transect lines at Tennessee River Miles 390.8 - 392.4 along the right and left descending banks and within the navigation channel.

Scientific Name	Common Name	Total	Percent Abundance
<i>Megaloniaias nervosa</i> (Rafinesque, 1820)	Washboard	174	38.84%
<i>Potamilus alatus</i> (Say, 1817)	Pink Heelsplitter	134	29.91%
<i>Pleurobema cordatum</i> (Rafinesque, 1820)	Ohio Pigtoe	43	9.60%
<i>Elliptio crassidens</i> (Lamarck, 1819)	Elephant-ear	38	8.48%
<i>Quadrula pustulosa</i> (Lea, 1831)	Pimpleback	26	5.80%
<i>Obliquaria reflexa</i> Rafinesque, 1820	Threehorn Wartyback	11	2.46%
<i>Ellipsaria lineolata</i> (Rafinesque, 1829)	Butterfly	8	1.79%
<i>Quadrula metanevra</i> (Rafinesque, 1820)	Monkeyface	6	1.34%
<i>Amblema plicata</i> (Say, 1817)	Threeidge	4	0.89%
<i>Cycloniaias tuberculata</i> (Rafinesque, 1820)	Purple Wartyback	2	0.45%
<i>Pyganodon grandis</i> (Say, 1829)	Giant Floater	1	0.22%
<i>Utterbackia imbecillis</i> (Say, 1829)	Paper Pondshell	1	0.22%
Total Number of Live Mussels		448	100.00%

Table 3. Distribution of mussels along each 10 meter segment of the transect lines.

	Right Bank										
	E-01	E-02	E-03	E-04	E-05	E-06	E-07	E-08	E-09	E-10	E-11
0m - 10m		1	1		1		1			2	
10m - 20m		1		1	3		1	3			5
20m - 30m	1			2	4	2	2	8			9
30m - 40m	5			4		5	8	5	6	2	5
40m - 50m	4		1			7	11	5	12		8
50m - 60m	4	2	1			4	5	4	4		14
60m - 70m	3	2	2	1		5	3	10	6	2	1
70m - 80m	5		1			4	4	3	2	3	4
80m - 90m	5	1	2		1			5	4	3	2
90m - 100m	5	1	1		1			2	3		
Est. Density Per Transect Line (#/m²)	0.32	0.08	0.09	0.08	0.10	0.27	0.35	0.45	0.37	0.12	0.48
Max. Density per 10 meter (#/m²)	0.50	0.20	0.20	0.40	0.40	0.70	1.10	1.00	1.20	0.30	1.40

	Right Bank						Channel			Left Bank		
	E-12	E-13	E-14	E-15	E-16	E-17	E-18	E-19	E-20	E-21	E-22	
0m - 10m	2	1				1						
10m - 20m	4	2	1		3	1				1		
20m - 30m	24	4	7		4			1	1			
30m - 40m	2	1	8	1	3				1			
40m - 50m	2	13	9	1	4							
50m - 60m	5		2	2	4	1		1			2	
60m - 70m		1	2	4	3						1	
70m - 80m	2	5	5	2	1	2					1	
80m - 90m	1	3	6	3	4					1	1	
90m - 100m	2		2	4		1			1			
Est. Density Per Transect Line (#/m²)	0.44	0.30	0.42	0.17	0.26	0.06	0.00	0.02	0.03	0.02	0.05	
Max. Density per 10 meter (#/m²)	2.40	1.30	0.90	0.40	0.40	0.20	0.00	0.10	0.10	0.10	0.20	

Table 4. Percentage of mussels located within each transect interval along the right descending bank, within the navigation channel, and along the left descending bank between TRM 390.8 - 392.4.

Right Descending Bank

Transect Interval	# Mussels	Percent Abundance
0m - 10m	9	2%
10m - 20m	24	6%
20m - 30m	67	16%
30m - 40m	55	13%
40m - 50m	77	18%
50m - 60m	51	12%
60m - 70m	45	10%
70m - 80m	41	10%
80m - 90m	40	9%
90m - 100m	21	5%
TOTAL	430	100%

Channel

Transect Interval	# Mussels	Percent Abundance
0m - 10m	1	13%
10m - 20m	1	13%
20m - 30m	1	13%
30m - 40m	0	0%
40m - 50m	0	0%
50m - 60m	2	25%
60m - 70m	0	0%
70m - 80m	2	25%
80m - 90m	0	0%
90m - 100m	1	13%
TOTAL	8	100%

Left Descending Bank

Transect Interval	# Mussels	Percent Abundance
0m - 10m	0	0%
10m - 20m	1	10%
20m - 30m	1	10%
30m - 40m	1	10%
40m - 50m	0	0%
50m - 60m	2	20%
60m - 70m	1	10%
70m - 80m	1	10%
80m - 90m	2	20%
90m - 100m	1	10%
TOTAL	10	100%

Table 5. Number of mussels of each species collected alive along the transects at Tennessee River Miles 390.8 - 392.4.

Scientific Name	Right Descending Bank								
	E-01	E-02	E-03	E-04	E-05	E-06	E-07	E-08	E-09
<i>Amblema plicata</i>							1		
<i>Cyclonaias tuberculata</i>									
<i>Ellipsaria lineolata</i>						1	3		2
<i>Elliptio crassidens</i>	2		2			2	3	5	3
<i>Megaloniaias nervosa</i>	13	1	4		4	17	18	23	16
<i>Obliquaria reflexa</i>	1		1	1				1	1
<i>Pleurobema cordatum</i>	7		1			2	1		4
<i>Potamilus alatus</i>	8	7	1	7	6	3	5	13	8
<i>Pyganodon grandis</i>							1		
<i>quadrula metanevra</i>							1		1
<i>Quadrula pustulosa</i>	1					2	2	3	2
<i>Utterbackia imbecillis</i>									
Number of mussels collected	32	8	9	8	10	27	35	45	37
Number of species collected	6	2	4	3	2	6	9	5	8

Scientific Name	Right Descending Bank							Channel	
	E-10	E-11	E-12	E-13	E-14	E-15	E-16	E-17	E-18
<i>Amblema plicata</i>		1			1	1			
<i>Cyclonaias tuberculata</i>			1				1		
<i>Ellipsaria lineolata</i>		1		1					
<i>Elliptio crassidens</i>	2	5	4	3	3	1	2		
<i>Megaloniaias nervosa</i>	4	18	14	10	19	4	4		
<i>Obliquaria reflexa</i>			3				1	1	
<i>Pleurobema cordatum</i>		7	4	2	6	5	2	1	
<i>Potamilus alatus</i>	6	13	9	10	12	5	15	3	
<i>Pyganodon grandis</i>									
<i>quadrula metanevra</i>		1	1	2					
<i>Quadrula pustulosa</i>		2	8	2		1	1	1	
<i>Utterbackia imbecillis</i>					1				
Number of mussels collected	12	48	44	30	42	17	26	6	0
Number of species collected	3	8	8	7	6	6	7	4	0

Scientific Name	Channel	Left Descending Bank			Total
	E-19	E-20	E-21	E-22	
<i>Amblema plicata</i>					4
<i>Cyclonaias tuberculata</i>					2
<i>Ellipsaria lineolata</i>					8
<i>Elliptio crassidens</i>				1	38
<i>Megaloniaias nervosa</i>		1		4	174
<i>Obliquaria reflexa</i>		1			11
<i>Pleurobema cordatum</i>			1		43
<i>Potamilus alatus</i>	1	1	1		134
<i>Pyganodon grandis</i>					1
<i>quadrula metanevra</i>					6
<i>Quadrula pustulosa</i>	1				26
<i>Utterbackia imbecillis</i>					1
Number of mussels collected	2	3	2	5	448
Number of species collected	2	3	2	2	12

Table 6. Tennessee River Miles 390.8 - 392.4 Transects - Approximate bottom elevation, water depth at normal pool elevation (595'), and type of sediment recorded at each 10-meter interval along the transects. (Elevations and Depths are only approximate and should not be used for engineering or navigational purposes. Depth and substrate are only intended to describe mussel habitat.)

Transect Mark	E-01 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	2" silt over hard clay
10 m	592	3	1" silt over hard clay
20 m	585	10	1" silt over hard clay
30 m	576	19	1" silt over hard clay
40 m	570	25	1" silt over gravel and hard clay
50 m	570	25	1" silt over gravel and hard clay
60 m	570	25	10% silt, 70% gravel, 20% cobble over hard clay
70 m	569	26	10% silt, 70% gravel, 20% cobble over hard clay
80 m	569	26	10% silt, 70% gravel, 20% cobble over hard clay
90 m	569	26	10% silt, 70% gravel, 20% cobble
100 m	567	28	10% silt, 70% gravel, 20% cobble

Transect Mark	E-02 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	12" silt over hard packed sand
10 m	590	5	5" silt over hard packed sand
20 m	581	14	1" silt over hard clay
30 m	574	21	1" silt over hard clay
40 m	570	25	10% silt, 70% gravel, 20% cobble
50 m	569	26	10% silt, 70% gravel, 20% cobble
60 m	569	26	10% silt, 70% gravel, 20% cobble
70 m	568	27	10% silt, 70% gravel, 20% cobble
80 m	568	27	10% silt, 70% gravel, 20% cobble
90 m	568	27	10% silt, 70% gravel, 20% cobble
100 m	568	27	10% silt, 70% gravel, 20% cobble

Transect Mark	E-03 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	6" silt over hard packed sand
10 m	581	14	1" silt over hard clay
20 m	573	22	1" silt over hard clay
30 m	571	24	20% silt, 80% gravel over hard clay
40 m	568	27	20% silt, 80% gravel over hard clay
50 m	570	25	10% silt, 90% gravel over hard clay
60 m	570	25	10% silt, 90% gravel over hard clay
70 m	570	25	10% silt, 70% gravel, 20% cobble
80 m	569	26	10% silt, 70% gravel, 20% cobble
90 m	569	26	10% silt, 70% gravel, 20% cobble
100 m	569	26	10% silt, 70% gravel, 20% cobble

Transect Mark	E-04 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	4" silt over hard clay
10 m	585	10	4" silt over hard clay
20 m	582	13	boulders
30 m	579	16	10% sand, 50% gravel, 20% cobble, 20% boulders
40 m	571	24	10% sand, 50% gravel, 20% cobble, 20% boulders
50 m	571	24	10% silt, 50% gravel, 40% cobble
60 m	572	23	10% silt, 50% gravel, 40% cobble
70 m	571	24	10% silt, 50% gravel, 40% cobble
80 m	571	24	10% silt, 50% gravel, 40% cobble
90 m	571	24	10% silt, 50% gravel, 40% cobble
100 m	571	24	10% silt, 50% gravel, 40% cobble

Table 6. Cont'd.

Transect Mark	E-05 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	4" silt over hard clay
10 m	586	9	2" silt over hard clay
20 m	579	16	1" silt over hard clay
30 m	571	24	10% silt, 70% gravel, 20% cobble
40 m	571	24	10% silt, 70% gravel, 20% cobble
50 m	571	24	10% silt, 70% gravel, 20% cobble
60 m	571	24	10% silt, 70% gravel, 20% cobble
70 m	571	24	10% silt, 70% gravel, 20% cobble
80 m	571	24	10% silt, 70% gravel, 20% cobble
90 m	571	24	10% silt, 70% gravel, 20% cobble
100 m	571	24	10% silt, 70% gravel, 20% cobble

Transect Mark	E-06 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	50% silt, 50% gravel over hard clay
10 m	592	3	50% silt, 50% gravel over hard clay
20 m	581	14	3" silt over hard clay
30 m	574	21	3" silt over hard clay
40 m	572	23	10% silt, 70% gravel, 20% cobble
50 m	571	24	10% silt, 70% gravel, 20% cobble
60 m	571	24	10% silt, 70% gravel, 20% cobble
70 m	570	25	10% silt, 70% gravel, 20% cobble
80 m	569	26	2" silt over bedrock
90 m	569	26	2" silt over bedrock
100 m	569	26	10% silt, 40% sand, 50% gravel over bedrock

Transect Mark	E-07 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	591	4	1" silt over hard clay
10 m	586	9	1" silt over hard clay
20 m	574	21	1" silt over hard clay
30 m	572	23	50% silt, 50% gravel over hard clay
40 m	572	23	10% silt, 70% gravel, 20% cobble
50 m	572	23	10% silt, 70% gravel, 20% cobble
60 m	571	24	10% silt, 70% gravel, 20% cobble
70 m	571	24	10% silt, 70% gravel, 20% cobble
80 m	571	24	10% silt, 70% gravel, 20% cobble
90 m	570	25	10% silt, 70% gravel, 20% cobble
100 m	569	26	10% silt, 70% gravel, 20% cobble

Transect Mark	E-08 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	50% silt, 50% gravel over hard clay
10 m	588	7	50% silt, 50% gravel over hard clay
20 m	582	13	2" silt over hard clay
30 m	573	22	10% silt, 70% gravel, 20% cobble
40 m	573	22	10% silt, 70% gravel, 20% cobble
50 m	573	22	10% silt, 70% gravel, 20% cobble
60 m	573	22	10% silt, 70% gravel, 20% cobble
70 m	572	23	10% silt, 70% gravel, 20% cobble
80 m	572	23	10% silt, 70% gravel, 20% cobble
90 m	572	23	10% silt, 70% gravel, 20% cobble
100 m	571	24	10% silt, 70% gravel, 20% cobble

Table 6. Cont'd.

Transect Mark	E-09 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	100% silt
10 m	592	3	100% silt
20 m	591	4	6" silt over hard clay
30 m	580	15	1" silt over hard clay
40 m	573	22	10% silt, 70% gravel, 20% cobble over hard clay
50 m	573	22	10% silt, 70% gravel, 20% cobble over hard clay
60 m	572	23	10% silt, 70% gravel, 20% cobble over hard clay
70 m	572	23	5% silt, 90% gravel, 5% cobble
80 m	572	23	10% silt, 40% gravel, 40% cobble
90 m	572	23	10% silt, 40% gravel, 40% cobble
100 m	572	23	10% silt, 40% gravel, 40% cobble

Transect Mark	E-10 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	582	13	1" silt over gravel
10 m	581	14	1" silt over gravel with some boulders
20 m	582	13	100% boulders
30 m	581	14	90% boulders, 10% gravel
40 m	579	16	1" silt over hard clay
50 m	574	21	1" silt over hard clay
60 m	573	22	1" silt over gravel
70 m	572	23	1" silt over gravel
80 m	570	25	1" silt over gravel
90 m	570	25	10% silt, 40% gravel, 40% cobble
100 m	568	27	10% silt, 40% gravel, 40% cobble

Transect Mark	E-11 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	2" silt over hard packed sand
10 m	574	21	50% silt, 50% cobble over hard clay
20 m	572	23	20% silt, 40% sand, 40% gravel
30 m	573	22	10% silt, 10% sand, 40% gravel, 40% cobble
40 m	577	18	10% silt, 50% gravel, 40% cobble
50 m	571	24	10% silt, 50% gravel, 40% cobble
60 m	570	25	10% silt, 50% gravel, 40% cobble
70 m	569	26	10% silt, 50% gravel, 40% cobble over bedrock
80 m	568	27	10% silt, 50% gravel, 40% cobble
90 m	568	27	10% silt, 50% gravel, 40% cobble
100 m	568	27	10% silt, 50% gravel, 40% cobble

Transect Mark	E-12 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	575	20	1" silt over hard clay
10 m	571	24	1" silt over hard clay
20 m	572	23	10% silt, 50% gravel, 40% cobble
30 m	570	25	10% silt, 40% gravel, 40% cobble, 10% boulders
40 m	575	20	10% silt, 40% gravel, 40% cobble, 10% boulders
50 m	581	14	10% silt, 40% gravel, 40% cobble, 10% boulders
60 m	580	15	10% silt, 30% gravel, 50% cobble, 10% boulders
70 m	570	25	10% silt, 30% gravel, 50% cobble, 10% boulders
80 m	568	27	10% silt, 20% gravel, 60% cobble, 10% boulders
90 m	567	28	10% silt, 20% gravel, 60% cobble, 10% boulders
100 m	567	28	10% silt, 40% gravel, 40% cobble, 10% boulders

Table 6. Cont'd.

Transect Mark	E-13 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	1" silt over hard clay
10 m	582	13	1" silt over hard clay
20 m	580	15	10% gravel, 90% boulders
30 m	581	14	10% gravel, 90% boulders
40 m	582	13	10% silt, 40% gravel, 40% cobble, 10% boulders
50 m	572	23	10% silt, 30% gravel, 30% cobble, 30% boulders
60 m	577	18	100% boulders
70 m	570	25	10% silt, 40% gravel, 40% cobble, 10% boulders
80 m	569	26	10% silt, 40% gravel, 40% cobble, 10% boulders
90 m	569	26	10% silt, 40% gravel, 40% cobble, 10% boulders
100 m	568	27	10% silt, 40% gravel, 40% cobble, 10% boulders

Transect Mark	E-14 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	1" silt over hard clay
10 m	582	13	1" silt over hard clay
20 m	571	24	1" silt over hard clay
30 m	570	25	2" silt over gravel
40 m	570	25	10% silt, 50% gravel, 40% cobble
50 m	570	25	10% silt, 50% gravel, 40% cobble
60 m	570	25	10% silt, 50% gravel, 40% cobble
70 m	570	25	10% silt, 50% gravel, 40% cobble
80 m	570	25	10% silt, 40% gravel, 40% cobble, 10% boulders
90 m	570	25	10% silt, 40% gravel, 40% cobble, 10% boulders
100 m	570	25	10% silt, 40% gravel, 40% cobble, 10% boulders

Transect Mark	E-15 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	1" silt over hard packed sand
10 m	579	16	1" silt over hard clay
20 m	571	24	1" silt over hard clay
30 m	570	25	5" silt over hard clay
40 m	569	26	10% silt, 50% gravel, 40% cobble
50 m	568	27	10% silt, 50% gravel, 40% cobble
60 m	568	27	10% silt, 50% gravel, 40% cobble
70 m	569	26	10% silt, 50% gravel, 40% cobble
80 m	570	25	10% silt, 50% gravel, 40% cobble
90 m	569	26	10% silt, 50% gravel, 40% cobble
100 m	569	26	10% silt, 50% gravel, 40% cobble

Transect Mark	E-16 (RDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	rip rap boulders, limestone gravel
10 m	571	24	2" silt over hard clay
20 m	570	25	10% silt, 50% gravel, 40% cobble
30 m	570	25	10% silt, 50% gravel, 40% cobble
40 m	570	25	10% silt, 50% gravel, 40% cobble
50 m	570	25	10% silt, 50% gravel, 40% cobble
60 m	570	25	10% silt, 50% gravel, 40% cobble
70 m	570	25	10% silt, 50% gravel, 40% cobble
80 m	570	25	10% silt, 50% gravel, 40% cobble
90 m	572	23	10% silt, 50% gravel, 40% cobble
100 m	571	24	10% silt, 50% gravel, 40% cobble

Table 6. Cont'd.

Transect Mark	E-17 (Channel)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	568	27	5% silt, 20% sand, 50% gravel, 25% cobble
10 m	567	28	5% silt, 20% sand, 50% gravel, 25% cobble
20 m	567	28	1" gravel over bedrock
30 m	568	27	1" gravel over bedrock
40 m	569	26	1" gravel over bedrock
50 m	569	26	1" gravel over bedrock
60 m	569	26	2" gravel over bedrock
70 m	570	25	1" gravel over bedrock
80 m	571	24	10% silt, 50% gravel, 40% cobble over bedrock
90 m	571	24	1" gravel over bedrock
100 m	570	25	1" gravel over bedrock

Transect Mark	E-18(Channel)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	569	26	5% silt, 20% sand, 50% gravel, 25% cobble
10 m	569	26	1" silt and gravel over bedrock
20 m	569	26	1" silt and gravel over bedrock
30 m	569	26	1" silt and gravel over bedrock
40 m	569	26	1" silt and gravel over bedrock
50 m	570	25	10% silt, 50% gravel, 40% cobble over bedrock
60 m	571	24	10% silt, 50% gravel, 40% cobble over bedrock
70 m	571	24	10% silt, 50% gravel, 40% cobble over bedrock
80 m	572	23	10% silt, 50% gravel, 40% cobble over bedrock
90 m	571	24	10% silt, 10% sand, 40% gravel, 40% cobble over bedrock
100 m	572	23	10% silt, 10% sand, 40% gravel, 40% cobble over bedrock

Transect Mark	E-19(Channel)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	570	25	1" silt and gravel over bedrock
10 m	570	25	1" silt and gravel over bedrock
20 m	569	26	1" silt and gravel over bedrock
30 m	568	27	1" silt and gravel over bedrock
40 m	566	29	50% silt, 50% gravel over hard clay
50 m	566	29	30% silt, 50% gravel, 20% cobble
60 m	566	29	30% silt, 10% sand, 60% gravel
70 m	568	27	30% silt, 70% gravel
80 m	571	24	20% silt, 60% gravel, 20% cobble over bedrock
90 m	570	25	20% silt, 60% gravel, 20% cobble over bedrock
100 m	570	25	20% silt, 60% gravel, 20% cobble over bedrock

Transect Mark	E-20 (LDB)		
	Bottom Elev. (Ft)	Depth (Ft)	Sediment
0 m	593	2	hard packed sand
10 m	592	3	1" silt over hard clay
20 m	576	19	1" silt over hard clay
30 m	573	22	3" silt over gravel
40 m	573	22	1" silt over gravel
50 m	573	22	10% silt, 50% gravel, 40% sand
60 m	572	23	10% silt, 50% gravel, 40% sand
70 m	571	24	10% silt, 50% gravel, 40% sand
80 m	571	24	10% silt, 50% gravel, 40% sand
90 m	571	24	10% silt, 50% gravel, 40% cobble over bedrock
100 m	570	25	10% silt, 50% gravel, 40% cobble over bedrock

RESPONSE TO ENVIRONMENTAL REPORT SUFFICIENCY REVIEW
Attachment E 2, Survey Of Mussel Stocks
May 2, 2008

**Survey of Native Mussel Stocks
Adjacent to the Bellefonte Nuclear Plant Site
Tennessee River Miles 390 - 392**

**Tennessee Valley Authority
1995**

**Survey of Native Mussel Stocks Adjacent to the Bellefonte Nuclear Plant
Site, Tennessee River Miles 390-392**

On August 29 and 30, 1995, Tennessee Valley Authority (TVA) biologists conducted a survey of native mussels in the Tennessee River adjacent to the Bellefonte Nuclear Plant site, Tennessee River Miles (TRM) 390 - 392, Jackson County, Alabama. This survey was designed to provide information about the mussels in this part of the river and will be used in an evaluation of alternative uses for the Bellefonte site which might include in-water construction.

The reach of the Tennessee River included in this survey included the right (descending) shoreline and right side of the river from downstream of the powerline crossing, TRM 390.8 upstream to approximately one-third the length of Bellefonte Island, to TRM 392.4. Along the upstream and downstream parts of this river reach, the shoreline consists of a series of long, narrow islands separated from the shore by shallow bays, pools, or swamps. In the center of this reach, the islands are absent along a short length of shoreline, from approximately TRM 391.3 to 391.7. Under water, the river bottom drops off quickly from the channel side of the islands or the shore approximately 7.5 meters (20 feet) to the wide, flat bottom of the river channel.

The mussel resources in this river reach were sampled by searching bottom habitats along a series of transects, typically oriented straight out from the shore of the barrier islands toward the channel. Each transect was established by anchoring one end of a 50-meter line near shore and the other end as far out into the channel as it would reach. Transects were established at approximately 0.2 mile intervals all along this reach of the river. Two divers

swam along the sides of these lines, collecting any live mussels they could see or feel within approximately one-half meter on each side of the line. All mussels collected by the divers were brought to the surface where they were sorted by species and counted. Notes taken while each transect was being searched included representative water depths and diver comments on substrate composition.

Results from this survey are presented in Table 1 and on Figure 1. During this survey, a total of 14 transects were searched. One of these transects was located along the left (descending) shore of this channel, close to Bellefonte Island. All of the 13 other transects were located along the right shore, adjacent to the Bellefonte Nuclear Plant site. Assuming that the divers were able to search a composite width of one meter along each transect, these 14 transects included 700 square meters of river substrate.

As indicated in Table 1, a total of 238 live mussels were found, representing 11 species. The two dominant species were the washboard (*Megaloniaias nervosa*) and pink heelsplitter (*Potamilius alatus*).

Table 1. Live freshwater mussels encountered during searches of 50-meter transects adjacent to the Bellefonte Nuclear Plant site Tennessee River Miles 390 - 392, August 29 - 30, 1995.

Transect Location (River Mile) Depth Range (feet) Substrate	2	1	3	4	5	6	7	8	9	11	10	12	13	14	Totals	Sites
	390.5 4-26 S/GC	390.7 9-25 S/GC	390.9 6-25 S/GC	391.1 4-26 S/GC	391.1 9-26 S/GC	391.2 21-24 S/GC	391.3 7-26 S/GC	391.4 4-24 S/GC	391.5 4-26 S/GC	391.8 5-24 S/GC	392.0 7-26 S/GC	392.2 4-27 S/GC	392.5 5-25 S/GC	392.3 22-30 S/GC		
Mussel Species																
<i>Megalonaias nervosa</i>			12	24	4	10	11	13	6	2	3	1	3		89	11
<i>Potamilus alatus</i>	3	7	4	11	16	4	6	4	10	7	4	2	4		82	13
<i>Pleurobema cordatum</i>		3	3	13		3	1	1	1	1	1		2		29	10
<i>Elliptio crassidens</i>			1	7	1	1						1	2		13	6
<i>Quadrula pustulosa</i>			2	2		2					1				7	4
<i>Quadrula metanevra</i>				4	1						1				6	3
<i>Amblyma plicata</i>	1						1	1	1						4	4
<i>Ellipsaria lineolata</i>				3											3	1
<i>Obliquaria reflexa</i>				1				1						1	3	3
<i>Cyclonaias tuberculata</i>		1													1	1
<i>Tritogonia verrucosa</i>															1	1
Totals																
Specimens	4	11	22	65	23	20	19	20	17	11	9	5	11	1	238	14
Species	2	3	5	8	5	5	4	5	3	4	4	4	4	1	11	

Substrate abbreviations: C - cobble, G - gravel, S - silt or clay