

Limerick Generating Station Units 1 & 2

License Renewal Project

Environmental Report



**Response to Request for Additional Information (RAI) for
the Review of LGS LRA ER, Dated February 28, 2012**

Enclosure 2

Book 11 of 11

E2-31: Enclosure 2: Terrestrial Ecology, item D

Exelon. 1984. Limerick Generating Station Non-radiological Environmental Report.

Exelon Response

The NRC staff and representatives of Exelon Generation held a telephone conference on February 23, 2012, to discuss and clarify whether the staff was requesting only the excerpts that were provided at the Limerick License Renewal Environmental Audit from the referenced document, or the entire document. The staff clarified that only the excerpts provided at the Audit are requested.

The following excerpts, which were provided at the Limerick License Renewal Environmental Audit, from the referenced document are being provided:

- Cover Page
- Table of Contents
- Section 7.0, Asiatic Clam
- Section 8.0, Cooling Tower Bird Mortality
- Section 9.0, Literature Cited

PROGRESS REPORT

Non-Radiological Environmental Monitoring for Limerick Generating Station 1984

Prepared for

Philadelphia Electric Company

by

RMC-Environmental Services

Pottstown, Pennsylvania

DECEMBER 1985

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7.0 Asiatic clam

Introduction

Section 7.0 Pages 7.0-1 through 7.0-7 in PROGRESS REPORT: Non-Radiological Environmental Monitoring for Limerick Generating Station 1979-1983 fully describes introductory, background, or materials, methods, and study area sections for similar studies conducted in 1984. Only additions to or changes from this information are discussed below.

Frequency and Duration of Study in 1984

1. Qualitative survey of the Delaware River, Schuylkill River, and Perkiomen Creek.
 - Conducted once, 11 September to 5 November.

2. Quantitative studies in the Schuylkill River at Norristown.
 - Conducted monthly, January to December.

Changes in Study Area in 1984

1. Qualitative survey of the Delaware River, Schuylkill River, and Perkiomen Creek.
 - No change.

2. Quantitative studies in the Schuylkill River at
Norristown.

- Stations S38830 and S39650 were dropped
because of insufficient numbers of clams
collected.

Changes in Methods or Materials in 1984

1. Qualitative survey of the Delaware River, Schuylkill
River, and Perkiomen Creek.

- No change.

2. Quantitative studies in the Schuylkill River at
Norristown.

- Use of a clam rake as a semi-quantitative
technique for collection of samples at
S38320 when water depth was too great
for use of the PIBS.
- Use of the clam rake and the consequent
ramifications on data evaluation are
described in the Results and Discussion
section.

- In the previous report, it was erroneously stated on page 7.0-4 that clam shell "lengths were measured... to the nearest millimeter", when in fact, they were measured to the nearest higher millimeter. This practice was continued through 1984.

Results and Discussion

Qualitative Program

The results of 1984 qualitative sampling for the presence of Corbicula in the Delaware and Schuylkill Rivers and Perkiomen Creek are shown in Tables 7.0-1, 2, and 3, respectively. For ease of comparison, data obtained in 1982 and 1983 are included in these tables. The known geographic extent of Corbicula distribution in the Delaware and Schuylkill Rivers is shown in Figure 7.0-1.

Attention is drawn to the fact that the Delaware River mileage and distance from Pt. Pleasant for many of the locations shown in Table 7.0-1 are different from those presented in the analogous table (Table 7.0-2) in the previous report. The numbers presented in Table 7.0-1 reflect the use of a standard system of Delaware River mileage established by the Delaware River Basin Commission (1969).

In 1984, Corbicula was found to be present in an approximately 58 mile long reach of the Delaware River extending from the vicinity of Eddystone Generating Station upriver to the Route 532 bridge near Yardley, Pennsylvania (Table 7.01-1). In particular, detection of Corbicula at the latter location extended its range 3 miles upriver of that observed in 1983. This location is only 15 miles from Pt. Pleasant. Although Southwark, Delaware, and Richmond Generating Stations are located within the confirmed range of Corbicula distribution, sampling failed to detect the species' presence in the immediate vicinity of any of these stations.

Sampling in 1984 also established the presence of Corbicula at locations in the Schuylkill River upriver of where it had been observed previously (Table 7.0-2). Collection of clams at a point located 1 mile upriver of Betzwood Bridge represented a range extension of 2.5 miles. This location is 10.5 miles downriver of Cromby Generating Station and only 2.5 miles downriver of the Perkiomen Creek confluence. Sampling in the tidal reach of the Schuylkill River downriver of Fairmount Dam confirmed Corbicula's presence in the vicinity of Schuylkill Generating Station, but in low density.

Corbicula was not observed at any location in Perkiomen Creek (Table 7.0-3).

Quantitative Program

Samples were collected in only 3 months (September, October, and December) in 1983. Since data generated from these samples received only limited discussion in the 1983 Progress Report, they are included within this report in order to provide more detailed discussion in relation to the 1984 data.

Samples were collected monthly at all stations in 1984 with two exceptions. No samples were collected at any station in June or at S38320 in July for the same reason that none were collected at any station in November 1983 or at S38320 in December 1983 - high water conditions.

Use of the clam rake at S38320

Samples usually were collected at S38320 with a Portable Invertebrate Box Sampler (PIBS), an instrument with successful use restricted to water depth \leq 30 cm. Consequently, when water depth was greater, but still wadeable, an alternate method of sample collection was required and use of a clam rake was instituted.

The clam rake employed is long-handled, with a 14 cm x 28 cm metal basket lined with 3.2 mm mesh screen. An individual sample replicate collection effort consisted of the operator holding the rake basket tightly against the river bottom (substrate) with its opening oriented upstream. The operator stood immediately up-

stream of the rake and vigorously kicked at the river substrate for 30 seconds, thereby dislodging clams and substrate into the basket. The contents of the basket constituted 1 replicate sample.

Sample collection with the clam rake is a semi-quantitative effort because there is no clearly defined substrate surface area that is sampled. However, experimentation with the rake indicated that approximately 0.25 m² of the substrate surface would be disturbed (or "sampled") within the 30 seconds of the collection effort. Therefore, standing crop data prepared using the clam rake are based on a sample area of 0.25 m².

In November 1984, an experiment was conducted to determine what relationship might exist between data prepared from samples collected by the two sampling methods - PIRS and clam rake. Therefore, 4 replicate samples were collected using each sampling technique. The results indicated that the clam rake seriously underestimated standing crop; the PIRS yielded an estimate approximately 2 1/2 times greater. Furthermore, size frequency analysis showed that larger clams (> 11 mm) were underrepresented in clam rake samples and that the largest clams virtually were not collected. Therefore, although use of the clam rake was beneficial in that samples were collected during higher water conditions that prevented use of the PIRS, data from samples collected with the clam rake must be carefully compared with those derived from PIRS samples. Those months in which samples were

collected with the clam rake were January, March, April, May, and December 1984.

Standing Crop

Generally, large numbers of Corbicula were observed at all stations in fall 1983, followed by a decline in winter through spring 1984 (Table 7.0-4). This decline was precipitous at S38320, with monthly standing crop dropping from 3783.3/m² in September to 8.0/m² in April. The decline also was sharp at S38860. However, in January, an anomalous increase to 6018.9/m² was observed at S38860. Of possible significance to explanation of this increase was the measurement on 14 December (between the December and January sample dates) of the highest river flows observed during the study period (USGS 1984a, 1985). Since S38860 is located in deep water (about 2.4 m) just upriver of Norristown Dam, this station may display an inflated standing crop resulting from deposition of clams scoured from upriver locations and transported as bedload during the December high water event.

The reduced standing crops observed in the spring continued through summer. Large numbers of juvenile clams appeared at all stations in September, thereby increasing standing crops substantially. With exception of S38320 in November and December, standing crops further increased through fall. Standing crop observed at S38320 in December may be low due to

sample collection by clam rake. Use of the PIBS as had been done in August-November may have resulted in a higher value.

Shell Length Frequency

Corbicula shell length frequency data displayed interesting disparity among the sample stations (Tables 7.0-5, 6, and 7). The large majority of the clams present at S38320 and S38860 in September 1983 was 14-19 mm, with very few less than 13 mm collected. An obvious increase in size could be traced through October (S38320) and December (S38860) at these stations. However, most of the clams present at S40450 were much smaller, 4-11 mm, with a less obvious increase in size evident through December.

The size range of most clams present at S38320 changed little from October 1983 to February 1984. However, a great change was observed at S38860 from December 1983 to January 1984 when a large number of 11-19 mm clams were collected. Size range remained largely unchanged at this station in February but increased substantially in March. At S40450, size range increased from December 1983 to May 1984. Unfortunately, the numbers of clams collected at all stations in the late spring and early summer months were insufficient to reliably define length frequency.

The first juvenile clams (undoubtedly spawned in 1964) appeared in samples collected at all stations in August. Much larger numbers of juvenile clams were collected in September

through December. The size range of these clams generally grew larger through November at all stations. Few clams larger than 15 mm were collected at any station in the fall.

Because of the large numbers of juvenile clams collected in fall 1984, it is possible to estimate mean growth rate at each station during the first year of life. The mean growth rates appeared to be: S38320 - about 6 mm, S38860 - about 5 mm, and S40450 - 7.5 mm. It is important to note that there is apparent large variation in first year growth of individual clams at all stations, although the samples of young clams display length distributions that are decidedly normal (bell-shaped) in most cases.

Age Determination

In response to a request for assistance, John W. Ropes of the National Marine Fisheries Service attempted age determination of 10 specimens of Corbicula collected 19 September 1983 at S38320 (Ropes 1985). Ropes examined the shells for annuli, thickened concentric rings laid down in the shell during the colder months when shell growth is minimal. Shell examination consisted of preparation of acetate peels and thin sections of each specimen.

The results of the shell examination were not conclusive for several reasons. Most importantly, they were not validated by marking living specimens, allowing them to grow, and measuring the observed growth. Secondly, sample size was small and shell

surfaces were eroded, obscuring annuli. However, the results can be partially validated using length frequency data and will be when sufficient data are prepared. Nevertheless, the results seemed to indicate that clams in the size range 14.0-15.9 mm were 2 years old, and that those larger (≥ 21.2 mm) were 3 years old (Table 7.0-8).

Ropes' age estimates fit well with the first year growth rate estimated from the juvenile clams collected in fall 1984. In summary, Corbicula mean growth in the Schuylkill River apparently is to 5-7.5 mm in the first year, to < 14 mm in the second year, and to < 21 mm in the third year. Assuming that growth rate is uniform and extrapolating to the fourth and fifth year, expected shell length would be < 28 mm and < 35 mm, respectively. Therefore, the largest specimens collected, 30-35 mm at S38860 in December 1983, may have been 5 years old. If these clams were spawned in the Schuylkill River, the presence of Corbicula would date back at least to 1979.

Population Dynamics and River Water Temperature

It is generally believed that Corbicula is at the northern limit of its existence in north central and northeastern United States because of the cold winter temperatures commonly experienced in these areas. For example, substantial mortality of Corbicula was observed in the New River, Virginia when water temperature fell to 0°C for a 2 week period in the winter of 1976 (Graney et al. 1980). These authors also reported lesser mortality when minimum water temperatures of about 3-4°C were observed during the winters of 1977 and 1978. Other researchers (Mattice and Dye 1976) consider 2°C to be the minimum lower lethal temperature for Corbicula.

The substantial over-winter decline in Corbicula numbers observed in the Schuylkill River, particularly at S38320 and S38860, may have been a similar phenomenon in response to low water temperature. Daily river temperature is measured 16 km downstream at Manayunk by the U.S. Geological Survey. These data indicate that water temperature fell to 4°C on 20 December 1983 and remained at that level or lower through 11 February 1984, including two periods (23 December 1983 - 4 January 1984 and 11-25 January 1984) when it did not exceed 2°C. It is noteworthy that the samples collected in February 1984 at S38860 contained many clams that were 'gaping' (the valves open approximately 5 mm), a behavioral response indicative of death or imminent death. Furthermore, the samples gave off a distinct odor of decay.

At the other extreme, McMahon (1983) reviewed the literature on temperature tolerance and concluded that "temperatures above 25-30°C seemed to have extensive effects on the biology of Corbicula fluminea". These effects included severe depression in oxygen uptake (McMahon 1979) and water filtration (Mattice 1979) rates at temperatures above 25°C. Summer water temperature in the Schuylkill River rises to these physiologically inhibitory levels (>25°C). In 1984, water temperature in excess of 25°C was measured at Manayunk (USGS 1984) on 22 dates during June-August with a maximum of 29°C recorded. Water temperature in summer 1983 was much warmer, exceeding 25°C on 79 dates from 15 June to 12 September, including 2 periods of 33 and 27 consecutive days. Maximum water temperature recorded was 30.5°C.

Another potential effect of warm Schuylkill River water temperature is directly related to reproduction. McMahon (1983) reported that juvenile Corbicula release is initiated at 19°C and markedly inhibited above 26°C. No juvenile release occurs at temperatures above 32°C (Aldridge 1976 and Aldridge and McMahon 1978). Although no Schuylkill River water temperature above 32°C was recorded in 1983 or 1984, temperature above 26°C was observed on many dates, especially in 1983.

Water temperature in the reproductively favored 19-26°C range was measured on fewer dates in 1983 (71) than in 1984 (107). Furthermore, these years differed markedly in the distribution of dates on which 19-26°C water temperature was recorded. In spring

and early summer 1983, water temperature in this range essentially was limited to June and early July prior to higher measurements recorded in mid- and late summer. When temperature declined in mid-September through mid-October, most of the 19-26°C measurements were in the lower part of the range. In contrast, water temperature in the 19-26°C range was measured sporadically in late May and early June 1984 and nearly continuously from mid-June through late September of that year.

The less frequent occurrence of water temperature in the 19-26°C range in conjunction with the physiologically stressful higher temperatures observed in 1983 relative to 1984 may have been instrumental in the reduced reproductive success observed in the earlier year. In fall 1983, only a few juvenile clams were collected at S40450 and virtually none were collected at the other stations, whereas large numbers were collected at all stations in fall 1984.

Table 7.0-1. Location and results of qualitative sampling for Corbicula on the Delaware River, 1982-1984.

<u>Location (River Mile)</u>	<u>Distance from Pt. Pleasant (miles)</u>	<u>Sample Areas*</u>	<u>1982 result</u>	<u>1983 result</u>	<u>1984 Result</u>
Pt. Pleasant Canoe Livery (157.2)	0	1+,5	Absent	Absent	Absent
Lumberville Canal Park Footbridge (155.4)	1.8	1,5+	Absent	Absent	Absent
PA Rt. 263 Bridge, town of Center Bridge (151.9)	5.3	1+,5	Absent	Absent	Absent
PA Rt. 179 Bridge, New Hope (148.7)	8.5	1+,5	Absent	Absent	Absent
Washington Crossing State Park (146.0)	11.2	1+		Absent	Absent
100 yds above Rt. 532 Bridge (142.0)	15.2	1+,5+	Absent	Absent	Present
0.75 mi above I-95 Bridge (139.7)	17.5	1+	Absent	Absent	Present
Under I-95 Bridge (139.0)	18.2	1+		Present	Present
Yardley Boat Ramp (138.4)	18.8	1+,3,5+	Absent	Present	Present
1.5 mi below Yardley Boat Ramp (136.9)	20.3	1,3,5	Absent		
Below 3-island archipelago, above Trenton Ave. and Calhoun St. bridge (134.0)	23.2	1,3,5	Present		
Below railroad bridge (mid-town Trenton) (133.0)	24.2	1,3,5+	Present		Present
Between buoys 105 and 106 (131.7)	25.5	1,5	Absent		
Biles Creek (131.2)	26.0	1,3,5	Present		
Buoy 97 (130.6)	26.6	1+,5	Present		Present
Buoy 92 (129.1)	28.1	1+,3+,5+	Present		Present

<u>Location (River Mile)</u>	<u>Distance from Pt. Pleasant (miles)</u>	<u>Sample Areas*</u>	<u>1982 results</u>	<u>1983 results</u>	<u>1984 Results</u>
0.5 mi above Newbold Island (127.0)	30.2	1+,3+,5	Present		Present
Southern tip of Newbold Island (124.9)	32.5	1,3+,5	Present		Present
Florence Boat Ramp (122.0)	34.0	1,3,5	Present		
Above I-276 Bridge (121.3)	35.9	1,3+,5	Present		Present
Burlington Island at buoy 45 (113.9)	38.5	1,3	Present		
Croydon Generating Station (117.0)	40.2	1,3+,5	Present		Present
1.5 mi below Neshaminy Creek (114.1)	43.1	1,5	Present		
Mouth of Rancocas Creek (111.1)	46.1	1,3,5	Present	Present	
0.5 mi downstream of buoy 18 (109.3)	47.9	3,5		Present	Present
0.5 mi downstream of buoy 15 (108.0)	49.2	1,3,5	Absent	Present	
Under Tacony Palmyra bridge (107.1)	50.1	5	Absent	Present	
Betsy Ross Bridge (104.8)	52.4	3+,5+	Absent	Present	Present
Richmond Generating Station (104.4)	52.8	1+,3+,5+	Absent	Absent	Absent
Northern tip of Petty Island (103.2)	54.0	1,3+,5+	Absent	Absent	Present
Delaware Generating Station (101.1)	56.1	1+,3+,5		Absent	Absent
Benjamin Franklin bridge (100.2)	57.5	1,5+	Absent		Present
upstream of Walt Whitman bridge (98.0)	59.2	1,5	Absent	Absent	

<u>Location (River mile)</u>	<u>Distance from Pt. Pleasant (miles)</u>	<u>Sample Areas*</u>	<u>1982 Result</u>	<u>1983 Result</u>	<u>1984 Result</u>
Southwark Generating Station (97.5)	59.7	1+,3+		Absent	Absent
Buoy 46A (95.0)	62.2	1,5	Present (shell)		
Mouth of Schuylkill River (92.5)	64.7	1,3+,5	Absent	Present	Present
Opposite Paulsboro, NJ (90.0)	67.2	1,5	Absent		
Northern tip of Tinicum Island (87.5)	69.7	1+,3+,5	Absent		Present
Northern tip of Mond's Island (85.6)	71.0	1,3,5	Absent		
Edgystone Generating Station (84.3)	72.9	1+,3+		Present	Present
Just north of Commodore Barry Bridge (81.8)	75.4	1,5	Absent		

*Facing upstream: 1 = left shore, 3 = midstream, 5 = right shore

+Areas sampled in 1984 survey.

A blank in a result column indicates no sample collected.

Table 7.0-2. Location and results of qualitative sampling for Corbicula on the Schuylkill River, 1982-1984.

<u>Location (River Mile)</u>	<u>Distance from LGS (miles)</u>	<u>Sample Areas*</u>	<u>1982 result</u>	<u>1983 result</u>	<u>1984 result</u>
Limerick Generating Station (S48)	0	1+,3+,5+	Absent		Absent
Vincent Dam (S45)	3.0	1,3+,5+	Absent		Absent
Main Street, Spring City (S42)	0.0	1+,3+,5	Absent		Absent
0.25 mi above Cromby Generating Station (LGS) (S40)	0.25	1+,3+,5+		Absent	Absent
Adjacent to LGS (S40)	0.0	1+,3+,5+		Absent	Absent
0.25 mi below LGS (S39)	0.75	1+,3,5+		Absent	Absent
Phoenixville Water Treatment Plant (S38)	9.25	3,5+		Absent	Absent
Black Rock Road, Rt. 113, Phoenixville (S37)	10.0	1+,3+,5+	Absent	Absent	Absent
Public Picnic Area opposite Fish Commission boat ramp (S37)	10.0	1+,3+,5+		Absent	Absent
Black Rock Dam (S36)	11.25	1+,3+,5+		Absent	Absent
Bridge St., Rt. 29, Phoenixville (S35)	13.0	1,5	Absent		
Pawlins Road, Phoenixville (S31)	17.0	5+	Absent		Absent
1.0 mi above Betzwood bridge (S29)	19	1			Present
0.5 mi above Betzwood bridge (S28.5)	19.5	3			Present
Betzwood Bridge (S28)	20.0	1,3,5+	Absent	Absent	Present
0.75 mi above Abrams Creek (S27)	21.0	1+,5+		Present	Present

<u>Location (River Mile)</u>	<u>Distance from LGS (miles)</u>	<u>Sample Areas*</u>	<u>1982 result</u>	<u>1983 result</u>	<u>1984 result</u>
Abrams Creek (S20)	22.25	1,3		Present	Present
Tip of Barbadoes Island (S26)	22.5	1+,3+,5+		Present	Present
Intake to Barbadoes Generating Station (S25)	23.25	5+		Present	Present
Under Rt. 202 bridge (S25)	23.5	1+,3+,5+		Present	Present
Norristown Dam (S24)	24.0	1+,3+,5+	Present	present	Present
1-270 bridge, Swedesburg (S22)	26.0	1	Present		
Plymouth Dam, west Conshohocken (S20)	28.0	1	Present		
Near Montgomery County/ Philadelphia County line (S17)	31.0	5	Present		
west of Green Lane bridge (S14)	34.0	5	Present		
Pencova bridge (S12)	36.0	5	Present		
Strawberry Bridge (S11)	37.0	5	Present		
Fairmount Dam (S0)	40	3,5	Present	Present	
Under Park Drive Bridge (S3)	40.25	3+,5+		Absent	Absent
Under Market St. Bridge (S7)	40.75	1,3+,5		Absent	Present
Under South St. bridge (S0)	41.5	3+,5		Absent	Absent
Adjacent to Schuylkill Generating Station (SGs) (S5)	42.0	1,3,5+	Absent	Present	Present
0.25 mi below SGs (S5)	42.25	1+,3+,5	Absent	Absent	Present
Under Passyunk Ave. bridge (S3)	44.0	5	Absent	Absent	

<u>Location (River Mile)</u>	<u>Distance from LGS (miles)</u>	<u>Sample Areas*</u>	<u>1982 result</u>	<u>1983 result</u>	<u>1984 result</u>
South of I-95 bridge (S1)	47.0	1,3+,5	Absent		Absent
Mouth of Schuylkill River (SU)	48.0	3+,5	Absent	Present (shell)	Present

*Facing upstream: 1 = left shore, 3 = midstream, 5 = right shore

+Areas sampled in 1984 survey.

A blank in a result column indicates no sample collected.

Table 7.0-3. Location and results of qualitative sampling for Corbicula on the Perkiomen Creek, 1963-1984.

<u>Location</u>	<u>Distance from Confluence w/ Schuylkill (mi)</u>	<u>Sample Areas*</u>	<u>1963 Result</u>	<u>1984 Result</u>
below Wetherills Dam	0.75	1+,3,5+	Absent	Absent
Egypt Road	1.50	1+,3+,5+	Absent	Absent
Indian Road Dam	2.25	1+,3,5+	Absent	Absent
Yerkes Road Bridge	4.50	1+,3,5+	Absent	Absent
Collegeville Dam	6.50	1+,3+,5	Absent	Absent
Kann's Bridge, Rt. 113	7.25	1,5+,5+	Absent	Absent
Graterford Road Bridge	9.25	1+,3,5	Absent	Absent
Utt's Dam Bridge	10.50	1+,3,5+	Absent	Absent
Rt. 73 Bridge	11.25	1,5+,5+	Absent	Absent
Schwenksville Road Bridge	12.00	1+,3,5	Absent	Absent

*Facing upstream: 1 = left shore, 3 = midstream, 5 = right shore

+Areas sampled in 1984 survey.

A blank in a result column indicates no sample collected.

Table 7.0-4. Standing crop (mean number/sq. meter) of Corbicula observed in the Schuylkill River at Norristown, Pennsylvania.

Month	538320	538860	540450
9/83	3783.3	2000.0	735.8
10/83	2740.0	1496.9	905.7
12/83	-	1836.5	886.8
1/84	140.0	6018.9	352.2
2/84	427.5	1047.2	207.5
3/84	21.0	792.5	523.6
4/84	8.0	80.2	467.0
5/84	13.0	70.8	193.4
7/84	-	61.3	150.9
8/84	185.0	127.4	424.5
9/84	2420.0	5004.7	5886.8
10/84	5190.0	6707.5	25759.4
11/84	3620.0	11556.6	26320.8
12/84	852.0	15485.8	26292.5

Table 7.0-5. Corbicula shell size distribution observed at S38320.

Interval	9/83 No	9/83 No	10/83 No	12/83 No	1/84 No	2/84 No	3/84 No	4/84 No	5/84 No	7/84 No	8/84 No	9/84 No	10/84 No	11/84 No	12/84 No
3	-	-	-	-	-	-	-	-	-	-	2	-	7	2	3
4	-	-	-	-	-	-	-	-	-	-	15	43	99	102	44
5	-	2	3	-	-	-	-	-	-	-	45	174	274	134	120
6	-	4	4	-	3	-	-	-	-	-	1	165	332	155	173
7	-	3	3	-	-	2	-	-	-	-	-	86	321	161	124
8	-	3	1	-	-	-	-	-	-	-	-	93	254	168	96
9	-	2	-	-	-	-	-	1	-	-	-	89	184	127	76
10	-	3	-	-	1	1	-	-	-	-	2	139	127	93	50
11	-	-	3	-	-	-	-	-	-	-	2	134	157	89	38
12	-	8	1	-	-	1	-	-	-	-	-	23	187	138	42
13	-	29	7	-	1	7	-	-	-	-	2	2	99	169	64
14	-	52	7	-	-	11	-	-	-	-	2	5	13	73	17
15	-	158	20	-	4	6	2	-	-	-	2	4	1	5	3
16	-	247	56	-	3	14	-	-	-	-	-	4	4	2	-
17	-	249	119	-	11	32	7	-	-	-	-	2	7	9	1
18	-	172	213	-	27	35	1	1	3	-	-	-	4	6	-
19	-	100	200	-	29	37	6	-	3	-	-	-	1	2	1
20	-	50	111	-	13	10	2	4	2	-	-	-	-	1	-
21	-	26	34	-	5	8	2	1	2	-	-	-	-	1	-
22	-	16	21	-	4	5	-	-	-	-	-	-	-	-	-
23	-	10	12	-	2	1	1	1	3	-	-	-	-	-	-
24	-	1	6	-	1	1	-	-	-	-	-	-	-	-	-
25	-	-	1	-	1	-	-	-	-	-	-	1	1	1	-
26	-	-	-	-	-	-	-	-	-	-	1	-	-	2	-
27	-	-	-	-	-	-	-	-	-	-	-	3	2	6	-
28	-	-	-	-	-	-	-	-	-	-	-	1	2	2	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
31	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
		1135	822		105	171	21	8	13		74	968	2077	1448	852

Table 7.0-6. Corbicula shell size distribution observed at 538860.

Interval	9/83 No	9/83 No	10/83 No	12/83 No	1/84 No	2/84 No	3/84 No	4/84 No	5/84 No	7/84 No	8/84 No	9/84 No	10/84 No	11/84 No	12/84 No
3	-	-	-	-	-	-	-	-	-	-	-	204	60	29	175
4	-	-	-	-	-	-	1	-	-	-	-	224	293	303	276
5	-	-	6	-	-	-	-	-	-	-	20	424	448	581	1197
6	1	-	-	-	-	-	1	-	-	-	-	147	406	528	614
7	-	-	1	-	-	-	-	-	1	-	-	34	140	576	532
8	2	-	-	-	-	-	-	-	-	1	-	3	49	357	338
9	-	-	-	-	1	-	-	-	-	4	1	1	4	51	123
10	-	-	1	-	6	2	-	-	-	2	1	1	7	7	11
11	4	-	2	-	22	4	1	-	1	-	-	-	2	3	-
12	4	-	1	-	76	16	-	-	-	-	1	1	-	2	3
13	5	-	5	-	138	23	2	-	-	-	-	-	1	1	-
14	16	-	16	1	187	15	4	-	-	-	-	2	-	-	2
15	39	-	4	-	198	34	8	-	1	-	-	-	1	1	1
16	66	-	4	5	173	42	10	6	2	-	-	1	-	-	-
17	181	-	12	9	84	29	9	7	2	-	-	-	-	-	2
18	62	-	28	22	34	20	12	2	1	-	-	-	-	-	-
19	28	-	58	73	20	18	20	1	3	2	-	-	-	-	-
20	3	-	69	70	9	7	40	1	3	1	-	1	-	1	-
21	2	-	15	52	8	6	34	-	1	1	-	1	3	1	-
22	1	-	7	23	-	3	17	-	-	1	1	1	1	-	1
23	-	-	2	11	-	1	5	-	1	-	3	1	1	2	2
24	-	-	-	2	-	1	1	-	-	1	-	1	1	2	1
25	-	-	-	-	-	-	-	-	-	-	-	2	2	3	2
26	-	-	1	1	-	-	-	-	-	-	-	-	2	1	1
27	1	-	-	-	1	-	-	-	-	-	-	5	2	-	-
28	1	-	2	3	-	-	1	-	-	-	-	6	1	-	-
29	-	-	1	2	-	1	1	-	-	-	-	1	-	-	1
30	-	-	2	8	-	-	1	-	-	-	-	-	-	-	-
31	-	-	1	5	-	-	-	-	-	-	-	-	-	-	1
32	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-
35	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
	328		238	292	957	222	168	17	15	13	27	1061	1423	2450	3284

Table 7.0-7. Corbicula shell size distribution observed at S40450.

Interval	9/83 No	9/83 No	10/83 No	12/83 No	1/84 No	2/84 No	3/84 No	4/84 No	5/84 No	7/84 No	8/84 No	9/84 No	10/84 No	11/84 No	12/84 No
2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
3	1	-	28	48	-	-	-	-	-	-	-	149	136	10	-
4	8	-	8	22	-	-	1	-	-	-	-	299	645	104	151
5	28	-	16	15	6	8	1	-	-	-	54	666	1385	824	896
6	21	-	11	9	6	2	5	-	-	-	-	82	1538	990	1057
7	8	-	6	3	6	1	5	-	1	1	-	13	1027	1054	1267
8	12	-	5	6	2	7	6	3	-	-	1	10	511	1503	1269
9	14	-	4	15	6	3	6	6	2	-	-	2	185	877	718
10	7	-	12	11	7	7	16	15	6	3	-	-	13	161	168
11	5	-	12	5	8	5	18	20	7	-	2	1	5	24	15
12	2	-	12	-	4	3	21	19	8	2	-	-	1	6	7
13	-	-	7	1	4	-	10	11	5	-	4	1	-	1	3
14	2	-	3	-	2	2	2	6	3	3	-	2	-	-	-
15	4	-	-	3	2	-	3	2	5	3	-	1	1	1	1
16	1	-	2	1	-	-	-	-	1	5	1	1	3	2	1
17	1	-	2	1	-	-	3	1	-	5	2	-	3	8	2
18	-	-	3	-	-	-	4	5	-	4	2	-	-	1	1
19	1	-	3	-	-	1	3	1	-	-	7	-	-	1	3
20	-	-	2	-	-	1	1	2	-	-	5	5	1	2	-
21	1	-	4	-	-	2	2	1	1	-	1	5	-	-	1
22	-	-	2	-	1	-	1	2	1	2	2	2	1	2	1
23	-	-	-	-	-	-	2	1	-	1	2	1	1	2	1
24	-	-	-	-	-	2	-	2	-	1	-	2	1	-	3
25	-	-	-	-	-	-	-	1	-	2	1	2	-	4	-
26	-	-	-	-	-	-	-	-	-	-	3	-	1	2	5
27	-	-	-	-	-	-	1	-	1	-	2	1	1	3	1
28	1	-	-	-	-	-	-	1	-	-	1	3	1	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
31	-	-	-	1	1	-	-	-	-	-	-	-	-	1	-
32	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	117		144	141	56	44	111	99	41	32	90	1248	5462	5582	5573

Table 7.0-8. Summary of results of Corbicula age determination by shell sectioning (Ropes 1985).

<u>Clam</u>	<u>Shell Length(mm)</u>	<u>Number of Annuli</u>	<u>Year Spawned</u>	<u>Age at Collection¹</u>
1	14.0	2	1981	2
2	15.5	2	1981	2
3	15.2	2	1981	2
4	15.9	2	1981	2
5	21.2	3	1980	3
6	21.0	2	1981	2
7	22.9	3	1980	3
8	24.6	3	1980	3

¹Clams collected at S38320 on 19 September 1983

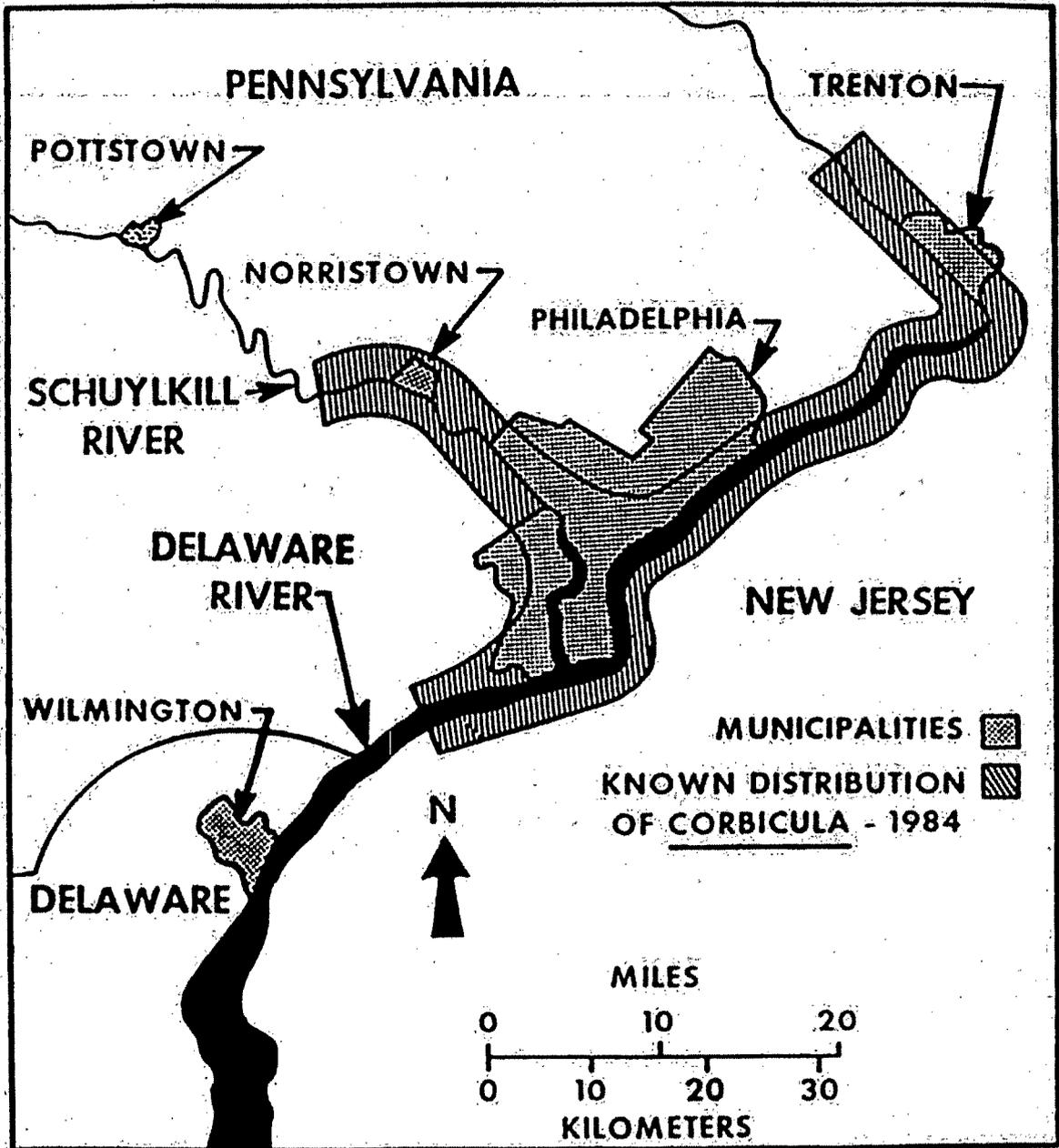


FIGURE 7.0-1 CORBICULA DISTRIBUTION IN THE DELAWARE AND SCHUYLKILL RIVERS AS OBSERVED IN 1984.

8.0 Cooling Tower Bird Mortality

Introduction

Section 8.0 Pages 8.0-1 through 8.0-3 in PROGRESS REPORT: Non-Radiological Environmental Monitoring for Limerick Generating Station 1979-1983 fully describes introductory, background, or material, methods and study area sections for a similar study conducted in 1984. Only additions to or changes from this information are discussed below.

Frequency and Duration of Study in 1984:

The cooling towers were searched daily during the work week from 5 March through 31 May (spring) and from 20 August through 21 November (fall).

Changes in Methods or Materials in 1984

Each bird collected was weighed to the nearest gram.

Results and Discussion

A total of eighteen birds of seven species was found during the 1984 spring and fall monitoring periods. Vireos accounted for the majority of the bird specimens collected (5 red eyed vireos, 4 solitary vireos, 1 white eyed vireo). No waterfowl and

no endangered or threatened species were collected. All collected specimens were donated to the Philadelphia Academy of Natural Sciences to satisfy the federal and state salvage permit.

The number of bird specimens found on (LGS) cooling towers in 1984 was substantially lower than past years' totals. Speculation was made that scavenging activity by common crows (Corvus brachyrhynchos) contributed to these low numbers. This was based on evidence of scant traces of feathers and remains of some unidentifiable specimens which were found. To confirm this theory a preliminary experiment was conducted in October 1984. Two previously collected specimens were placed on the concrete decking where most birds specimens have been found; within ten minutes two crows had approached the specimens and one proceeded to partially consume a specimen and then fly off with the carcass. The experiment was terminated at this point. No trace of the consumed bird could be found on the concrete decking.

Again, the small number of birds collected indicate that cooling tower bird mortality is not a significant factor when compared to the large number of birds which migrate through the area.

Table 8.0-1 Birds collected at Limerick Generating Station cooling towers from April 1984 through November 1984.

Date	Species	Weight
5/8/84	White Eyed Vireo	17 gms.
9/13/84	Red Eyed Vireo	20 gms.
	Red Eyed Vireo	20 gms.
	Northern Water Thrush	21 gms.
9/27/84	Solitary Vireo	19 gms.
	Solitary Vireo ¹	19 gms.
	Solitary Vireo	19 gms.
	Red Eyed Vireo ³	22 gms.
	Black Throated Green	16 gms.
10/1/84	Solitary Vireo	18 gms.
	Common Yellow Throat	12 gms.
	Blackburnian	11 gms.
	Unidentified ²	
10/3/84	Red Eyed Vireo	18 gms.
	Unidentified ²	
10/25/84	Red Eyed Vireo	19 gms.
	Unidentified ²	

¹Damaged - Disposed of 14 February 1985

²Unidentified (Scavenged by common crows)

³Specimen used in experiment, not retainable

Collected by Philadelphia Academy of Natural Sciences 14 February 1985

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Exelon Response

The NRC staff and representatives of Exelon Generation held a telephone conference on February 23, 2012, to discuss and clarify whether the staff was requesting only the excerpts that were provided at the Limerick License Renewal Environmental Audit from the referenced document, or the entire document. The staff clarified that only the excerpts provided at the Audit are requested.

The following excerpts, which were provided at the Limerick License Renewal Environmental Audit, from the referenced document are being provided:

- Cover Page
- Table of Contents
- Section 7.0, Asiatic Clam
- Section 8.0, Cooling Tower Bird Mortality
- Section 9.0, Literature Cited

PROGRESS REPORT

Non-Radiological Environmental Monitoring for Limerick Generating Station 1985

Prepared for

Philadelphia Electric Company

by

**RMC-Environmental Services
Pottstown, Pennsylvania**

SEPTEMBER 1986

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7.0 Asiatic Clam

Summary

1. Field surveys for the presence of Corbicula were conducted in late summer and early fall at 2-4 mile intervals in the Delaware River, Schuylkill River, and Perkiomen Creek.
2. Corbicula was found in the Delaware River from near the Commodore Barry Bridge (river mile 81.8) to Washington Crossing State Park (river mile 146.0), only 11 miles downriver of the Delaware River intake for the proposed water diversion, and in the Schuylkill River from its mouth (river mile 0) to Black Rock Dam (river mile 36), only 3 miles and 11 miles downriver of Cromby Generating Station and LGS, respectively.
3. Corbicula was not found in the Perkiomen Creek, nor was it observed in benthic macroinvertebrate samples collected in the East Branch Perkiomen Creek.

Introduction and Methods

Studies of Asiatic clam (Corbicula fluminea) conducted in 1982-84, including both qualitative survey of the species' distribution in the Delaware and Schuylkill Rivers and Perkiomen

Creek and quantitative sampling conducted in the Schuylkill River at Norristown, were considered part of non-radiological environmental monitoring at Limerick Generating Station (LGS) and reported as such (RMC-Environmental Services 1984 and 1985). However, only the 1985 qualitative survey will be described in this report. The Corbicula studies have expanded in response to increased concern for biofouling at several additional generating stations and now are not considered to be part of LGS non-radiological monitoring. Consequently, the results of these studies will appear in a separate report.

In short, field surveys were conducted in late summer and early fall at approximately 2-4 mile intervals on the Delaware River from the Commodore Barry Bridge (river mile 81.8) to Pt. Pleasant, Pennsylvania (river mile 157.2); on the Schuylkill River from its mouth (river mile 0) to LGS (river mile 48); and on the Perkiomen Creek from its mouth (river mile 0) to the Schwenksville Road bridge (river mile 12.0). At locations where water depth permitted, the stream or river bottom was visually scanned for Corbicula shells. Samples of stream or river bottom materials were collected and washed through a 3.2 mm mesh sieve and inspected for Corbicula at all stations.

Results and Discussion

The results of 1985 qualitative sampling for the presence of Corbicula in the Delaware and Schuylkill Rivers and Perkiomen Creek are shown in Tables 7.0-1, 2, and 3, respectively. For ease of comparison, data obtained in 1982, 1983, and 1984 also are included in these tables.

Attention is drawn to the misidentification of Burlington Generating Station as Croydon Generating Station on Table 7.0-1 in the previous reports (RMC-Environmental Services 1984 and 1985). This location is at Delaware River mile 117.0.

Sampling in 1985 indicated continued presence of Corbicula in the Delaware River (Table 7.0-1). Distribution of the population in the lower study reach from near the Commodore Barry Bridge (river mile 81.8) to the Tacony Palmyra Bridge (river mile 107.1) appeared to be spotty in that living clams were collected at only a few sample stations. This may be a reflection of less than optimal habitat conditions in this part of the river.

In the upper end of the Delaware River study reach, Corbicula was found to be present at Washington Crossing State Park at river mile 146.0 (Table 7.0-1). This represents a range extension of 4 miles since 1984, reducing the distance to the Delaware River intake for the proposed water diversion to approximately 11 miles.

In 1985, living Corbicula were collected at only 1 of 8 sample stations within the tidal reach (river miles 0-8) of the Schuylkill River (Table 7.0-2). As in the Delaware River, Corbicula distribution probably was restricted by less than favorable habitat conditions. With one exception, Corbicula was found to be present at all sample stations from Fairmount Dam (river mile 8) to Black Rock Dam (river mile 36). Collection of Corbicula at Black Rock Dam represents a 7 mile upriver extension of the species' range and places it approximately 3 miles from Cromby Generating Station and approximately 11 miles from LGS.

Corbicula was not collected at any sample station in the Perkiomen Creek (Table 7.0-3). However, it is noteworthy that the range of Corbicula in the Schuylkill River includes the Perkiomen Creek confluence. Therefore, the appearance of Corbicula in Perkiomen Creek probably will occur shortly.

The East Branch Perkiomen Creek was not part of the 1985 Corbicula qualitative survey program. However, the species was not collected at the 6 sample stations that are part of the benthic macroinvertebrate sampling program (see Section 4.2 Benthic Macroinvertebrates).

Table 7.0-1. Results of qualitative sampling for Corbicula in the Delaware River, 1982-1985.

<u>Location (River Mile)</u>	<u>Distance from Point Pleasant (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Point Pleasant Canoe Livery (157.2)	0	0	0	0	0
Lumberville Canal Park Footbridge (155.4)	1.8	0	0	0	0
PA Rt. 263 Bridge, town of Center Bridge (151.9)	5.3	0	0	0	0
PA Rt. 179 Bridge, New Hope (148.7)	8.5	0	0	0	0
Washington Crossing State Park (146.0)	11.2		0	0	+
100 yds above PA Rt. 532 Bridge (142.0)	15.2	0	0	+	+
0.75 mi above I-95 Bridge (139.7)	17.5	0	0	+	
Under I-95 Bridge (139.0)	18.2		+	+	
Yardley Boat Ramp (138.4)	18.8	0	+	+	+
1.5 mi below Yardley Boat Ramp (136.9)	20.3	0			
Below 3-island archipelago, above Trenton Avenue and Calhoun Street Bridge (134.0)	23.2	+			+

Table 7.0-1. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from Point Pleasant (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Below railroad bridge (mid-town Trenton) (133.0)	24.2	+		+	
Between buoys 105 and 106 (131.7)	25.5	0			
Biles Creek (131.2)	26.0	+			+
Buoy 97 (130.6)	26.6	+		+	
Buoy 92 (129.1)	28.1	+		+	
0.5 mi above Newbold Island (127.0)	30.2	+		+	
Southern tip of Newbold Island (124.9)	32.3	+		+	+
Florence Boat Ramp (122.6)	34.6	+			
Above I-276 Bridge (121.3)	35.9	+		+	
Burlington Island at Buoy 45 (118.9)	38.3	+			
Burlington Generating Station (117.0)	40.2	+		+	
1.5 mi below Neshaminy Creek (114.1)	43.1	+			
Mouth of Rancocas Creek (111.1)	46.1	+	+		+

Table 7.0-1. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from Point Pleasant (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
0.5 mi downstream of buoy 18 (109.3)	47.9		+	+	
0.5 mi downstream of buoy 15 (108.0)	49.2	0	+		
Under Tacony Palmyra Bridge (107.1)	50.1	0	+		0
Betsy Ross Bridge (104.8)	52.4	0	+	+	0
Richmond Generating Station (104.4)	52.8	0	0	0	
Northern tip of Petty Island (103.2)	54.0	0	0	+	0
Delaware Generating Station (101.1)	56.1		0	0	0
Benjamin Franklin Bridge (100.2)	57.0	0		+	0
Upstream of Walt Whitman Bridge (98.0)	59.2	0	0		
Southwark Generating Station (97.5)	59.7		0	0	0
Buoy 46A (95.0)	62.2	0			+
Mouth of Schuylkill River (92.5)	64.7	0	+	+	
Opposite Paulsboro, NJ (90.0)	67.2	0			

Table 7.0-1. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from Point Pleasant (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Northern tip of Tinicum Island (87.5)	69.7	0		+	+
Northern tip of Mond's Island (85.6)	71.6	0			
Eddystone Generating Station (84.3)	72.9		+	+	
Just north of Commodore Barry Bridge (81.3)	75.4	0			0

A "0" indicates that no clams were present.

A "+" indicates that clams were present.

A blank indicates that no sample was collected.

Table 7.0-2. Results of qualitative sampling for Corbicula in the Schuylkill River, 1982-1985.

<u>Location (River Mile)</u>	<u>Distance from LGS (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Limerick Generating Station (S48)	0	0	0	0	0
Vincent Dam (S45)	3.5	0		0	0
Main Street, Spring City (S42)	6.0	0		0	0
0.25 mi above Cromby Generating Station (CGS) (S40)	8.25		0	0	0
Adjacent to CGS (S40)	8.5		0	0	0
0.25 mi below CGS (S39)	8.75		0	0	0
Phoenixville Water Treatment Plant (S38)	9.25		0	0	0
Black Rock Road, Rt. 113, Phoenixville (S37)	10.0	0	0	0	0
Public Picnic Area opposite Fish Commission boat ramp (S37)	10.5		0	0	0
Black Rock Dam (S36)	11.25		0	0	+
Bridge Street, Rt. 29, Phoenixville (S35)	13.0	0			+
Pawlings Road, Phoenixville (S31)	17.0	0		0	0

Table 7.0-2. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from LGS (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
1.0 mi above Betzwood Bridge (S29)	19			+	
0.5 mi above Betzwood Bridge (S28.5)	19.5			+	+
Betzwood Bridge (S28)	20.0	0	0	+	
0.75 mi above Abrams Creek (S27)	21.5		+	+	
Abrams Creek (S26)	22.25		+	+	
Tip of Barbadoes Island (S26)	22.5		+	+	+
Intake to Barbadoes Generating Station (S25)	23.25		+	+	
Under Rt. 202 Bridge (S25)	23.5		+	+	+
Norristown Dam (S24)	24.0	+	+	+	+
I-276 Bridge, Swedesburg (S22)	26.0	+			+
Plymouth Dam, West Conshohocken (S20)	28.0	+			+
Near Montgomery County/Philadelphia County line (S17)	31.0	+			+
West of Green Lane Bridge (S14)	34.0	+			+

Table 7.0-2. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from LGS (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Pencoyd Bridge (S12)	36.0	+			+
Strawberry Bridge (S11)	37.0	+			+
Fairmount Dam (S8)	40	+	+		+
Under Park Drive Bridge (S8)	40.25		0	0	0
Under Market Street Bridge (S7)	40.75		0	+	+
Under South Street Bridge (S6)	41.5		0	0	0
Adjacent to Schuylkill Gen- erating Station (SGS) (S5)	42.0	0	+	+	0
0.25 mi below SGS (S5)	42.25	0	0	+	0
Under Passyunk Avenue Bridge (S3)	44.0	0	0		0
South of I-95 Bridge (S1)	47.0	0		0	0
Mouth of Schuylkill River (S0)	48.0	0	0	+	0

A "0" indicates that no clams were present.

A "+" indicates that clams were present.

A blank indicates that no sample was collected.

Table 7.0-3. Results of qualitative sampling for Corbicula in the Perkiomen Creek, 1983-1985.

<u>Location</u>	<u>Distance from Confluence w/ Schuylkill(mi)</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Below Wetherill's Dam	0.75	0	0	0
Egypt Road	1.5	0	0	0
Indian Road Dam	2.25	0	0	0
Yerkes Road Bridge	4.5	0	0	0
Collegeville Dam	6.5	0	0	0
Rahn's Bridge, Rt. 113	7.25	0	0	0
Graterford Road Bridge	9.25	0	0	0
Ott's Dam Bridge	10.5	0	0	0
Rt. 73 Bridge	11.25	0	0	0
Schwenksville Road Bridge	12.0	0	0	0

A "0" indicates that no clams were present.

A "+" indicates that clams were present.

A blank indicates that no sample was collected.

8.0 Cooling Tower Bird Mortality

Summary

1. Bird impaction at both LGS cooling towers was investigated during spring and fall migrations during 1985.
2. A total of 57 birds of 14 species was collected.
3. This total is considered insignificant when compared to the number that migrate through the area.

Introduction and Methods

The potential for migrating bird mortality due to impaction in the LGS cooling towers was identified early in the environmental impact review process. A fall survey of bird mortalities at a nearly completed cooling tower at Susquehanna Steam Electric Station produced a mortality count of 80 birds during a 2-month survey period.

A survey to document the extent of bird mortality, the time periods when most bird kills occur, and the bird species involved was initiated in spring 1981 and continued in subsequent years until the present. Regular, almost daily, checks of both cooling towers were made during the work week throughout the spring and fall migration periods.

Each inspection consisted of an early morning, usually between 0700-0900, search of the precast concrete deck which covers the fill structure of each cooling tower. Experience indicated that virtually all the birds which strike the LGS towers can be found on the concrete decking which overtops the fill structure.

Results and Discussion

A total of 57 birds of 14 species was found between 11 April and 29 October 1985. One of these specimens was not identifiable to species because of deteriorated condition (Table 8.0-1). Greatest apparent mortality occurred just prior to 7 October 1985. Seventeen dead birds were recovered on this day. Mortalities continue to be insignificant when compared to the large number of birds which migrate through the area.

Table 8.0-1. Birds collected at LGS cooling towers in 1985.

Common Name ¹	April		May	August		September						
	11	19	7	28	29	4	6	9	11	16	18	20
Golden-crowned kinglet												
Ruby-crowned kinglet	1											
Gray-cheeked thrush												
White-eyed vireo			1									
Solitary vireo		1										
Philadelphia vireo												
Red-eyed vireo				2	2		2	1	1	2	1	1
Chestnut-sided warbler				1								
Magnolia warbler												
Black-throated green warbler												
Blackburnian warbler				1								
Prairie warbler		1										
Bay-breasted warbler												
Common yellowthroat			1			1		1				
Unidentified specimen												

Common Name ¹	September			October						Totals	
	23	25	26	7	9	11	14	17	28		29
Golden-crowned kinglet								1		1	2
Ruby-crowned kinglet								2	1		4
Gray-cheeked thrush	1										1
White-eyed vireo											1
Solitary vireo			1	2			1			1	6
Philadelphia vireo				1							1
Red-eyed vireo	2	2		4	1	1		2			24
Chestnut-sided warbler											1
Magnolia warbler				4							4
Black-throated green warbler				2							2
Blackburnian warbler											1
Prairie warbler											1
Bay-breasted warbler				2							2
Common yellowthroat				2	1						6
Unidentified specimen								1			1

¹Common names are from the American Ornithologist Union Checklist of North American Birds, Sixth edition, 1983.

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E2-33: Enclosure 2: Terrestrial Ecology, item F

Exelon. 1986. Limerick Generating Station Non-radiological Environmental Report.

Exelon Response

The NRC staff and representatives of Exelon Generation held a telephone conference on February 23, 2012, to discuss and clarify whether the staff was requesting only the excerpts that were provided at the Limerick License Renewal Environmental Audit from the referenced document, or the entire document. The staff clarified that only the excerpts provided at the Audit are requested.

The following excerpts, which were provided at the Limerick License Renewal Environmental Audit, from the referenced document are being provided:

- Cover Page
- Table of Contents
- Section 7.0, Asiatic Clam
- Section 8.0, Cooling Tower Bird Mortality
- Section 9.0, Literature Cited

Robert W. Blye

PROGRESS REPORT

Non-Radiological Environmental Monitoring for Limerick Generating Station 1986

Prepared for

Philadelphia Electric Company

by

RMC 
ENVIRONMENTAL SERVICES
Pottstown, Pennsylvania

November 1987

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7.0 Asiatic Clam

Summary

1. Field surveys for the presence of Corbicula were conducted in the summer of 1986 at 2-4 mile intervals in the Delaware River, Schuylkill River, and Perkiomen Creek.
2. Corbicula did not extend its range of distribution in 1986. It was present in the Delaware River at Washington Crossing State Park (river mile 146.0), 11 miles from the intake for the proposed Point Pleasant Diversion, and in the Schuylkill River below Black Rock Dam (river mile 36.6), only 3 miles and 11 miles from Cromby Generating Station and LGS, respectively.
3. Corbicula was not collected in the Perkiomen Creek, nor was it observed in benthic macroinvertebrate samples collected in the East Branch Perkiomen Creek.

Introduction and Methods

A survey of the distribution of Asiatic clam (Corbicula fluminea) in the Delaware and Schuylkill Rivers and Perkiomen Creek was initially conducted in 1982 and has been repeated annually. The results have been used to assess the potential threat of this water-system-fouling species to PECO generating

stations, particularly LGS, and are reported in this document as well as in the previous volumes in this series (RMC Environmental Services 1984, 1985 and 1986).

Methods employed in the 1986 survey were the same as used previously. The study reaches consisted of the Delaware River from the Commodore Barry Bridge (river mile 81.8) to Point Pleasant, Pennsylvania (river mile 157.2); the Schuylkill River from its mouth (river mile 0) to LGS (river mile 48); and the Perkiomen Creek from its mouth (river mile 0) to the Schwenksville Road bridge (river mile 12.0). Stations established at 2-4 mile intervals in each stream were sampled for the presence of Corbicula. At locations where water depth permitted, the river or stream bottom was visually scanned for Corbicula shells. Samples of bottom substrate were collected at all stations, washed through a 3.2-mm mesh sieve, and inspected for Corbicula.

Results and Discussion

The sampling conducted in 1986 indicated continued presence of Corbicula in the Delaware River (Table 7.0-1). Specimens were collected at all sample stations from Washington Crossing State Park (river mile 146.0) to the Tacony Palmyra Bridge (river mile 107.1). Downriver of the Tacony Palmyra Bridge, Corbicula were collected at only one sample station, the Benjamin Franklin

Bridge (river mile 100.2). The presence of Corbicula at Washington Crossing State Park placed the species approximately 11 miles downstream of the Delaware River intake for the proposed Point Pleasant Diversion.

In 1986, Corbicula was present in the Schuylkill River at nearly all sample stations below Black Rock Dam (river mile 36.6) to the Strawberry Mansion Bridge (river mile 11.0) (Table 7.0-2). No specimens were collected in the tidal reach located downriver of Fairmount Dam (river mile 8.5). Collection of Corbicula below Black Rock Dam placed the species about 3 miles from Cromby Generating Station and 11 miles from LGS.

Corbicula was not collected at any sample station in the Perkiomen Creek despite the species' presence in the Schuylkill River near the Perkiomen Creek confluence (Table 7.0-3).

The East Branch Perkiomen Creek was not part of the 1986 Corbicula qualitative survey program. However, the species was not collected at the 6 sample stations that are part of the benthic macroinvertebrate sampling program (see Section 4.2 Benthic Macroinvertebrates).

No extension of the range of Corbicula distribution was observed in 1986, unlike the years 1983-1985. The reasons for the apparent lack of range extension are unclear. However, in the

case of the Schuylkill River, Black Rock Dam may act as a formidable barrier to further upriver dispersal.

It is noteworthy that massive Corbicula mortality was observed in June and July in the Schuylkill River. Population density was greatly reduced at several quantitative sample stations near Norristown. Although no mortality was directly observed in the Delaware River, an apparent reduction in population density indicated that the same phenomenon may have occurred there as well.

Table 7.0-1. Results of qualitative sampling for Corbicula in the Delaware River, 1982-1986.

<u>Location (River Mile)</u>	<u>Distance from Point Pleasant (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Point Pleasant Canoe Livery (157.2)	0	0	0	0	0	0
Lumberville Canal Park Footbridge (155.4)	1.8	0	0	0	0	0
PA Rt. 263 Bridge, town of Center Bridge (151.9)	5.3	0	0	0	0	0
PA Rt. 179 Bridge, New Hope (148.7)	8.5	0	0	0	0	0
Washington Crossing State Park (146.0)	11.2		0	0	+	+
100 yds. above PA Rt. 532 Bridge (142.0)	15.2	0	0	+	+	+
0.75 mi. above I-95 Bridge (139.7)	17.5	0	0	+		
Under I-95 Bridge (139.0)	18.2		+	+		
Yardley Boat Ramp (138.4)	18.8	0	+	+	+	+
1.5 mi. below Yardley Boat Ramp (136.9)	20.3	0				
Below 3-island archipelago, above Trenton Avenue and Calhoun Street Bridge (134.0)	23.2	+			+	+

Table 7.0-1. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from Point Pleasant (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Below railroad bridge (mid-town Trenton) (133.0)	24.2	+		+		
Between buoys 105 and 106 (131.7)	25.5	0				
Biles Creek (131.2)	26.0	+			+	+
Buoy 97 (130.6)	26.6	+		+		
Buoy 92 (129.1)	28.1	+		+		
0.5 mi. above Newbold Island (127.0)	30.2	+		+		
Southern tip of Newbold Island (124.9)	32.3	+		+	+	+
Florence Boat Ramp (122.6)	34.6	+				
Above I-276 Bridge (121.3)	35.9	+		+		
Burlington Island at Buoy 45 (118.9)	38.3	+				
Burlington Generating Station (117.0)	40.2	+		+		+
1.5 mi. below Neshaminy Creek (114.1)	43.1	+				
Mouth of Rancocas Creek (111.1)	46.1	+	+		+	+

Table 7.0-1. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from Point Pleasant (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
0.5 mi. downstream of buoy 18 (109.3)	47.9		+	+		
0.5 mi. downstream of buoy 15 (108.0)	49.2	0	+			
Under Tacony Palmyra Bridge (107.1)	50.1	0	+		0	+
Betsy Ross Bridge (104.8)	52.4	0	+	+	0	0
Richmond Generating Station (104.4)	52.8	0	0	0		0
Northern tip of Petty Island (103.2)	54.0	0	0	+	0	0
Delaware Generating Station (101.1)	56.1		0	0	0	0
Benjamin Franklin Bridge (100.2)	57.0	0		+	0	+
Upstream of Walt Whitman Bridge (98.0)	59.2	0	0			
Southwark Generating Station (97.5)	59.7		0	0	0	0
Buoy 46A (95.0)	62.2	0			+	0
Mouth of Schuylkill River (92.5)	64.7	0	+	+	0	0
Opposite Paulsboro, NJ (90.0)	67.2	0				0

Table 7.0-1. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from Point Pleasant (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Northern tip of Tinicum Island (87.5)	69.7	0		+	+	0
Northern tip of Mond's Island (85.6)	71.6	0				0
Eddystone Generating Station (84.3)	72.9		+	+		0
Just north of Commodore Barry Bridge (81.8)	75.4	0			0	0

A "0" indicates that no clams were present.
 A "+" indicates that clams were present.
 A blank indicates that no sample was collected.

Table 7.0-2. Results of qualitative sampling for Corbicula in the Schuylkill River, 1982-1986.

<u>Location (River Mile)</u>	<u>Distance from LGS (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Limerick Generating Station (48.0)	0	0	0	0	0	0
Vincent Dam (44.7)	3.3	0		0	0	0
Main Street, Spring City (42.1)	5.9	0		0	0	0
0.25 mi. above Cromby Generating Station (CGS) (40.3)	7.7		0	0	0	0
Adjacent to CGS (40.0)	8.0		0	0	0	0
0.25 mi. below CGS (39.8)	8.2		0	0	0	0
Phoenixville Water Treatment Plant (38.2)	9.8		0	0	0	0
Black Rock Road, PA Rt. 113, Phoenixville (38.0)	10.0	0	0	0	0	0
Public Picnic Area opposite Fish Commission boat ramp (37.8)	10.2		0	0	0	0
Black Rock Dam (36.6)	11.4		0	0	+	+
Bridge Street, PA Rt. 29, Phoenixville (35.6)	12.4	0			+	+
Pawlings Road, Phoenixville (31.0)	17.0	0		0	0	+

Table 7.0-2. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from LGS (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
1.0 mi. above Betzwood Bridge (29.3)	18.7			+		
0.5 mi. above Betzwood Bridge (28.8)	19.2			+	+	+
Betzwood Bridge (28.3)	19.7	0	0	+		
0.75 mi. above Abrams Creek (26.5)	21.5		+	+		
Abrams Creek (25.7)	22.3		+	+		
Tip of Barbadoes Island (25.2)	22.8		+	+	+	+
Intake to Barbadoes Generating Station (24.6)	23.4		+	+		
Under U.S. Rt. 202 Bridge (24.3)	23.7		+	+	+	+
Norristown Dam (24.0)	24.0	+	+	+	+	+
I-276 Bridge, Swedesburg (22.5)	25.5	+			+	+
Plymouth Dam, West Conshohocken (20.7)	28.0	+			+	+
Near Montgomery County/Philadelphia County line (17.0)	31.0	+			+	+
West of Green Lane Bridge (14.0)	34.0	+			+	+

Table 7.0-2. (Cont.)

<u>Location (River Mile)</u>	<u>Distance from LGS (miles)</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Pencoyd Bridge (12.6)	35.4	+			+	0
Strawberry Bridge (11.0)	37.0	+			+	+
Fairmount Dam (8.5)	39.5	+	+		+	0
Under Park Drive Bridge (8.2)	39.8		0	0	0	
Under Market Street Bridge (7.5)	40.5		0	+	+	
Under South Street Bridge (6.8)	41.2		0	0	0	
Adjacent to Schuylkill Gen- erating Station (SGS) (6.5)	41.5	0	+	+	0	0
0.25 mi. below SGS (6.3)	41.7	0	0	+	0	0
Under Passyunk Avenue Bridge (3.6)	44.4	0	0		0	
South of I-95 Bridge (0.5)	47.5	0		0	0	
Mouth of Schuylkill River (0)	48.0	0	+	+	0	0

A "0" indicates that no clams were present.
A "+" indicates that clams were present.
A blank indicates that no sample was collected.

Table 7.0-3. Results of qualitative sampling for Corbicula in the Perkiomen Creek, 1983-1986.

<u>Location (River mile)</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Below Wetherill's Dam (0.8)	0	0	0	0
Egypt Road (1.5)	0	0	0	0
Indian Road Dam (2.3)	0	0	0	0
Yerkes Road Bridge (4.5)	0	0	0	0
Collegeville Dam (6.5)	0	0	0	0
Rahn's Bridge, PA Rt. 113 (7.3)	0	0	0	0
Graterford Road Bridge (9.3)	0	0	0	0
Ott's Dam Bridge (10.5)	0	0	0	0
PA Rt. 73 Bridge (11.3)	0	0	0	0
Schwenksville Road Bridge (12.0)	0	0	0	0

A "0" indicates that no clams were present.
 A "+" indicates that clams were present.
 A blank indicates that no sample was collected.

8.0 Cooling Tower Bird Mortality

Summary

1. Bird impaction at both LGS cooling towers was investigated during spring and fall migrations in 1986.
2. A total of 83 birds of 18 species was collected in 1986.
3. Magnitude of bird mortality is insignificant when compared to the total number of birds that migrate through the area.

Introduction and Methods

The potential for migrating bird mortality due to impaction in the LGS cooling towers was identified early in the environmental impact review process. A fall survey of bird mortalities at the nearly completed cooling tower of Susquehanna Steam Electric Station produced a mortality count of 80 birds during a 2-month survey period.

A survey initiated in 1981, and continuing presently, has documented the extent of bird mortality, the bird species involved, and the time periods when most bird kills occur at LGS. In 1986, daily checks of both cooling towers at LGS were made during the work week throughout the spring and fall migration periods.

Results and Discussion

A total of 83 birds of 18 species was found between 31 March and 17 October 1986. One of these specimens was not identifiable because of deteriorated condition (Table 8.0-1). The highest daily totals were 15 specimens collected on 15 September and 23 specimens collected 6 October 1986. The highest monthly total was 51 specimens collected in October. Mortalities continue to be insignificant when compared to the large number of birds which migrate through the area.

Table 8.0-1. Birds collected at LGS cooling towers in 1986.

Common Name ¹	March	April	May			August	September			
	31	22	2	7	29	25	2	8	15	16
Yellow-bellied sapsucker										
Yellow-bellied flycatcher										1
Swainson's thrush										
White-eyed vireo				1						1
Solitary vireo										
Philadelphia vireo					1				1	
Red-eyed vireo				1		1		1		9
Tennessee warbler										
Chestnut-sided warbler										1
Magnolia warbler										2
Black-throated blue warbler										
Black-throated green warbler										1
Blackburnian warbler								1		
Bay-breasted warbler							1			1
American redstart							1			
Ovenbird										
Common yellowthroat										
Field sparrow	1									
Unidentified					1					

Common Name ¹	September		October							Total	
	29	30	2	3	6	7	8	10	17		
Yellow-bellied sapsucker					1						1
Yellow-bellied flycatcher											1
Swainson's thrush							1				1
White-eyed vireo				1							4
Solitary vireo					11	2	2		3		18
Philadelphia vireo											2
Red-eyed vireo	2	1		3	1	8	8			1	36
Tennessee warbler								1			1
Chestnut-sided warbler								1			2
Magnolia warbler						1					3
Black-throated blue warbler						1					1
Black-throated green warbler											1
Blackburnian warbler											1
Bay-breasted warbler											2
American redstart											1
Ovenbird											1
Common yellowthroat		1					1	1			3
Field sparrow											1
Unidentified											1

¹Common names are from the American Ornithologist Union Checklist of North American Birds, Sixth edition, 1983.

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Exelon Response

The requested document is provided.

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Limerick Generating Station

WILDLIFE MANAGEMENT PLAN

2010

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What is a Wildlife Management Plan (WMP)?

A Wildlife Management Plan (WMP) is a comprehensive strategy which outlines goals of the wildlife habitat program, describes projects to achieve these goals, makes provisions for monitoring projects, and presents implementation and evaluation schedules.

A WMP serves as a tool for you to use at the facility. It provides direction and detailed information to guide you through the development of your program and each component is important in its own way. For example, knowledge of the background of the facility, such as historical use and ecological description, aids in knowing which native plants are best to select for plantings. This way the Wildlife Team can chose restoration efforts that will most likely provide benefits to wildlife.

Keep in mind that a WMP should be a working document; it is intended to be modified as goals change due to facility conditions and in response to the implementation of your projects. The WMP should be written so that if a new member joins the Wildlife Team, they would be able to quickly understand the program.

WMP Glossary

Program – The *Wildlife at Work* program, encompassing all *projects*.

Mission – The mission is the overarching aim of a *Wildlife at Work Program*.

Project – A project is a discrete wildlife enhancement venture, meeting the **four essential habitat components** for target wildlife and having one or more *objectives*.

Objective – An objective is a broad action that must be achieved to accomplish a *project*. Usually an objective will have multiple *prescriptions*.

Prescription – Prescriptions are the specific management activities that must be completed to accomplish an objective. They are narrower than *objectives* and should be SMART: Specific, Measurable, Achievable, Relevant, and Time-bound.

Four essential habitat components – *Food, water, cover* and *space* are four elements essential to all wildlife. Every *project* must address how these components are being met for the target wildlife.

Food - Foliage, nectar, pollen, berries, seeds and nuts from native forbs, shrubs and trees. Native plants must be used to qualify for certification. A variety of native plants should be planted, monocultures are not recommended.

Water - Water is needed by wildlife for drinking, bathing, and reproduction. A source of water must be provided by the project, or be located sufficiently close depending on the species of wildlife using the habitat. Artificial water sources can include sediment ponds, rain gardens, and bird baths. Naturally occurring water sources can include streams, ponds, rivers, springs, and wetlands. Native plants can also be a source of water as plant tissue stores water and the water is released when the plant is digested by wildlife. This can be an important source of water for some wildlife in arid environments.

Cover – Wildlife need places to hide, rest, sleep, and take cover from environmental stress (sun, rain, wind, etc). Cover is species specific, birds and small mammals take cover in bushes and thickets, snags and brush piles. Aquatic organisms can take cover in under water rock piles. Native grass can provide cover to insects, mammals, birds and other wildlife. Artificial cover consists of brush piles, bat boxes, and bird houses.

Space – Wildlife need space that can encompass the entire life-cycle of the organism; from a tadpole to a frog or a caterpillar to a butterfly. The type and size of space depends on the species of wildlife. Providing a safe and appropriate place for wildlife to reproduce, raise young, and mature is essential to habitat. Examples of space are: wildflower meadow, mature forest, forest with vernal pools, and wetland.

Native Species - Native species have evolved complex relationships with other species in the same area, including plants, bacteria, mammals, birds, reptiles and amphibians. The members of the biological community have been evolving together, a process known as co-evolution, for

thousands of years. Native plants are adapted to specific geographic areas depending on environmental variables such as soil type, climate, rainfall, pollinators, and seed dispersers.

Non-native Species - Non – native species (also called exotic species) are those that evolved in a different geographic location and/or environment. These species have developed complex relationships in their native range, but behave differently, sometimes invasively, when growing outside their natural range.

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SUMMARY

Exelon's Limerick Generating Station is located in Pottstown, Pennsylvania. A large portion of Limerick Generating Station's 650 acres are undeveloped areas not used for plant operations. These areas are used as a buffer region for the station from the local residents and businesses. This unused property has become essential for countless species of animals in the area, particularly migratory birds, due to the increased development surrounding the Pottstown area. The ISO 14001 certified, operating facility for Exelon's Limerick Generating Station takes up the remaining portion of the property. The operating facilities consist of open grassland areas, forested buffers, a waterway, buildings and parking lots.

The Limerick Generating Station's Environmental Stewardship Committee has been working diligently on site and with the local community in order to increase awareness of the importance of habitat for wildlife. The Environmental Stewardship Committee has been working for the last three years to establish a safe place for birds, bats, and raptors.

Environmental Stewardship is prevalent at the station and examples include:

- Weekly Environmental Stewardship article in Inside LGS Newsletter.
- Weekly Environmental Stewardship message at the Directors' meeting.
- Weekly Environmental Stewardship message at the First Line Supervisors' meeting.
- Mandatory Environmental Stewardship Training for all Exelon Employees (see Appendix Q).
- Training for all site personnel (including contractors) once per year on the following:
 - Exelon's Commitment to the Environment
 - Exelon's Environment Policy (EN-AC-1)
 - Exelon's Environment Policy Implementation
 - Potential Regulatory Impacts
 - Benefits of Environmental Programs
 - Environmental Performance and You
 - Chemicals/Controlled Materials
- Procedure has been created that lists all environmental training and who is requires for each training topic to ensure the work force is being properly trained.
- Pre-Job Briefing sheets for work in the field have environmental risk and spill prevention listed.
- Pre work week certification meeting discusses environmental risk and ensure appropriate measures are in place or the job will not proceed.
- All work as it is being planned is reviwed for environmental impact; any identified potential impacts are reviewed by site Environmental who has the authority to stop any job. Procedures for this process were also created.
- A map of the risk locations for spills located at LGS has been given to the site population along with the required protective measures required at each location.
- Posters for environmental stewardship and ISO 14001 compliance are located throughout the sire.
- Water sampling and analysis at the station is more stringent than is required by the NPDES Permit and NRC Regulations.

1. Background

Exelon Corporation has been a member of the Wildlife Habitat Council (WHC) since 2005, a standing that exemplifies its commitment to improving wildlife habitat through the enrichment of pre-existing habitat and the establishment of new habitat on the company's landholdings. Induction into the *Wildlife at Work* program will enable the Limerick Generating Station to get assistance from the Wildlife Habitat Council in its efforts to improve the facility's wildlife habitat. Furthermore, partnership with WHC provides Exelon with an opportunity to demonstrate responsible corporate environmental stewardship by formulating and implementing a balanced and operative wildlife management program.

1.1. Corporate Environmental Stewardship

Exelon's Environment Strategy and stewardship goals have been successful in helping us to improve our environmental performance in many areas. The Exelon Environment Strategy is based on a hierarchy of four fundamental areas of performance:

- Compliance
- Risk management
- Resource stewardship
- Leadership

Compliance

The foundation for Exelon's environmental strategy is being in compliance with environmental laws, regulations and our voluntary commitments 100 percent of the time. Our regulators, our investors, our customers, and the people who live in the communities where we operate expect us to be meeting the law. We expect no less of ourselves.

In order to ensure that we are 100 percent complaint, it is each employee's responsibility to know the applicable requirements and to comply with them. To help us achieve this outcome, Exelon has developed an Environmental Management System (EMS) that conforms to ISO Standard for environmental management (ISO 14001:2004). Limerick Generating Station has been ISO 14001 certified since 2005. The benefits of this program have been realized through improved compliance performance and increased environmental awareness at the station. Elements of Limerick's EMS that have served to improve our environmental performance include training for employees and contractors, expanded communications on environmental issues, improved procedures to help employees perform their job, and increased awareness of our surrounding environment at Limerick Generating Station.

Risk Management

Exelon's historical operations created some legacy environmental risks that occurred prior to modern environmental regulations. While no such historic environmental issues exists on site at Limerick Generating Station, we take action to prevent and minimize the risks that may arise from of our current operations. Through training, adhering to established procedures and by conducting ongoing reviews of potential environmental risks, Exelon Limerick employees and contractors can prevent future environmental risks from occurring.

Resource Stewardship

Exelon relies on natural resources to operate its business and there are costs related to the use of these resources such as fuel procurement, air emissions credit and offset purchases; water use fees; land purchases/leases; and operating costs for our facilities and office buildings. Material and equipment purchases create waste streams – both conventional and hazardous – that also have disposal costs. By implementing more efficient processes and reusing/recycling materials, operating costs can be reduced and natural resources conserved.

At Limerick Generating Station as part of project HERE (Help the Environment by Recycling at Exelon) we recycle office wastes including paper, cardboard, printer-ink cartridges, and plastic, glass and aluminum cans and bottles. Industrial recycling includes light bulbs, batteries, used oil and scrap metal.

Leadership

Exelon leadership focuses on significant environmental issues including climate change, renewable energy, energy management and the future of nuclear power.

Over the past several years, Exelon's senior management has been actively involved with the development of national policy initiatives and legislation concerning global warming and greenhouse gas reduction. Exelon's commitment to addressing climate change has served as an umbrella program for a number of related environmental initiatives undertaken at Limerick Generating Station, including improving energy efficiency, increasing recycling and reducing waste and increasing the use of renewable transportation fuels and/or alternative fueled vehicles.

Environmental leadership for Exelon begins and ends with each employee, from complying with all applicable environmental requirements, to taking steps to be more energy efficient, to working with members of Congress to establish effective policies on energy and the environment. Exelon is committed to delivering superior value to our customers, investors, employees and the communities we serve, through pursuit of our goal to capitalize on environmental leadership.

1.2. Facility Description

Limerick Generating Station is a nuclear power plant located in southeastern Pennsylvania, about 20 miles northwest of Philadelphia in Montgomery County. Limerick is built on a 650-acre site and draws its cooling water from the Schuylkill River. Units 1 and 2 began commercial operation in February 1986 and January 1990, respectively.

FIGURE 1: LIMERICK GENERATING STATION



Photo by Limerick Generating Station

The facility has two General Electric boiling water reactor (BWR) units, cooled by natural draft cooling towers with water from the Schuylkill River. Together both units can produce enough carbon-free electricity to power more than 2 million average American homes.

The site was chosen and plans to build the station were announced in 1969, by the Philadelphia Electric Company (now Exelon). Limerick Unit 1 first attained criticality (began producing nuclear power, at limited capacity) on December 22, 1984 and was certified for commercial operation on February 1, 1986. Limerick Unit 2 attained criticality on August 1, 1989, and commercial operation began on January 8, 1990.

The site is located in gently rolling countryside, traversed by numerous valleys containing small streams which empty into the Schuylkill River. On the eastern bank of the Schuylkill River the terrain rises from just under el 110' MSL (mean sea level) at the river, to approximately el 300' MSL toward the east, which is the highest ground on the site boundary. Two parallel streams, Possum Hollow Run and Brooke Evans Creek, cut through the site in wooded valleys, running southwest into the Schuylkill River. The grade in the area of the reactor and turbine enclosures is about el 217 feet MSL. On the western bank of the river, the terrain is relatively flat, rising only about 50 feet from the shore to the western edge of the site. One small stream flows southeastward through the site to the Schuylkill River.

FIGURE 2: LIMERICK GENERATING STATION PROPERTY BOUNDARIES



Photo by Normandeau

Five years ago, Limerick Generating Station partnered with the Schuylkill River Heritage Area to establish the Schuylkill River Restoration Fund, a 501c3 non profit that funds on-the-ground projects that improve the water resources of the Schuylkill River. Through this partnership, Exelon has contributed over \$1,000,000 to the Restoration Fund and has started to match those funds with pledges from other local corporations and businesses.

The Limerick Energy Information Center is located on the site property. The information center, owned and operated by Exelon, is open to the public during specified hours. A nuclear training center consisting of a simulator, laboratories and classrooms is also located on site.

Limerick Generating Station is owned wholly by Exelon Corporation, the nation's largest owner and operator of nuclear power stations. Exelon's ten stations and 17 reactors represent more than 20 percent of the U.S. nuclear industry's power capacity. The nuclear power facility employs approximately 900 people through operations at the generating station.

LGS draws water from the Schuylkill River, Perkiomen Creek, and Delaware River. The Schuylkill River is the onsite makeup water source, but only has the capability to supply the plant for about six months of the year. LGS is restricted from using water from the Schuylkill River when the temperature is above 59°F or the flow is below 560cfs. During restricted operation, all makeup water is drawn from the Delaware River (approximately 40 miles away) by means of the Water Diversion System. The Water Diversion System is currently in Demonstration Phase as approved by the Delaware River Basin Commission (DRBC).

FIGURE 3: DELAWARE RIVER BASIN RESERVOIRS

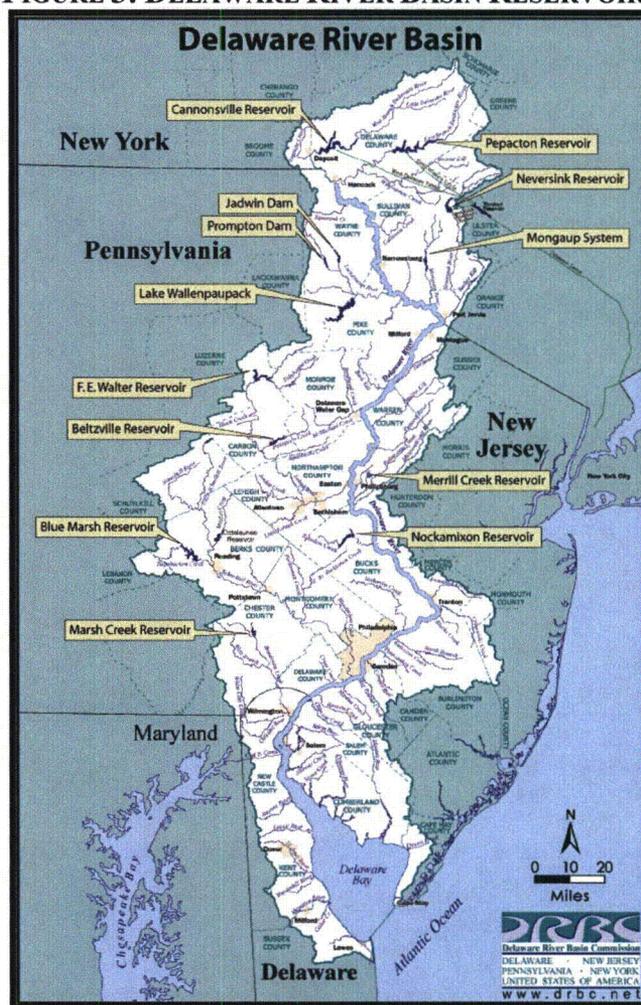


Photo by DRBC

The Water Diversion System is shown below. Point Pleasant Pump Station draws water from the Delaware River and supplies it to the Bradshaw Reservoir, which is then pumped to Water

Processing Facility and then discharged into the east branch of Perkiomen Creek. The Perkiomen pump house then pumps it 8 miles to LGS.

FIGURE 4: WATER DIVERSION

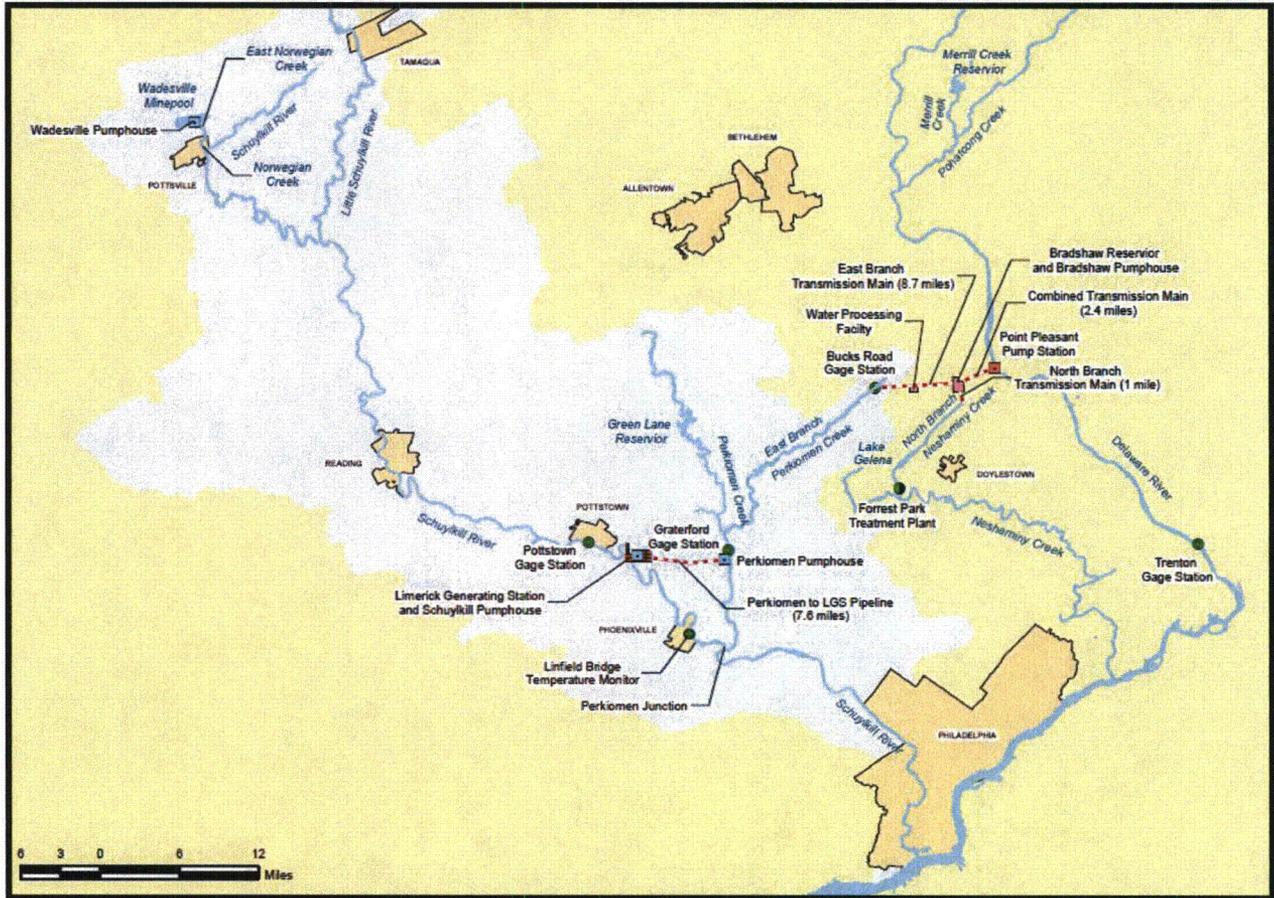


Photo by Limerick Generating Station

Limerick's property also includes Frick's Lock. Frick's Lock is an abandoned village, along the also abandoned Schuylkill Canal, in the northeast portion of East Coventry Township, Chester County. This 18th century village outlasted the canal, being abandoned in the late 20th century with the construction of the adjacent LGS Plant. Frick's Locks is considered a modern ghost town, and although private property, attracts visitors. While some buildings date from the Revolutionary War era, the village name was a result of the "Schuylkill Navigation" canal. The canal required construction of a set of locks in the early 1820s at that point along the Schuylkill River. Locks #54 and #55 were built on farm land acquired from John Frick and the village became known as Frick's Locks. The village thrived due to the economic stimulus of the canal. Eventually the commercial canal traffic declined toward the turn of the century and gave way to the railroad. Frick's Locks had become the singular Frick's Lock before the Pennsylvania Rail Road arrived and built a station with the latter name. The canal was filled-in starting in 1947. While the railroad eventually declined, the village remained inhabited until near the end of the 20th century.

Like the canal system that put it on the map, Frick's Lock is history. Today it is a completely deserted Chester County village of ten abandoned buildings, some dating from the 1700s, some more recent. Although it's within striking distance of highly populated areas, it will never be developed or lived in again, because it's in the shadow of the Limerick power plant. Some of the buildings are clearly from the Revolutionary war era, others are more modern. In its heyday, Frick's Lock was a thriving commercial boat town, a major economic factor in the 1800s. Canals were the best way to transport materials back then, so when the Schuylkill Navigation Company routed a sixty-mile long canal through the area in the 1820s, Frick's Lock really took off. The lock was closed down in 1890 when the canal company went bankrupt. The canals were drained in 1930 and by the late 1900s the village had declined so much that no opposition was put forth and the Limerick power plant was built in it's backyard. The village has been deserted ever since. See Appendix P for pictures of Frick's Lock.

FIGURE 5: FRICK'S LOCK

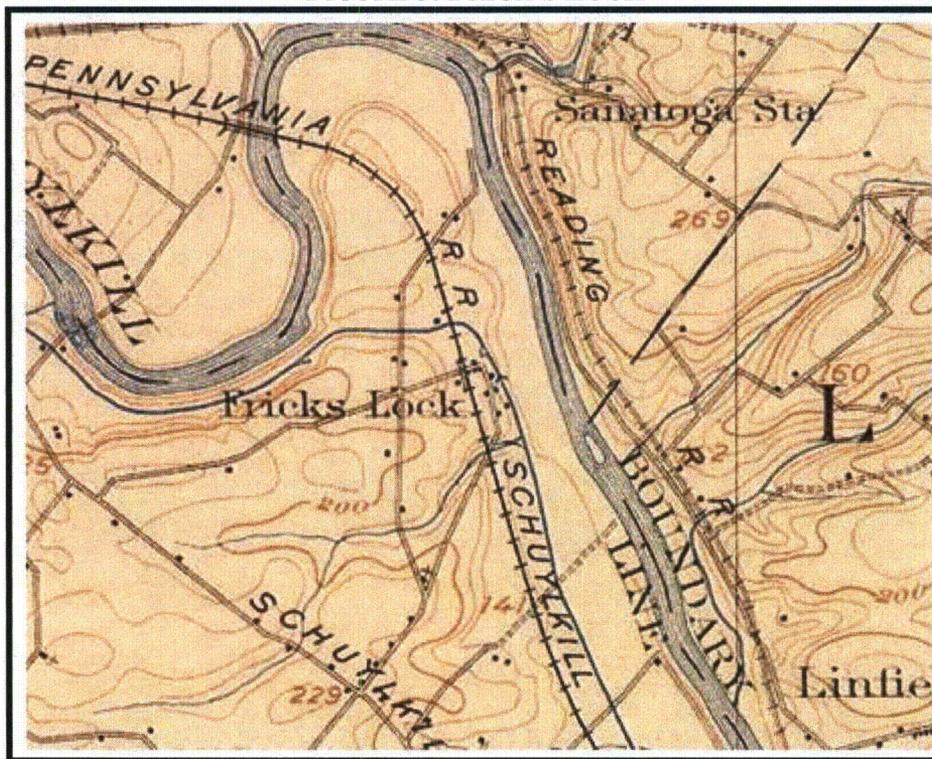


Photo by Limerick Generating Station

How Limerick (a boiling water reactor) produces electricity: In a typical commercial boiling water reactor (1) the reactor core creates heat, (2) a steam-water mixture is produced when very pure water (reactor coolant) moves upward through the core absorbing heat, (3) the steam-water mixture leaves the top of the core and enters the two stages of moisture separation where water droplets are removed before the steam is allowed to enter the steam line, (4) the steam line directs the steam to the main turbine causing it to turn the turbine generator, which produces electricity. The unused steam is exhausted to the condenser where it is condensed into water. The resulting water is pumped out of the condenser with a series of pumps, reheated, and pumped back to the reactor vessel. The reactor's core contains fuel assemblies which are cooled by water, which is force-circulated by electrically powered pumps.

Emergency cooling water is supplied by other pumps which can be powered by onsite diesel generators. Other safety systems, such as the containment cooling system, also need electric power.

FIGURE 6: BWR OPERATION CYCLE

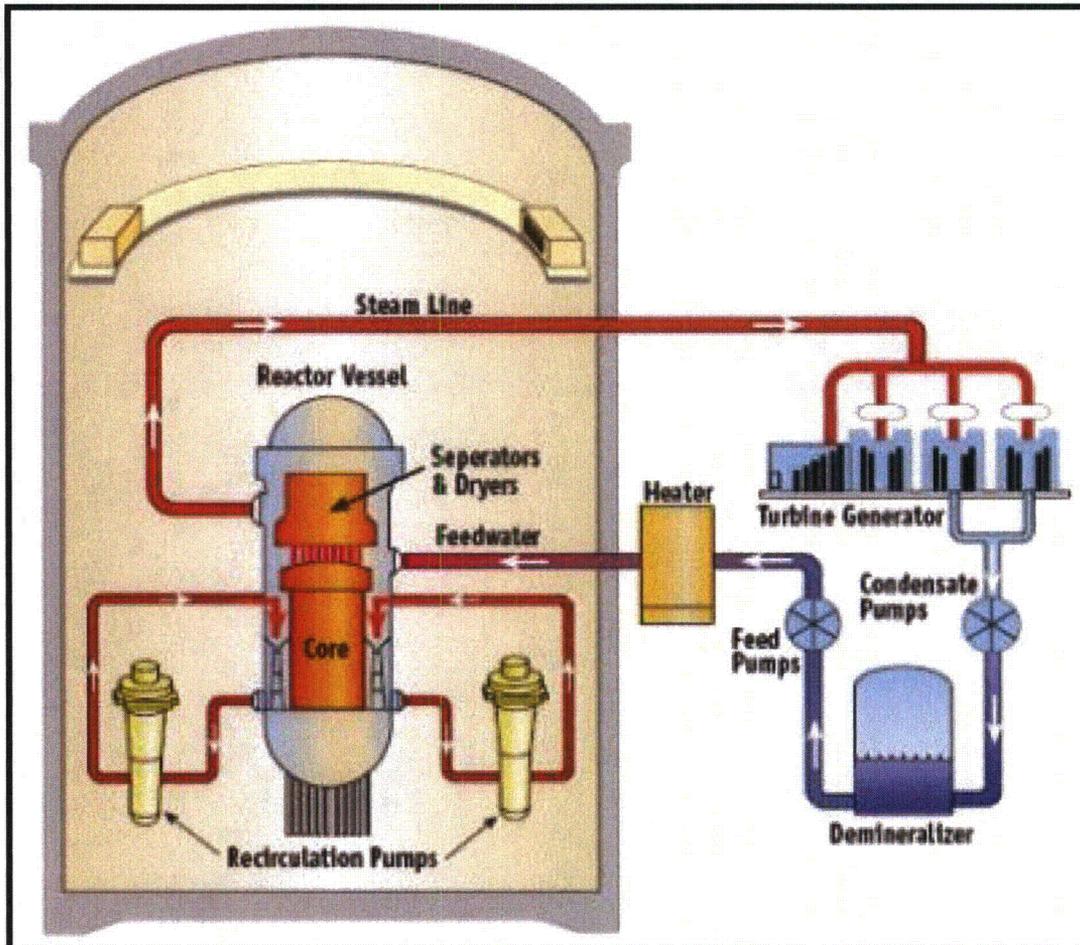


Photo by US NRC

Geology

The site is situated in the Triassic Lowland section of the Piedmont Physiographic Province. This section is characterized by a gently rolling land surface formed on an eroded low plateau. The rocks in the region surrounding the site include Precambrian and Lower Paleozoic crystalline rocks and folded sedimentary strata, and essentially unfolded Triassic sedimentary rocks and igneous intrusions. The Triassic rocks belong to the Newark Group which is divided into the basal Stockton Formation and the Brunswick, Lockatong, and Hammer Creek Lithofacies. Bedrock at the site underlies a thin cover of residual soil. The Brunswick red siltstone, sandstone, and shale are the predominant bedrock formation. Gray shale and argillite of the Lockatong Lithofacies, light gray sandstones and conglomerates of the Hammer Creek Lithofacies, and intruded diabase and associated hornfels are also found in the area. The strata exhibit gentle homoclinal dips to the north and northwest. The thickness of the Newark Group overlying the Paleozoic and Precambrian basement rocks at the site is on the order of 8000 feet. The dominant structural feature of the region is the Regional Appalachian Orogenic Belt. This belt is marked

by the northeast-southwest orientation of the axes and lineation of most of the structural features and stratigraphic contacts.

FIGURE 7: LIMERICK GENERATING STATION'S PROPERTY LINE

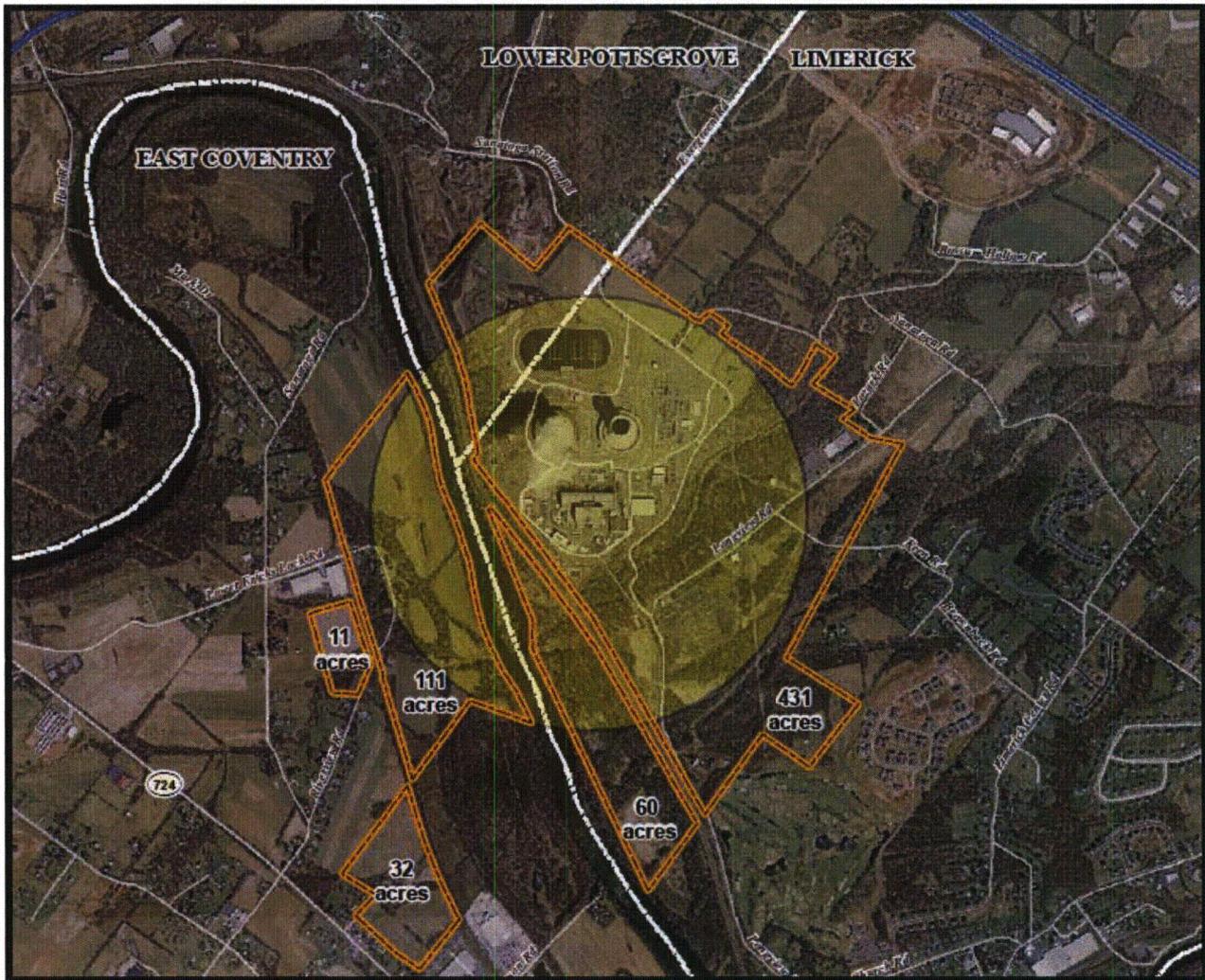


Photo provided by Limerick Generating Station

Seismology

The seismicity of the site was evaluated on the basis of historical earthquakes, damage resulting from these shocks, and the regional and local geologic structure. The site lies in a region that has experienced a moderate amount of earthquake activity. Most of the reported earthquakes have occurred in the Piedmont province. Some minor shocks have occurred in a northeast-southwest trend along the Fall Zone, the physiographic boundary between the Piedmont and the Coastal Plain to the southeast. Some scattered activity has occurred in the Coastal Plain. No recent faulting has been mapped in the area of the site. Based on the seismic history and the geologic structure of the region, no significant earthquake ground motion is expected at the site during the life of the proposed facility.

Hydrology

In the site area, Triassic-age siltstone, sandstone, and shale are found at shallow depths beneath a thin cover of residual soils. The residual soils are relatively impermeable. Most groundwater in the area is found in joints, fractures, and other secondary openings in the rock. The groundwater table is found at relatively shallow depths, except in the vicinity of pumping wells. Because of the limited quantities of available groundwater, surface water is the primary source of supply in the region. Groundwater accounts for only about 3% of the total industrial and commercial use in the region. However, numerous domestic wells extract small quantities of water from the Triassic strata. A number of wells are located in the general site area. However, the geologic, hydrologic, and topographic conditions are such that the possibility of any adverse effect on these wells by operation of LGS is extremely remote. The flows of the Schuylkill vary widely at different points along the river. This is mainly due to the varying topography and climatological and geohydrologic conditions along its course. The probable maximum flood peak and stage at the plant site are estimated to be 500,000 cfs and el 174' (MSL), respectively.

Meteorology

The general climate of the site is best described as humid continental. The region is dominated by continental air masses in winter, and by alternating continental and maritime tropical air masses in the summer. The site is near the track of most eastwardly moving low pressure systems that are brought from the interior of the U.S. by the prevailing westerlies. Annual average wind speeds in the region are between 9 and 10 mph and temperatures rarely exceed 100 degrees F or drop below 0 degrees F. The region receives a moderate amount of precipitation which is well distributed over the year. Five years of meteorological data collected on the site have verified that the general regional conditions do exist at the site and that no unusual meteorological conditions prevail.

1.2.1. Wildlife Team

LGS has an Environmental Stewardship Committee that meets Monthly as a main group and during other times of the month as a sub group. The Committee is completely volunteer and has increased in size since its inception. The current member list includes:

Department	Representative
Chemistry / Environmental	Leanne Birkmire / Chris Conroy / Chris Cooney
Maintenance	Ed Kriner / Thomas Rohlring
Operations	Craig Markle / Mark Arnosky
Engineering	Jeremy Thoryk / Maricarmen Trexler
Security	Jim Lotz / Ryan Maher
Regulatory Assurance	Lisa MacDonald
Work Control	David Rietscha
Training	Dean Vining
Radiation Protection	Lamar Weikel / Tony Davis
Communications	Joe Szafran
NOS	Darrell Speirs

The objectives of the Committee include Wildlife at Work and other Environmental Support Functions. The objectives are as follows:

- Review and approve status of open items.
- Manage per Tier 3 list (Station Environmental Equipment) as appropriate.
- Review environmental Issue Reports and challenge effectiveness of corrective actions from events.
- Review site environmental performance, implement lessons learned.
- Provide recommendations to site management for improving performance.
- Provide a vehicle for environmental communications at the station (including environmental education and outreach).
- Perform select EMS (ISO 14001) functions.
- Select and implement environmental improvement projects (e.g. wildlife habitat, ecosystem enhancement, spill prevention, resource conservation, pollution prevention, recycling, additional communication methods, etc).

For each wildlife project there is a lead who is usually a supervisor or designee, and members for the project implementation. Member's interests are active in executing projects, but are not always the primary driver of the project. Projects are chosen such as:

- Increase shelter opportunities for native wetland animals
- Provide opportunity for raptors to co-occupy the areas surrounding the plant
- Increase small mammal habitat in balance with raptor opportunity
- Amphibian preservation

See Appendices F, G, and H for 2008, 2009, and 2010 Environmental Stewardship Committee Meeting Agendas, Minutes and Packages.

1.2.2. Ecological Background

Exelon's Limerick Generating Station is located within Bailey's Humid Temperate Domain, which is characterized by four distinct seasons with strong annual cycles of temperature and precipitation. Forests of broadleaf deciduous and needleleaf evergreen trees are the primary vegetational characteristic of this domain. Within this domain, the site is located within the Hot Continental Division, which is characterized by hot summers and cool winters. Vegetation is primarily winter deciduous forest, dominated by a dense canopy of tall broadleaf trees in summer which completely lose their leaves by winter. The understory is underdeveloped but the herbaceous ground cover is significant at the onset of spring, becoming greatly reduced once the trees leaf out and shade the ground. Primary productivity of forest in this division is high during the summer but reduces drastically in winter. Soils are rich in humus and slightly leached, making this area favorable for agriculture when topography allows. Precipitation increases with proximity to the ocean, further subdividing the Hot Continental Division into moist oceanic and dry continental provinces (Bailey 1995).

Exelon's Limerick Generating Station lies within the Eastern Broadleaf Forest (Oceanic) Province. Topography in this region is diverse in nature and origin but the site lies east of the Appalachian Mountains within the Piedmont Plateau and coastal region, with altitudes ranging from sea level to approximately 1,000 feet. Altitudes at Exelon's Limerick Generating Station range from 100 feet MSL to 300 feet MSL. The continental climatic regime in this province is responsible for a strong annual temperature cycle, with cold winters and warm summers (Bailey 1995). The average temperatures at Exelon's Limerick Generating Station ranges from an average mean of 30° F in January to an average mean of 76° F in July (TWC 2010).

Precipitation occurs year-round in this province with more rainfall in the summer months when evapotranspiration peaks and there are high moisture demands (Bailey 1995). A small water deficit is incurred in the summer but typically offset by a large surplus in the spring. Average annual precipitation at Exelon's Limerick Generating Station is approximately 44 inches with average monthly precipitation at its lowest in February (2.75 inches) and its highest in September (4.32 inches) (TWC 2010).

The Eastern Broadleaf Forest (Oceanic) Province is characterized by winter deciduous forest (also called temperate deciduous forest) that forms a thick canopy of tall deciduous trees that lose their leaves before the winter months. The forest vegetation in this province is further divided into three major associations: mixed mesophytic, Appalachian oak, and pine-oak. Exelon's Limerick Generating Station occurs entirely within the Appalachian oak association which begins east of the Appalachian Mountains and terminates along the northern Coastal Plain where it forms an ecotone with the pine-oak association. The Appalachian oak association is dominated by white oak (*Quercus alba*) and northern red oak (*Quercus rubra*). American chestnut (*Castanea dentata*) was once a dominant species as well but has been eliminated as a functional part of this community due to the chestnut blight, a fungal disease (Bailey 1995).

Main Habitat Types

The main habitats at Exelon's Limerick Generating Station consist of developed areas, agricultural fields, old field meadow, old field scrub/shrub, pioneer herbaceous, forest, palustrine wetlands, and open water.

Developed areas at Exelon's Limerick Generating Station consist of buildings, asphalted parking lots, roads, landscaping, and mowed lawns. Mowed lawns consist largely of non-native cold season grasses that are of minimal value to native species. Landscaping consist of mostly non-native ornamental species, some of which may serve as breeding habitat, cover, and food sources for some native species that are tolerant of humans.

Agricultural fields are currently or were previously planted with crops such as corn, wheat, barley, soybeans, and hay. These areas serve as cover and food for wildlife species such as white-tailed deer (*Odocoileus virginianus*) that are tolerant of human presence and adapted to edge habitats. In addition to the planted fields, agricultural areas contain hedgerows of upland tree species which serve as cover for wildlife species. Hedgerows in agricultural areas at Exelon's Limerick Generating Station typically contain tree species such as black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), Osage orange (*Maclura pomifera*), white ash (*Fraxinus americana*), red cedar (*Juniperus virginiana*), tulip poplar (*Liriodendron tulipifera*), sassafras (*Sassafras albidum*), and common hackberry (*Celtis occidentalis*). Common understory plants include poison ivy (*Toxicodendron radicans*), honeysuckle (*Lonicera* spp.), and spicebush (*Lindera benzoin*).

FIGURE 8: FARM AREA OWNED BY LIMERICK GENERATING STATION



Photo by LGS ESC

Old field habitat consists of abandoned agricultural areas that are in either the **meadow** (grasses and forbs) or **scrub/shrub** state of succession. Both of these stages are well-represented at Exelon's Limerick Generating Station. The tree species will eventually shade out these seral stages as they succeed to an upland forest habitat. Wildlife species present depend on the stage of the old field and the plant species present in the community but common species typically observed in these habitats include white-tailed deer, red fox (*Vulpes vulpes*), cottontail (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), and Virginia opossum (*Didelphis virginiana*).

Old field meadow habitats at Exelon's Limerick Generating Station are characterized by various naturalized grasses such as fescue (*Festuca* spp.), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), and orchardgrass (*Dactylis glomerata*). Forbs commonly observed in the meadow stage of old field habitat at Exelon's Limerick Generating Station include naturalized and native species such as Canada goldenrod (*Solidago canadensis*), daisy fleabane (*Erigeron strigosus*), evening primrose (*Oenothera biennis*), dwarf cinquefoil (*Potentilla canadensis*), wild carrot (*Daucus carota*), teasel (*Dipsacus fullonum*), red clover (*Trifolium pratense*), smartweeds (*Polygonum* spp.), and brambles (*Rubus* spp.).

Old field scrub/shrub habitats at Exelon's Limerick Generating Station are characterized by naturalized and native shrub species such as hawthorn (*Craetagus* spp.), arrowwood (*Viburnum* spp.), and multiflora rose (*Rosa multiflora*). The shrub stage of old field habitat at Exelon's Limerick Generating Station is also characterized by seedlings and saplings of tree species such as black cherry, flowering dogwood (*Cornus florida*), tulip poplar, white ash, black locust (*Robinia pseudoacacia*), and red cedar.

FIGURE 9: HABITAT CHARACTERISTICS OF LIMERICK GENERATING STATION



Photo by LGS ESC

Pioneer herbaceous habitat at Exelon's Limerick Generating Station consists of a disturbed and invasive plant community that has colonized following disturbance due to construction, grading, and periodic mowing. This community at Exelon's Limerick Generating Station is sparse and low and typically consists of plant species such as wineberry (*Rubus phoenicolasius*), mugwort (*Artemisia vulgaris*), multiflora rose, lesser celandine (*Ranunculus ficaria*), orchardgrass, foxtails (*Alopecurus* spp.), white goosefoot (*Chenopodium album*), spotted lady's thumb (*Polygonum persicaria*), Pennsylvania smartweed (*Polygonum pennsylvanicum*), cespitose knotweed (*Polygonum cespitosum*), curly dock (*Rumex crispus*), wild carrot, white amaranth (*Amaranthus albus*), butter-and-eggs (*Linaria vulgaris*), red clover, yellow sweetclover (*Melilotus officinalis*), white sweetclover (*Melilotus alba*), and Deptford pink (*Dianthus armeria*). This habitat is of low value to native wildlife although it is beneficial to some of the

more human tolerant species such as white-tailed deer, cottontail, and meadow vole (*Microtus pennsylvanicus*). Larger species such as deer may feed in this area but lack sufficient cover. Cottontails and voles may find sufficient cover in this area as well as food and in turn may attract predators such as red fox.

Forest habitat on Exelon's Limerick Generating Station consists of two main types, upland and riparian. The **riparian forest** at Exelon's Limerick Generating Station is associated with the banks of the Schuylkill River and smaller tributaries such as Brooke Evans Creek and Possum Hollow Run. Tree species in these areas were dominated by silver maple (*Acer saccharinum*), American sycamore (*Plantanus occidentalis*), American elm (*Ulmus americana*), and slippery elm (*Ulmus rubra*). Other tree species less common in the canopy included river birch (*Betula nigra*), box elder (*Acer negundo*), black willow (*Salix nigra*), bitternut hickory (*Carya cordiformis*), red maple (*Acer rubrum*), black walnut, tree-of-heaven (*Ailanthus altissima*), American beech (*Fagus grandifolia*), white ash, northern catalpa (*Catalpa speciosa*), and American basswood (*Tilia americana*). Plants common in the understory include spicebush, American elderberry (*Sambucus canadensis*), American bladdernut (*Staphylea trifolia*), frost grape (*Vitis vulpina*), and Japanese honeysuckle (*Lonicera japonica*). Riparian forest is an extremely valuable habitat to wildlife species in the area and serves as a vital source of food, cover, and reproductive habitat. During spring some areas may become sufficiently wet as to support amphibian breeding in the form of vernal pools that are devoid of fish predators. Waterfowl and neotropical migrant birds may use this area as a vital stopover in their long journeys. This area is also a vital link for many animals that use river corridors as dispersal or seasonal migration routes as it provides cover and a water source during these movements.

Upland forest is another valuable habitat to wildlife that occurs on Exelon's Limerick Generating Station as it provides food, cover, and reproductive habitat that serves as refugia for species that are less tolerant of human presence. The tree species most common to forest on Exelon's Limerick Generating Station includes white ash, tulip poplar, red maple, chestnut oak (*Quercus prinus*), American elm, black walnut, slippery elm, flowering dogwood, bitternut hickory, American beech, and red oak (*Quercus rubra*). Spicebush, red maple, flowering dogwood, American elm, oaks, frost grape, white ash, bitternut hickory and black cherry were the most common species in the shrub and sapling layer. In the herbaceous layer, Japanese honeysuckle, poison ivy, bitternut hickory, oaks, black cherry, frost grape, Virginia creeper (*Parthenocissus quinquefolia*), white ash, and spicebush were the most common species.

Small areas of **palustrine wetlands** also occurred on Exelon's Limerick Generating Station and though they comprise a small area of the site, are a very important habitat for wildlife. Wetlands not only serve as a reliable water source but are also important to the breeding biology of aquatic and semi-aquatic animals and are important foraging areas for herbivores and some predators. Most of the wetlands on Exelon's Limerick Generating Station are of the **palustrine forested** type, but some **palustrine emergent wetlands**, composed of emergent herbaceous vegetation, are present. **Palustrine forested wetlands** typically are dominated by red maple and silver maple. Vegetation common to the **palustrine emergent wetlands** include sedges (*Carex* spp.), microstegium (*Eulalia viminea*), bedstraws (*Galium* spp.), arrow-leaf tearthumb (*Polygonum sagittatum*), halberd-leaf tearthumb (*Polygonum arifolium*), flatsedges (*Cyperus* spp.), hollow joe-pye-weed (*Eupatoriadelphus fistulosus*), and swamp milkweed (*Asclepias incarnata*).

Open water within Exelon’s Limerick Generating Station consists of the Schuylkill River and two tiny tributaries. The river bracketing the site is predominately run habitat with small portions of riffle, pool, and backwater habitat. The substrate is primarily gravel-rubble, with some silt and organic muck. In addition to the Schuylkill River, there are three small tributaries to the river that pass through Exelon’s Limerick Generating Station, Possum Hollow Run and Brooke Evans Creek on the east side of the river and Akm Run on the west side of the river. These three tributaries are of extremely small size and may become dry during periods of drought. It is highly unlikely that these tributaries contain any species that are not found in the river. For at least the last 40 years the Schuylkill River has been recovering from multiple anthropogenic sources of pollution, and now displays greater diversity and less tolerant species than in previous decades. The current presence of northern hogsucker (*Hypentelium nigricans*) and margined madtom (*Noturus insignis*), which in previous decades were found only in distant, more pristine tributaries, are examples. The river near Exelon’s Limerick Generating Station is productive, but dependent to a large degree upon allochthonous sources of energy, as it is measurably heterotrophic most of the year. Due to its geologic history, the Schuylkill River, like all the other portions of the Delaware River drainage, is represented by a depauperate fish community. Various species have been introduced in the last two centuries.

FIGURE 10: HABITAT MAP OF LIMERICK GENERATING STATION

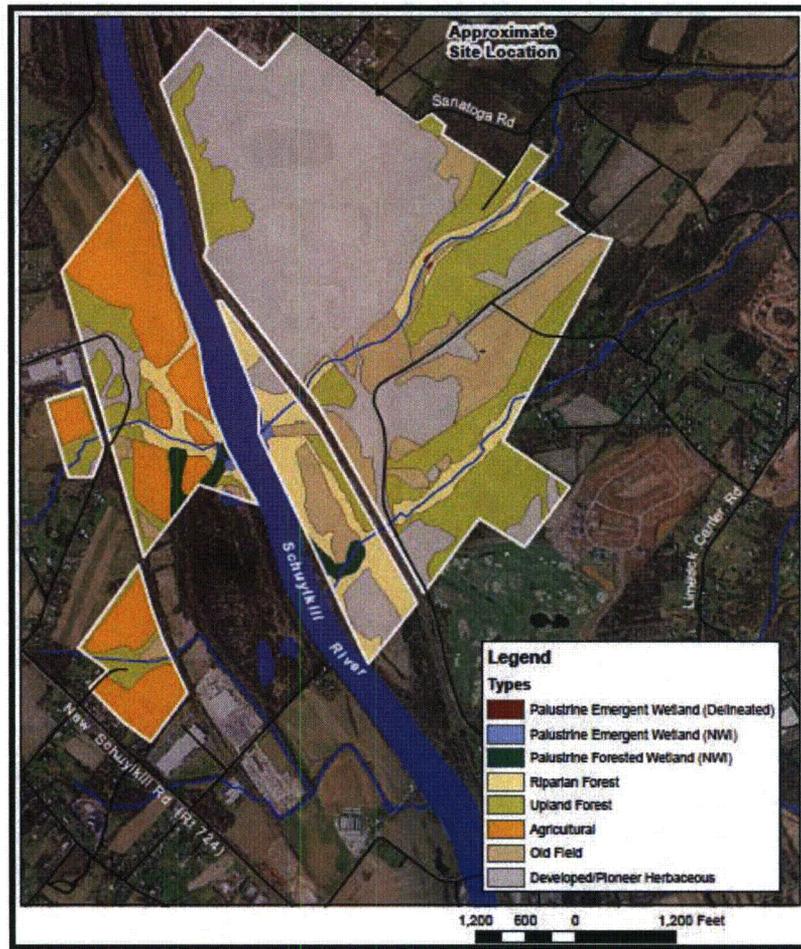


Photo by Normandeau

Soils

The soils of the Eastern Broadleaf (Oceanic) Forest Province are predominantly Alfisols, with Ultisols occurring in the lower latitudes, and Inceptisols on the plateaus. All three soil types are rich in humus due to the thick layer of leaves deposited in the deciduous forest which are moderately leached due to significant precipitation in this Province. The soils of Chester County and Montgomery County, Pennsylvania (in which Exelon's Limerick Generating Station is located) are predominantly moderately deep or deep and gently sloping. They are acidic in nature and of moderate natural fertility with moderately slow internal drainage (NRCS 1967). Specifically, soils occurring on Exelon's Limerick Generating Station in Montgomery County consist of these soil series: Bouldery alluvial land, Bowmansville-Knauers silt loam, Klinesville very shaly silt loam, Lansdale loam, Lansdale silt loam, Made land, Penn silt loam, Penn-Lansdale loam, Penn-Klinesville channery silt loam, Readington silt loam, Reaville shaly silt loam, Rowland silt loam, and Stony land (NRCS 1967, NRCS 2010a). Soils of the Bowmanville-Knauers silt loam series are classified as hydric (wetlands) soils in Montgomery County while soils of the Penn-Klinesville channery silt loam, Readington silt loam, Reaville shaly silt loam, Rowland silt loam and Urban land-Penn complex series may have hydric inclusions in floodplains (NRCS 2010b). Soils occurring on Exelon's Limerick Generating Station in Chester County consist of these soils series: Bowmansville-Knauers silt loam, Croton silt loam, Gibraltar silt loam, Penn silt loam, Raritan silt loam, Readington silt loam, and Rowland silt loam (NRCS 2010a). Soils of the Bowmanville-Knauers silt loam and Croton silt loam series are classified as hydric (wetlands) soils in Chester County while soils of the Gibraltar silt loam, Raritan silt loam, Readington silt loam, Rowland silt loam and Urban land-Penn complex series may have hydric inclusions in floodplains and depressions (NRCS 2010b).

FIGURE 11: SOILS MAP OF LIMERICK GENERATING STATION

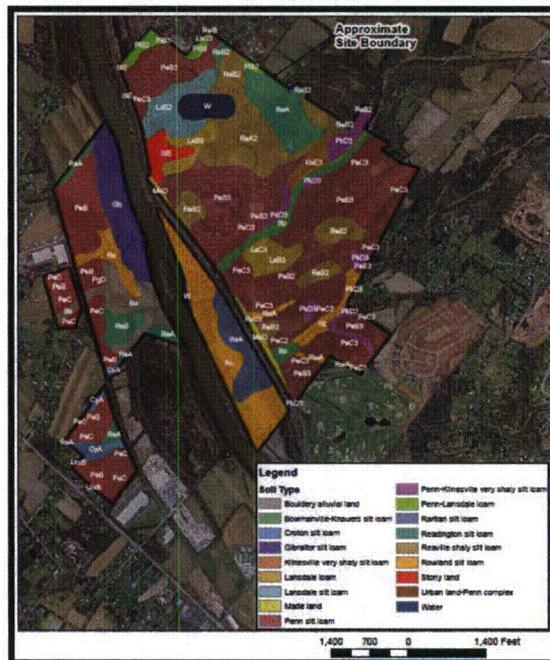


Photo by Normandeau

Fauna

Fauna common to the Eastern Broadleaf Forest (Oceanic) Province that have been observed on Exelon's Limerick Generating Station include mammals such as white-tailed deer, raccoon, striped skunk (*Mephitis mephitis*), red fox, opossum, eastern cottontail, gray squirrel (*Sciurus carolinensis*), and white-footed mouse (*Peromyscus leucopus*). Large mammalian predators such as the eastern timber wolf (*Canis lupus lycaon*) and eastern cougar (*Puma concolor cougar*) have been extirpated since European settlement of this area which has allowed prey species such as the white-tailed deer and smaller predators such as the red fox to proliferate.

Avian species common to this Province that have been observed at the site include game birds such as Canada goose (*Branta canadensis*) and mourning dove (*Zenaidura macroura*); raptors such as red-tailed hawk (*Buteo jamaicensis*) and turkey vulture (*Cathartes aura*), resident songbird species such as northern cardinal (*Cardinalis cardinalis*); and neotropical migrant songbirds such as Baltimore oriole (*Icterus galbula*), indigo bunting (*Passerina cyanea*), and red-eyed vireo (*Vireo olivaceus*). Other avian species commonly observed at Exelon's Limerick Generating Station include eastern bluebird (*Sialia sialis*), American robin (*Turdus migratorius*), eastern towhee (*Pipilo erythrophthalmus*), tufted titmouse (*Baeolophus bicolor*), downy woodpecker (*Picoides pubescens*), blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchus*), killdeer (*Charadrius vociferous*), barn swallow (*Hirundo rustica*), tree swallow (*Tachycineta bicolor*), purple martin (*Progne subis*), and the introduced European starling (*Sturnus vulgaris*).

Reptiles observed on the site include the northern black racer (*Coluber constrictor*), northern ring-necked snake (*Diadophis punctatus punctatus*), eastern garter snake (*Thamnophis sirtalis*), spotted turtle (*Clemmys guttata*), eastern box turtle (*Terrapene carolina carolina*), and eastern painted turtle (*Chrysemys picta picta*). Amphibians observed or heard on Exelon's Limerick Generating Station include red-backed salamander (*Plethodon cinereus*), long-tailed salamander (*Eurycea longicauda*), northern two-lined salamander (*Eurycea bislineata bislineata*), American toad (*Bufo americanus*), spring peeper (*Pseudacris crucifer*), bullfrog (*Rana catesbeiana*), and green frog (*Rana clamitans*).

Due to its geologic history, the Schuylkill River, like all the other portions of the Delaware River drainage, is represented by a depauperate fish community. Various species have been introduced in the last two centuries. Recent (2009) collections of fish and macroinvertebrates produced the following results:

Electrofishing and seining collection efforts yielded a combined total of 27 species of fish among 3,138 individuals. Cyprinids (minnows) and centrarchids (basses and sunfishes) were the dominant families, with nine and eight species collected for each family, respectively. Other families that were collected include Ictaluridae (catfishes), Catostomidae (suckers), Percidae (perches), Fundulidae (killfishes), and Anguillidae (eels). Spotfin shiner (*Cyprinella spiloptera*) was the most abundant species, comprising 50.2% of the total catch. Other abundant species that represented a substantial proportion of the total catch included redbreast sunfish (*Lepomis auritis*) (10.6%), rock bass (*Ambloplites rupestris*) (6.2%), white sucker (*Catostomus commersoni*) (5.9%), swallowtail shiner (*Notropis proce*) (5.5%), and common carp (*Cyprinus carpio*) (5.4%).

The benthic macroinvertebrate collections were comprised of a diverse mixture of insects, snails, clams, and crayfish. A total of 4,965 organisms and 58 taxa was identified from the spring and fall benthic macroinvertebrate collections during 2009. Insects in the orders Diptera (true flies) and Coleoptera (beetles) comprised a large proportion of the macroinvertebrate community. Other groups that were well represented included insects in the orders Ephemeroptera (mayflies) and Trichoptera (caddisflies) and non-insects in the order Gastropoda (snails).

FIGURE 12: TOPO MAP OF LIMERICK GENERATING STATION

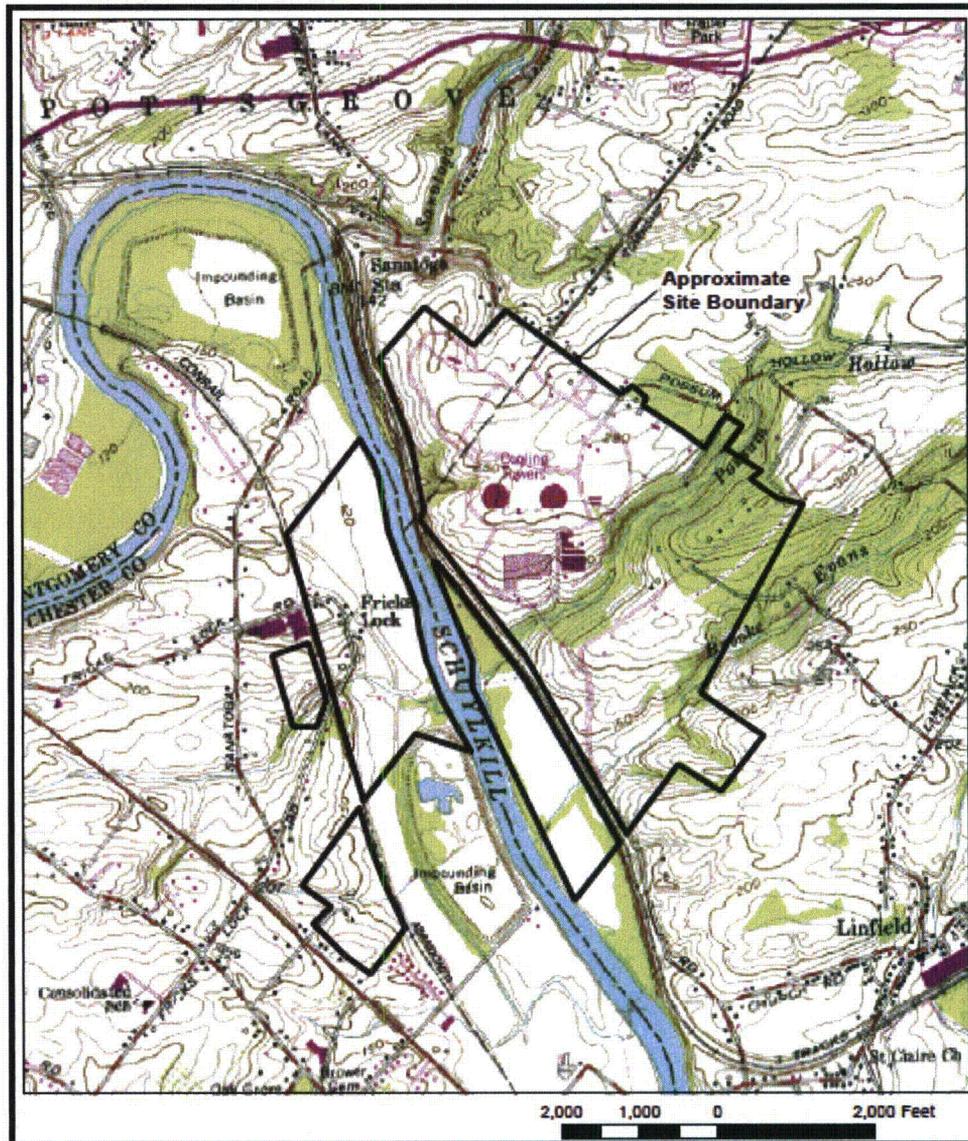


Photo by Normandeau

2. Development

2.1. Facility Inventory

Conducting a thorough inventory of the plants and animals present at the facility is a priority of the Wildlife Team, as an inventory helps the Limerick Generating Station Wildlife Team

members to become familiar with the plants, animals, and habitats found at the facility. The wildlife inventory is an ongoing process that provides useful information to the Limerick Generating Station *Wildlife at Work* program and any future outreach and education projects. The goal is to understand the facility habitats by compiling a list of resident and transitory species, using seasonal inventories conducted in the spring, summer, and fall.

On June 28, 2006 the Wildlife Habitat Council performed a site visit at Limerick Generating Station to assist in development of a biodiversity assessment and wildlife habitat management plan. See Appendix E for 2006 WHC Site Assessment.

On April 28, 2009 Limerick Generating Station (Ed Kriner and Lisa MacDonald) performed a walkdown of Possum Hollow for an informal survey of the wildlife and aquatic life of the creek.

On June 17, 2010 Normandeau Associates (Chris Roche) and Limerick Generating Station (Leanne Birkmire) performed a site walkdown to assess the plant and animal inventory at Limerick Generating Station. This was the final part of the assessment due to Normandeau being Limerick's Environmental Vendor of Choice and having records on LGS Wildlife and Habitats dating back to plant inception. See Appendix N for pictures of the walk down.

On June 4, 2010 Limerick Generating Station (Leanne Birkmire) and Corporate Environmental (Cliff Gibson) performed a walkdown of the remote facilities at Bedminster, Bradshaw and Perkiomen located respectively in Bucks (Bedminster & Bradshaw) and Montgomery (Perkiomen) Counties. See Appendix O for pictures of the Water Diversion Facilities.

TABLE 1: VEGETATION IDENTIFIED ON FACILITY

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Trees					
Box elder	<i>Acer negundo</i>	N	None	None	2010
Striped maple	<i>Acer pensylvanicum</i>	N	None	None	1978
Norway maple	<i>Acer platanoides</i>	I	None	None	2010
Red maple	<i>Acer rubrum</i>	N	None	None	1978
Silver maple	<i>Acer saccharinum</i>	N	None	None	2010
Sugar maple	<i>Acer saccharum</i>	N	None	None	1978
Horse chestnut	<i>Aesculus hippocastanum</i>	I	None	None	1978
Tree-of-heaven	<i>Ailanthus altissima</i>	I	None	None	2006
Hardy silk tree	<i>Albizia julibrissin</i>	I	None	None	1978
European black alder	<i>Alnus glutinosa</i>	I	None	None	1978
Shadbush	<i>Amelanchier sp.</i>	N	None	None	1978
Pawpaw	<i>Asimina triloba</i>	N	None	None	1978
Yellow birch	<i>Betula allegheniensis</i>	N	None	None	1972
Black birch	<i>Betula lenta</i>	N	None	None	1978
River birch	<i>Betula nigra</i>	N	None	None	1978
Paper birch	<i>Betula papyrifera</i>	N	None	None	1972
Gray birch	<i>Betula populifolia</i>	N	None	None	1978
Bitternut hickory	<i>Carya cordiformis</i>	N	None	None	1978
Pignut hickory	<i>Carya glabra</i>	N	None	None	1978
Sweet pignut hickory	<i>Carya ovalis</i>	N	None	None	1978
Shagbark hickory	<i>Carya ovata</i>	N	None	None	2010
Mockernut hickory	<i>Carya tomentosa</i>	N	None	None	1978
American chestnut	<i>Castanea dentata</i>	I	None	None	1978
Chinese chestnut	<i>Castanea mollissima</i>	I	None	None	1978
Southern catalpa	<i>Catalpa bignonioides</i>	I	None	None	1978
Northern catalpa	<i>Catalpa speciosa</i>	N	None	None	2010
Hackberry	<i>Celtis occidentalis</i>	N	None	None	1978
Eastern redbud	<i>Cercis canadensis</i>	N	None	None	1978
Flowering dogwood	<i>Cornus florida</i>	N	None	None	1978
Smoketree	<i>Cotinus coggygria</i>	I	None	None	1978
Frosted hawthorn	<i>Craetaegus pruinosa</i>	N	None	None	1972
American beech	<i>Fagus grandifolia</i>	N	None	None	2010
White ash	<i>Fraxinus americana</i>	N	None	None	2010
Green ash	<i>Fraxinus pennsylvanicus</i>	N	None	None	2010
Honey locust	<i>Gleditsia triacanthos</i>	N	None	None	1978
American holly	<i>Ilex opaca</i>	N	None	T	1978

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Butternut	<i>Juglans cinerea</i>	N	None	None	1978
Black walnut	<i>Juglans nigra</i>	N	None	None	2010
Eastern red cedar	<i>Juniperus virginiana</i>	N	None	None	2010
	<i>Liriodendron</i>				
Tulip poplar	<i>tulipifera</i>	N	None	None	2010
	<i>Liquidambar</i>				
Sweetgum	<i>styraciflua</i>	N	None	None	1972
Osage orange	<i>Maclura pomifera</i>	N	None	None	1978
Red mulberry	<i>Morus rubra</i>	N	None	None	1978
Blackgum	<i>Nyssa sylvatica</i>	N	None	None	1978
Hop-hornbeam	<i>Ostrya virginiana</i>	N	None	None	1978
Princess-tree	<i>Paulownia tomentosa</i>	I	None	None	1978
Norway spruce	<i>Picea abies</i>	I	None	None	1978
Jack pine	<i>Pinus banksiana</i>	I	None	None	1972
Red pine	<i>Pinus resinosa</i>	N	None	None	1978
White pine	<i>Pinus strobus</i>	N	None	None	1978
Scotch pine	<i>Pinus sylvestris</i>	I	None	None	1978
Virginia pine	<i>Pinus virginiana</i>	N	None	None	1978
American sycamore	<i>Platanus occidentalis</i>	N	None	None	2010
	<i>Populus</i>				
Bigtooth aspen	<i>grandidentata</i>	N	None	None	1978
Wild plum	<i>Prunus americana</i>	N	None	None	1978
Sweet cherry	<i>Prunus avium</i>	I	None	None	1978
Peach	<i>Prunus persica</i>	I	None	None	1978
Black cherry	<i>Prunus serotina</i>	N	None	None	1978
Chokecherry	<i>Prunus virginiana</i>	N	None	None	1978
Domestic pear	<i>Pyrus communis</i>	I	None	None	1978
Domestic apple	<i>Pyrus malus</i>	I	None	None	1978
White oak	<i>Quercus alba</i>	N	None	None	2010
Swamp white oak	<i>Quercus bicolor</i>	N	None	None	1972
Scarlet oak	<i>Quercus coccinea</i>	N	None	None	1978
Scrub oak	<i>Quercus ilicifolia</i>	N	None	None	1978
Pin oak	<i>Quercus palustris</i>	N	None	None	1978
Chestnut oak	<i>Quercus prinus</i>	N	None	None	1978
Northern red oak	<i>Quercus rubra</i>	N	None	None	2010
Black oak	<i>Quercus velutina</i>	N	None	None	1978
Dwarf sumac	<i>Rhus copallinum</i>	N	None	None	1978
Smooth sumac	<i>Rhus glabra</i>	N	None	None	2006
Staghorn sumac	<i>Rhus typhina</i>	N	None	None	2010
Black locust	<i>Robinia pseudoacacia</i>	I	None	None	2010
Black willow	<i>Salix nigra</i>	N	None	None	2010

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Sassafras	<i>Sassafras albidum</i>	N	None	None	1978
European yew	<i>Taxus baccata</i>	I	None	None	2006
Japanese yew	<i>Taxus cuspidata</i>	I	None	None	1972
Basswood	<i>Tilia americana</i>	N	None	None	1972
Northern white cedar	<i>Thuja occidentalis</i>	N	None	None	1978
American elm	<i>Ulmus americana</i>	N	None	None	1978
Slippery elm	<i>Ulmus rubra</i>	N	None	None	1978
Shrubs					
Dull-leaf indigibush	<i>Amorpha fruticosa</i>	N	None	None	1978
Japanese barberry	<i>Berberis thunbergii</i>	I	None	None	1978
Silky dogwood	<i>Cornus amomum</i>	N	None	None	1978
Gray dogwood	<i>Cornus racemosa</i>	N	None	None	1978
Red osier dogwood	<i>Cornus sericea</i>	N	None	None	1978
American hazelnut	<i>Corylus americana</i>	N	None	None	1978
	<i>Elaeagnus</i>				
Russian olive	<i>angustifolia</i>	N	None	None	1978
Black huckleberry	<i>Gaylussaccia baccata</i>	N	None	None	1978
Witch-hazel	<i>Hamamelis virginiana</i>	N	None	None	1978
Creeping cedar	<i>Juniperus horizontalis</i>	N	None	None	2006
Mountain laurel	<i>Kalmia latifolia</i>	N	None	None	1978
Spicebush	<i>Lindera benzoin</i>	N	None	None	1978
American fly-honeysuckle	<i>Lonicera canadensis</i>	N	None	None	1978
Tatarian honeysuckle	<i>Lonicera tatarica</i>	I	None	None	2010
European honeysuckle	<i>Lonicera xylosteum</i>	I	None	None	1978
	<i>Physocarpus</i>				
Ninebark	<i>opulifolius</i>	N	None	None	1978
	<i>Rhododendron</i>				
Pink azalea	<i>nudiflorum</i>	N	None	None	1978
Pasture rose	<i>Rosa carolina</i>	N	None	None	1978
Multiflora rose	<i>Rosa multiflora</i>	I	None	None	2010
Blackberry	<i>Rubus allegheniensis</i>	N	None	None	1978
Red raspberry	<i>Rubus idaeus</i>	I	None	None	1978
Black raspberry	<i>Rubus occidentalis</i>	N	None	None	1978
Wineberry	<i>Rubus phoenicolasius</i>	I	None	None	2010
American elderberry	<i>Sambucus canadensis</i>	N	None	None	1978
Broadleaf meadowsweet	<i>Spiraea latifolia</i>	N	None	None	1978
Vanhoutte spiraea	<i>Spiraea x vanhouttei</i>	I	None	None	1972
American bladdernut	<i>Staphylea trifolia</i>	N	None	None	1972
	<i>Symphoricarpos</i>				
Coralberry	<i>orbiculatus</i>	N	None	None	1978
Common lilac	<i>Syringa vulgaris</i>	I	None	None	2006

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Deerberry	<i>Vaccinium stamineum</i>	N	None	None	1978
Early low blueberry	<i>Vaccinium vacillans</i>	N	None	None	1978
Maple-leaved viburnum	<i>Viburnum acerifolium</i>	N	None	None	1978
Arrow wood	<i>Viburnum dentatum</i>	N	None	None	1978
Hobblebush	<i>Viburnum lantanoides</i>	N	None	None	1978
	<i>Viburnum nudum</i> var.				
Wild raisin	<i>cassinoides</i>	N	None	E	1978
Smooth blackhaw	<i>Viburnum prunifolium</i>	N	None	None	1978
Herbs					
Velvet-leaf	<i>Abutilon theophrasti</i>	I	None	None	1978
Yarrow	<i>Achillea millefolium</i>	B	None	None	1978
	<i>Actaea racemosa</i> var.				
Black cohosh	<i>racemosa</i>	N	None	None	1978
Agrimony	<i>Agrimonia</i> sp.	U	None	None	1978
Garlic mustard	<i>Alliaria petiolata</i>	I	None	None	2010
Meadow garlic	<i>Allium canadense</i>	N	None	None	1978
Wild onion	<i>Allium stellatum</i>	N	None	None	1978
Field garlic	<i>Allium vineale</i>	I	None	None	2010
	<i>Amaranthus</i>				
Amaranth pigweed	<i>retroflexus</i>	N	None	None	1978
	<i>Ambrosia</i>				
Common ragweed	<i>artemisiifolia</i>	N	None	None	2010
Great ragweed	<i>Ambrosia trifida</i>	N	None	None	2010
	<i>Ampelopsis</i>				
Amur peppervine	<i>brevipedunculata</i>	I	None	None	1978
Scarlet pimpernel	<i>Anagallis arvensis</i>	I	None	None	1978
	<i>Anaphalis</i>				
Pearly everlasting	<i>margaritacea</i>	N	None	None	1978
Tall thimbleweed	<i>Anemone virginiana</i>	N	None	None	1978
Pussy-toes	<i>Antennaria</i> sp.	U	U	U	1978
Mayweed	<i>Anthemis cotula</i>	I	None	None	1978
	<i>Apocynum</i>				
Indianhemp	<i>cannabinum</i>	N	None	None	2006
Red columbine	<i>Aquilegia canadensis</i>	N	None	None	1978
Garden columbine	<i>Aquilegia vulgaris</i>	I	None	None	1978
Smooth rockcress	<i>Arabis laevigata</i>	N	None	None	1978
Greater burdock	<i>Arctium lappa</i>	I	None	None	1978
Lesser burdock	<i>Arctium minus</i>	I	None	None	2006
Green dragon	<i>Arisaema dracontium</i>	N	None	None	1978
Jack-in-the-pulpit	<i>Arisaema triphyllum</i>	N	None	None	1978
Mugwort	<i>Artemisia vulgaris</i>	I	None	None	2010

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Canadian wild ginger	<i>Asarum canadense</i>	N	None	None	1978
Swamp milkweed	<i>Asclepias incarnata</i>	N	None	None	1978
Common milkweed	<i>Asclepias syriaca</i>	N	None	None	1978
Butterfly milkweed	<i>Asclepias tuberosa</i>	N	None	None	1978
White milkweed	<i>Asclepias variegata</i>	N	None	TU, PE	1978
Garden asparagus	<i>Asparagus officinalis</i>	I	None	None	1978
Ebony spleenwort	<i>Asplenium platyneuron</i>	N	None	None	1978
Wild indigo	<i>Baptisia tinctoria</i>	N	None	None	1978
Early wintercress	<i>Barbarea verna</i>	I	None	None	1978
Wintercress	<i>Barbarea vulgaris</i>	I	None	None	2010
Tickseed-sunflower	<i>Bidens coronata</i>	N	None	None	1978
Beggar-ticks	<i>Bidens frondosa</i>	N	None	None	1978
Hairy wood-mint	<i>Blepharia hirsuta</i>	N	None	None	1978
Smallspike false nettle	<i>Boehmeria cylindrica</i>	N	None	None	1978
Rattlesnake fern	<i>Botrychium virginianum</i>	N	None	None	1978
Black mustard	<i>Brassica nigra</i>	I	None	None	1978
Field mustard	<i>Brassica rapa</i>	I	None	None	1978
Corn gromwell	<i>Buglossoides arvensis</i>	I	None	None	1978
Hedge false bindweed	<i>Calystegia sepium</i>	I	None	None	1978
Shepherd's purse	<i>Capsella bursa-pastoris</i>	I	None	None	1978
Spring cress	<i>Cardamine bulbosa</i>	N	None	None	1978
Cut-leaved toothwort	<i>Cardamine concatenata</i>	N	None	None	1978
Awl-fruited sedge	<i>Carex stipata</i>	N	None	None	1978
American bittersweet	<i>Celastrus scandens</i>	N	None	None	1978
American knapweed	<i>Centaurea americana</i>	N	None	None	1978
Black knapweed	<i>Centaurea nigra</i>	I	None	None	1978
Common mouse-ear chickweed	<i>Cerastium fontanum</i>	I	None	None	1978
Partridge-pea	<i>Chamaecrista fasciculata</i> var. <i>fasciculata</i>	N	None	None	1978
Celandine	<i>Chelidonium majus</i>	I	None	None	1978
White turtlehead	<i>Chelone glabra</i>	N	None	None	1978
Lamb's-quarters	<i>Chenopodium album</i>	I	None	None	1978
Spotted wintergreen	<i>Chimaphila maculata</i>	N	None	None	1978
Chicory	<i>Cichorium intybus</i>	I	None	None	2006
Spotted water-hemlock	<i>Cicuta maculata</i>	N	None	None	1978

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Broadleaf enchanter's nightshade	<i>Circaea lutetiana</i>	N	None	None	1978
Canada thistle	<i>Cirsium arvense</i>	I	None	None	2010
Bull thistle	<i>Cirsium vulgare</i>	I	None	None	2010
Virginia spring-beauty	<i>Claytonia virginica</i>	N	None	None	1978
Spiny spider-flower	<i>Cleome spinosa</i>	I	None	None	1978
Asiatic dayflower	<i>Commelina communis</i>	I	None	None	1978
Garden larkspur	<i>Consolida ajacis</i>	I	None	None	1978
Field bindweed	<i>Convolvulus arvensis</i>	I	None	None	1978
Canadian honewort	<i>Cryptotaenia canadensis</i>	N	None	None	1978
Kenilworth ivy	<i>Cymbalaria muralis</i>	I	None	None	1978
Yellow nutgrass	<i>Cyperus esculentus</i>	I	None	None	1978
Orchardgrass	<i>Dactylis glomerata</i>	I	None	None	2010
Jimsonweed	<i>Datura stramonium</i>	I	None	None	1978
Queen Anne's lace	<i>Daucus carota</i>	I	None	None	2006
Hay-scented fern	<i>Dennstaedtia punctilobula</i>	N	None	None	1978
Naked-flowered tick-trefoil	<i>Desmodium nudiflorum</i>	N	None	None	1978
Panicled tick-trefoil	<i>Desmodium paniculatum</i>	N	None	None	1978
Deptford pink	<i>Dianthus armeria</i>	I	None	None	1978
Dutchman's-breeches	<i>Dicentra cucullaria</i>	N	None	None	1978
Hairy crab grass	<i>Digitaria sanguinalis</i>	N	None	None	1978
Common teasel	<i>Dipsacus sylvestris</i>	I	None	None	1978
Indian strawberry	<i>Duchesnea indica</i>	I	None	None	1978
Barnyard grass	<i>Echinochloa crus-galli</i>	I	None	None	1978
Wild cucumber	<i>Echinocystis lobata</i>	N	None	None	1978
Beechdrops	<i>Epifagus virginiana</i>	N	None	None	1978
Purple-leaved willow-herb	<i>Epilobium coloratum</i>	N	None	None	1978
Common horsetail	<i>Equisetum arvense</i>	N	None	None	1978
Weeping lovegrass	<i>Eragrostis curvula</i>	I	None	None	2006
Daisy fleabane	<i>Erigeron annuus</i>	N	None	None	2006
Common fleabane	<i>Erigeron philadelphicus</i>	N	None	None	1978
Dogtooth violet	<i>Erythronium americanum</i>	N	None	None	1978
Hollow joe-pye-weed	<i>Eupatorium fistulosum</i>	N	None	None	1978
Spotted joe-pye-weed	<i>Eupatorium maculatum</i>	N	None	None	1978

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Boneset	<i>Eupatorium perfoliatum</i>	N	None	None	1978
White snakeroot	<i>Eupatorium rugosum</i>	N	None	None	1978
Late-flowering thoroughwort	<i>Eupatorium serotinum</i>	N	None	None	1978
Spurge	<i>Euphorbia</i> sp.	U	U	U	1978
Schreber's aster	<i>Eurybia schreberi</i>	N	None	None	1978
Lance-leaved goldenrod	<i>Euthamia graminifolia</i>	N	None	None	1978
Grass-leaved goldenrod	<i>Euthamia tenuifolia</i>	N	None	None	1978
Fescues	<i>Festuca</i> spp.	I	None	None	2006
Woodland strawberry	<i>Fragaria vesca</i>	N	None	None	1978
Virginia strawberry	<i>Fragaria virginiana</i>	N	None	None	2006
Hairy galinsoga	<i>Galinsoga ciliata</i>	I	None	None	1978
Cleavers	<i>Galium aparine</i>	N	None	None	1978
Rough bedstraw	<i>Galium asprellum</i>	N	None	None	1978
Wild madder	<i>Galium mollugo</i>	I	None	None	1978
Fragrant bedstraw	<i>Galium triflorum</i>	N	None	None	1978
Biennial beeblossom	<i>Gaura biennis</i>	N	None	None	1978
Wild geranium	<i>Geranium maculatum</i>	N	None	None	1978
Small-flowered cranesbill	<i>Geranium pusillum</i>	I	None	None	1978
White avens	<i>Geum canadense</i>	N	None	None	1978
Gill-over-the-ground	<i>Glechoma hederacea</i>	I	None	None	1978
American false pennyroyal	<i>Hedeoma pulegioides</i>	N	None	None	1978
Common sunflower	<i>Helianthus annuus</i>	N	None	None	1978
Thin-leaved sunflower	<i>Helianthus decapetalus</i>	N	None	None	1978
Woodland sunflower	<i>Helianthus divaricatus</i>	N	None	None	1978
Jerusalem artichoke	<i>Helianthus tuberosus</i>	N	None	None	1978
Orange daylily	<i>Hemerocallis fulva</i>	I	None	None	1978
Daylily	<i>Hemerocallis x hybrida</i>	I	None	None	2006
Blunt-leaved hepatica	<i>Hepatica nobilis</i> var. <i>obtusa</i>	N	None	None	1978
Common cow parsnip	<i>Heracleum maximum</i>	N	None	None	1978
Dame's rocket	<i>Hesperis matronalis</i>	I	None	None	2010
Kidneyleaf mud-plantain	<i>Heteranthera reniformis</i>	N	None	None	1978
Crimson-eyed rose mallow	<i>Hibiscus moscheutos</i>	N	None	None	1978
Flower-of-an-hour	<i>Hibiscus trionum</i>	I	None	None	1978
Smoothish hawkweed	<i>Hieracium floribundum</i>	I	None	None	1978

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Mouse-ear hawkweed	<i>Hieracium pilosella</i>	I	None	None	1978
King devil	<i>Hieracium pratense</i>	I	None	None	1978
Rattlesnake weed	<i>Hieracium venosum</i>	N	None	None	1978
Azure bluet	<i>Houstonia caerulea</i>	N	None	None	1978
Orpine	<i>Hylotelephium telephium</i>	I	None	None	1978
	<i>Hypericum perforatum</i>	I	None	None	1978
Common St. Johnswort		I	None	None	1978
Spotted jewelweed	<i>Impatiens capensis</i>	N	None	None	2010
Pale jewelweed	<i>Impatiens pallida</i>	N	None	None	1978
Coast morning glory	<i>Ipomoea carica</i>	I	None	None	2006
Small red morning-glory	<i>Ipomoea coccinea</i>	I	None	None	1978
Ivy-leaved morning-glory	<i>Ipomoea hederacea</i>	I	None	None	1978
Common morning-glory	<i>Ipomoea purpurea</i>	I	None	None	1978
Common rush	<i>Juncus effusus</i>	N	None	None	2010
Wild lettuce	<i>Lactuca canadensis</i>	N	None	None	1978
Prickly lettuce	<i>Lactuca serriola</i>	I	None	None	1978
Henbit deadnettle	<i>Lamium amplexicaule</i>	I	None	None	1978
Purple deadnettle	<i>Lamium purpureum</i>	I	None	None	1978
Everlasting pea	<i>Lathyrus latifolius</i>	I	None	None	2006
Common motherwort	<i>Leonurus cardiaca</i>	I	None	None	1978
Cow cress	<i>Lepidium campestre</i>	I	None	None	1978
Roadside peppergrass	<i>Lepidium ruderale</i>	I	None	None	1978
Lespedeza	<i>Lespedeza</i> spp.	U	None	None	2006
	<i>Leucanthemum vulgare</i>	I	None	None	1978
Oxeye daisy		I	None	None	1978
Butter-and-eggs	<i>Linaria vulgaris</i>	I	None	None	1978
Indian tobacco	<i>Lobelia inflata</i>	N	None	None	1978
Great blue lobelia	<i>Lobelia siphilitica</i>	N	None	None	1978
Perennial ryegrass	<i>Lolium perenne</i>	I	None	None	2006
Birdfoot trefoil	<i>Lotus corniculatus</i>	I	None	None	1978
Ground pine	<i>Lycopodium</i> sp.	U	None	None	1978
Bugleweed	<i>Lycopus virginicus</i>	N	None	None	1978
Fringed loosestrife	<i>Lysimachia ciliata</i>	N	None	None	1978
	<i>Lysimachia nummularia</i>	I	None	None	1978
Moneywort		I	None	None	1978
	<i>Lysimachia quadrifolia</i>	N	None	None	1978
Whorled yellow loosestrife		N	None	None	1978
Prurple loosestrife	<i>Lythrum salicaria</i>	I	None	None	2010
	<i>Maianthemum racemosum</i>	N	None	None	1978
False Solomon's seal		N	None	None	1978
Musk mallow	<i>Malva moschata</i>	I	None	None	1978

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Common mallow	<i>Malva neglecta</i>	I	None	None	1978
White sweet clover	<i>Melilotus albus</i>	I	None	None	1978
Yellow sweet clover	<i>Melilotus officinalis</i>	I	None	None	1978
	<i>Menispermum</i>				
Canada moonseed	<i>canadense</i>	N	None	None	1978
Peppermint	<i>Mentha x piperita</i>	N	None	None	1978
Spearmint	<i>Mentha spicata</i>	I	None	None	1978
Virginia cowslip	<i>Mertensia virginica</i>	N	None	None	1978
	<i>Microstegium</i>				
Japanese stiltgrass	<i>vimineum</i>	I	None	None	2010
Square-stemmed monkey-flower	<i>Mimulus ringens</i>	N	None	None	1978
Heartleaf four-o'clock	<i>Mirabilis nyctaginea</i>	N	None	None	1978
Scarlet bee-balm	<i>Monarda didyma</i>	N	None	None	1978
Wild bergamot	<i>Monarda fistulosa</i>	N	None	None	1978
Indianpipe	<i>Monotropa uniflora</i>	N	None	None	1978
Common grape hyacinth	<i>Muscari botryoides</i>	I	None	None	1978
True forget-me-not	<i>Myosotis scorpioides</i>	I	None	None	1978
Watercress	<i>Nasturtium officinale</i>	I	None	None	1978
Catnip	<i>Nepeta cataria</i>	I	None	None	1978
	<i>Nuphar lutea</i> ssp.				
Bullhead-lily	<i>variegata</i>	N	None	None	1978
Common evening primrose	<i>Oenothera biennis</i>	N	None	None	1978
Sensitive fern	<i>Onoclea sensibilis</i>	N	None	None	1978
	<i>Ornithogalum</i>				
Star-of-Bethlehem	<i>umbellatum</i>	I	None	None	1978
One-flowered cancerroot	<i>Orobanche uniflora</i>	N	None	None	1978
Sweet cicely	<i>Osmorhiza claytonii</i>	N	None	None	1978
Yellow wood-sorrel	<i>Oxalis stricta</i>	N	None	None	1978
Foxglove beardtongue	<i>Penstemon digitalis</i>	N	None	None	1978
Hairy beardtongue	<i>Penstemon hirsutus</i>	N	None	None	1978
Timothy	<i>Phleum pratense</i>	I	None	None	2006
Moss phlox	<i>Phlox subulata</i>	N	None	None	1978
Common reed	<i>Phragmites australis</i>	B	None	None	2006
American lopseed	<i>Phryma leptostachya</i>	N	None	None	1978
Clammy gorund cherry	<i>Physalis heterophylla</i>	N	None	None	1978
	<i>Physalis longifolia</i>				
Smooth ground cherry	var. <i>subglabrata</i>	N	None	None	1978
	<i>Phytolacca</i>				
American pokeweed	<i>americana</i>	N	None	None	2010
Canadian clearweed	<i>Pilea pumila</i>	N	None	None	1978
Narrow-leaved plantain	<i>Plantago lanceolata</i>	I	None	None	1978

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Broad-leaved plantain	<i>Plantago major</i>	I	None	None	1978
Kentucky bluegrass	<i>Poa pratensis</i>	I	None	None	2006
Mayapple	<i>Podophyllum peltatum</i>	N	None	None	2010
	<i>Polygonatum</i>				
True Solomon's seal	<i>biflorum</i>	N	None	None	1978
	<i>Polygonum</i>				
Oriental lady's thumb	<i>cespitosum</i>	I	None	None	1978
	<i>Polygonum</i>				
Common smartweed	<i>hydropiper</i>	I	None	None	1978
	<i>Polygonum</i>				
Pennsylvania smartweed	<i>pensylvanicum</i>	N	None	None	1978
Spotted lady's thumb	<i>Polygonum persicaria</i>	I	None	None	1978
	<i>Polygonum</i>				
Arrowleaf tearthumb	<i>sagittatum</i>	N	None	None	1978
	<i>Polygonum</i>				
Virginia knotweed	<i>virginianum</i>	N	None	None	1978
	<i>Polystichum</i>				
Christmas fern	<i>acrostichoides</i>	N	None	None	1978
Common purslane	<i>Portulaca oleracea</i>	I	None	None	1978
	<i>Potentilla argentea</i>				
Silvery cinquefoil	var. <i>argentea</i>	I	None	None	1978
Dwarf cinquefoil	<i>Potentilla canadensis</i>	N	None	None	1978
Rough cinquefoil	<i>Potentilla norvegica</i>	I	None	None	1978
Rough-fruited cinquefoil	<i>Potentilla recta</i>	I	None	None	1978
Common cinquefoil	<i>Potentilla simplex</i>	N	None	None	1978
Common heal-all	<i>Prunella vulgaris</i>	N	None	None	1978
	<i>Pycnanthemum</i>				
Virginia mountainmint	<i>virginianum</i>	N	None	None	1978
Kidneyleaf buttercup	<i>Ranunculus abortivus</i>	N	None	None	1978
Common buttercup	<i>Ranunculus acris</i>	I	None	None	1978
Bulbous buttercup	<i>Ranunculus bulbosus</i>	I	None	None	1978
Fig buttercup	<i>Ranunculus ficaria</i>	I	None	None	2010
Pinnate prairie coneflower	<i>Ratibida pinnata</i>	N	None	None	2006
Black-eyed Susan	<i>Rudbeckia hirta</i>	N	None	None	2006
Green-headed coneflower	<i>Rudbeckia laciniata</i>	N	None	None	1978
Thin-leaved coneflower	<i>Rudbeckia triloba</i>	N	None	None	1978
Sheep sorrel	<i>Rumex acetosella</i>	I	None	None	1978
Smooth dock	<i>Rumex altissimus</i>	N	None	None	1978
Curly dock	<i>Rumex crispus</i>	I	None	None	2006
Broad dock	<i>Rumex obtusifolius</i>	I	None	None	1978
Broad-leaved arrowhead	<i>Sagittaria latifolia</i>	N	None	None	1978

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Bloodroot	<i>Sanguinaria canadensis</i>	N	None	None	1978
Bouncing bet	<i>Saponaria officinalis</i>	I	None	None	1978
Early saxifrage	<i>Saxafraga virginiana</i>	N	None	None	1978
Figwort	<i>Scrophularia marilandica</i>	N	None	None	1978
Mad-dog skullcap	<i>Scutellaria lateriflora</i>	N	None	None	1978
Crownvetch	<i>Securigera varia</i>	I	None	None	2010
Stringy stonecrop	<i>Sedum sarmentosum</i>	I	None	None	1978
Foxtails	<i>Setaria spp.</i>	I	None	None	1978
Japanese bristlegrass	<i>Setaria faberi</i>	I	None	None	2006
Oneseed bur-cucumber	<i>Sicyos angulatus</i>	N	None	None	1978
Sleepy catchfly	<i>Silene antirrhina</i>	N	None	None	1978
Evening lychnis	<i>Silene latifolia ssp. alba</i>	I	None	None	1978
Starry campion	<i>Silene stellata</i>	N	None	None	1978
Bladder campion	<i>Silene vulgaris</i>	I	None	None	1978
Tumble mustard	<i>Sisymbrium altissimum</i>	I	None	None	1978
Carolina horse nettle	<i>Solanum carolinense</i>	N	None	None	1978
European bittersweet	<i>Solanum dulcamara</i>	I	None	None	1978
Common nightshade	<i>Solanum nigrum</i>	I	None	None	1978
Silver rod	<i>Solidago bicolor</i>	N	None	None	1978
Blue-stemmed goldenrod	<i>Solidago caesia</i>	N	None	None	1978
Canada goldenrod	<i>Solidago canadensis</i>	N	None	None	2010
Early goldenrod	<i>Solidago juncea</i>	N	None	None	1978
Large-leaved goldenrod	<i>Solidago macrophylla</i>	N	None	None	1978
Gray goldenrod	<i>Solidago nemoralis</i>	N	None	None	1978
Rough-stemmed goldenrod	<i>Solidago rugosa</i>	N	None	None	1978
Field sow thistle	<i>Sonchus arvensis</i>	I	None	None	1978
Spiny-leaved sow thistle	<i>Sonchus asper</i>	I	None	None	1978
Rough hedge-nettle	<i>Stachys tenuifolia</i>	N	None	None	1978
Lesser stitchwort	<i>Stellaria graminea</i>	I	None	None	1978
Common chickweed	<i>Stellaria media</i>	I	None	None	1978
Heart-leaved aster	<i>Symphyotrichum cordifolium</i>	N	None	None	1978
White heath aster	<i>Symphyotrichum ericoides</i>	N	None	TU, PT	1978
Smooth aster	<i>Symphyotrichum laeve</i>	N	None	None	1978

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Lowrie's aster	<i>Symphotrichum lowrieanum</i>	N	None	None	1978
New England aster	<i>Symphotrichum novae-angliae</i>	N	None	None	1978
Crooked-stemmed aster	<i>Symphotrichum prenanthoides</i>	N	None	None	1978
Common dandelion	<i>Taraxicum officinale</i>	I	None	None	2010
Canada germander	<i>Teucrium canadense</i>	N	None	None	1978
Tall meadow rue	<i>Thalictrum pubescens</i>	N	None	None	1978
Field pennycress	<i>Thlaspi arvense</i>	I	None	None	1978
Heartleaf foamflower	<i>Tiarella cordifolia</i>	N	None	None	1978
Poison ivy	<i>Toxicodendron radicans</i>	N	None	None	2010
Virginia spiderwort	<i>Tradescantia virginiana</i>	N	None	None	1978
Yellow goat's-beard	<i>Tragopogon pratensis</i>	I	None	None	1978
Forked bluecurls	<i>Trichostema dichotomum</i>	N	None	None	1978
Rabbit's-foot clover	<i>Trifolium arvense</i>	I	None	None	1978
Alsike clover	<i>Trifolium hybridum</i>	I	None	None	1978
Red clover	<i>Trifolium pratense</i>	I	None	None	1978
Smaller hop clover	<i>Trifolium procumbens</i>	I	None	None	1978
White clover	<i>Trifolium repens</i>	I	None	None	2006
Clasping Venus's looking-glass	<i>Triodanis perfoliata</i>	N	None	None	1978
Common cattail	<i>Typha latifolia</i>	N	None	None	1978
Stinging nettle	<i>Urtica dioica</i>	I	None	None	1978
Slender nettle	<i>Urtica gracilis</i>	N	None	None	1978
Green false hellebore	<i>Veratrum viride</i>	N	None	None	1978
Moth mullein	<i>Verbascum blattaria</i>	I	None	None	1978
Common mullein	<i>Verbascum thapsus</i>	I	None	None	2006
Blue vervain	<i>Verbena hastata</i>	N	None	None	1978
White vervain	<i>Verbena urticifolia</i>	N	None	None	1978
Slender speedwell	<i>Veronica filiformis</i>	I	None	None	1978
Ivy-leaved speedwell	<i>Veronica hederifolia</i>	I	None	None	1978
Common speedwell	<i>Veronica officinalis</i>	I	None	None	1978
New York ironweed	<i>Vernonia noveboracensis</i>	N	None	None	1978
Cow vetch	<i>Vicia cracca</i>	I	None	None	1978
Creeping myrtle	<i>Vinca minor</i>	I	None	None	1978
Common blue violet	<i>Viola sororia</i>	N	None	None	1978
Striped cream violet	<i>Viola striata</i>	N	None	None	1978

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Three-lobed violet	<i>Viola trilobum</i>	N	None	None	1978
	<i>Xanthium strumarium</i>				
Cocklebur	var. <i>glubratum</i>	N	None	None	1978
Golden alexanders	<i>Zizia aurea</i>	N	None	None	1978
Vines					
Trumpet creeper	<i>Campsis radicans</i>	N	None	None	2006
English ivy	<i>Hedera helix</i>	I	None	None	1978
Japanese honeysuckle	<i>Lonicera japonica</i>	I	None	None	2010
	<i>Parthenocissus</i>				
Virginia creeper	<i>quinquefolia</i>	N	None	None	2010
Mile-a-minute	<i>Persicaria perfoliata</i>	I	None	None	2010
Frost grape	<i>Vitis vulpina</i>	N	None	None	1978
Mosses and Lichens					
	<i>Brachythecium</i>				
Rivulet brachythecium	<i>rivulare</i>	U	None	None	1972
Powderhorn lichen	<i>Cladonia coniocraea</i>	U	None	None	1972
Pyxie cup lichen	<i>Cladonia pyxidata</i>	U	None	None	1972
Pin cushion moss	<i>Leucobryum glaucum</i>	U	None	None	1972
Lichen	<i>Parmelia rudecta</i>	U	None	None	1972
Physcia lichen	<i>Physcia millegrana</i>	U	None	None	1972
Hairy-cap moss	<i>Polytrichum spp.</i>	U	None	None	1972

Source: PNHP 2010

Notes on Native or Introduced status: N = Native, I = Introduced, U = Unknown if native or introduced, B = Both (both native and introduced types of this species occur and hybridize)

Notes on Federal Status: E = Endangered, T = Threatened, U = Unknown status (not identified to species, status cannot be determined)

Notes on PA Status: E = Endangered, T = Threatened, R = Rare, V = Vulnerable, TU = Tentatively Undetermined, PE = Proposed as Endangered, PT = Proposed as Threatened, U = Unknown status (not identified to species, status cannot be determined)

TABLE 2: BIRDS IDENTIFIED ON FACILITY

Common Name	Scientific Name	Native or Introduced	Seasonal Occurrence	Federal Status	PA Status
Cooper's hawk	<i>Accipiter cooperii</i>	N	Y	None	None
Sharp-shinned hawk	<i>Accipiter striatus</i>	N	Y	None	None
Spotted sandpiper	<i>Actitis macularia</i>	N	S	None	None
Red-winged blackbird	<i>Agelaius phoeniceus</i>	N	S	None	None
Wood duck	<i>Aix sponsa</i>	N	S	None	None
Grasshopper sparrow	<i>Ammodramus savannarum</i>	N	S	None	None
Northern pintail	<i>Anas acuta</i>	N	M	None	None
American widgeon	<i>Anas americana</i>	N	M	None	None
Northern shoveler	<i>Anas clypeata</i>	N	M	None	None
Green-winged teal	<i>Anas crecca</i>	N	M	None	None
Blue-winged teal	<i>Anas discors</i>	N	S	None	None
Mallard	<i>Anas platyrhynchos</i>	N	Y	None	None
American black duck	<i>Anas rubripes</i>	N	Y	None	None
Ruby-throated hummingbird	<i>Archilocus colubris</i>	N	S	None	None
Great blue heron	<i>Ardea herodias</i>	N	Y	None	None
Lesser scaup	<i>Aythya affinis</i>	N	M	None	None
Ring-necked duck	<i>Aythya collaris</i>	N	M	None	None
Greater scaup	<i>Aythya marila</i>	N	M	None	None
Canvasback	<i>Aythya valisineria</i>	N	M	None	None
Tufted titmouse	<i>Baeolophus bicolor</i>	N	Y	None	None
Cedar waxwing	<i>Bombycilla cedrorum</i>	N	Y	None	None
Ruffed grouse	<i>Bonasa umbellus</i>	N	Y	None	None
American bittern	<i>Botaurus lentiginosus</i>	N	S	None	E
Canada goose	<i>Branta canadensis</i>	N	Y	None	None
Great horned owl	<i>Bubo virginianus</i>	N	Y	None	None
Bufflehead	<i>Bucephala albeola</i>	N	M	None	None
Common goldeneye	<i>Bucephala clangula</i>	N	W	None	None
Red-tailed hawk	<i>Buteo jamiacensis</i>	N	Y	None	None
Red-shouldered hawk	<i>Buteo lineatus</i>	N	Y	None	None
Broad-winged hawk	<i>Buteo platypteros</i>	N	S	None	None
Green heron	<i>Butoroides virescens</i>	N	S	None	None
Pectoral sandpiper	<i>Calidris melanotos</i>	N	M	None	None
Least sandpiper	<i>Calidris minutilla</i>	N	M	None	None
Semipalmated sandpiper	<i>Calidris pusillus</i>	N	M	None	None
Northern cardinal	<i>Cardinalis cardinalis</i>	N	Y	None	None
Common redpoll	<i>Carduelis flammea</i>	N	W	None	None

Common Name	Scientific Name	Native or Introduced	Seasonal Occurrence	Federal Status	PA Status
Pine siskin	<i>Carduelis pinus</i>	N	W	None	None
American goldfinch	<i>Carduelis tristis</i>	N	Y	None	None
House finch	<i>Carpodacus mexicanus</i>	N	Y	None	None
Purple finch	<i>Carpodacus purpureus</i>	N	Y	None	None
Great egret	<i>Casmerodius albus</i>	N	M	None	E
Turkey vulture	<i>Cathartes aura</i>	N	Y	None	None
Veery	<i>Catharus fuscescens</i>	N	S	None	None
Hermit thrush	<i>Catharus guttata</i>	N	S	None	None
Gray-cheeked thrush	<i>Catharus minimus</i>	N	M	None	None
Swainson's thrush	<i>Catharus ustulatus</i>	N	M	None	None
Brown creeper	<i>Certhia americana</i>	N	W	None	None
Belted kingfisher	<i>Ceryle alcyon</i>	N	Y	None	None
Chimney swift	<i>Chaetura pelagica</i>	N	S	None	None
Killdeer	<i>Charadrius vociferous</i>	N	S	None	None
Snow goose	<i>Chen caerulescens</i>	N	M	None	None
Common nighthawk	<i>Chordeiles minor</i>	N	S	None	None
Northern harrier	<i>Circus cyaneus</i>	N	S	None	None
Oldsquaw	<i>Clangula hyemalis</i>	N	M	None	None
Evening grosbeak	<i>Coccothraustes vespertinus</i>	N	W	None	None
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	N	S	None	None
Black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>	N	S	None	None
Northern flicker	<i>Colaptes auratus</i>	N	Y	None	None
Northern bobwhite	<i>Colinus virginianus</i>	N	Y	None	None
Rock dove	<i>Columba livia</i>	I	Y	None	None
Eastern wood pewee	<i>Contopus virens</i>	N	S	None	None
American crow	<i>Corvus brachyrhynchus</i>	N	Y	None	None
Fish crow	<i>Corvus ossifragus</i>	N	Y	None	None
Blue jay	<i>Cyanocitta cristata</i>	N	Y	None	None
Tundra swan	<i>Cygnus columbianus</i>	N	M	None	None
Mute swan	<i>Cygnus olor</i>	I	Y	None	None
Black-throated blue warbler	<i>Dendroica caerulescens</i>	N	M	None	None
Bay-breasted warbler	<i>Dendroica castanea</i>	N	M	None	None
Yellow-rumped warbler	<i>Dendroica coronata</i>	N	M	None	None
Prairie warbler	<i>Dendroica discolor</i>	N	S	None	None
Blackburnian warbler	<i>Dendroica fusca</i>	N	S	None	None
Magnolia warbler	<i>Dendroica magnolia</i>	N	M	None	None
Palm warbler	<i>Dendroica palmarum</i>	N	M	None	None

Common Name	Scientific Name	Native or Introduced	Seasonal Occurrence	Federal Status	PA Status
Chestnut-sided warbler	<i>Dendroica pensylvanica</i>	N	S	None	None
Yellow warbler	<i>Dendroica petechia</i>	N	S	None	None
Blackpoll warbler	<i>Dendroica striata</i>	N	M	None	E
Cape May warbler	<i>Dendroica tigrina</i>	N	M	None	None
Black-throated green warbler	<i>Dendroica virens</i>	N	S	None	None
Gray catbird	<i>Dumetella carolinensis</i>	N	S	None	None
Snowy egret	<i>Egretta thula</i>	N	M	None	None
Tricolored heron	<i>Egretta tricolor</i>	N	M	None	None
Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	N	M	None	E
Least flycatcher	<i>Empidonax minimus</i>	N	S	None	None
Horned lark	<i>Eremophila alpestris</i>	N	Y	None	None
Rusty blackbird	<i>Euphagus carolinus</i>	N	M	None	None
Peregrine falcon	<i>Falco peregrinus</i>	N	M	None	E
American kestrel	<i>Falco sparverius</i>	N	Y	None	None
American coot	<i>Fulica americana</i>	N	M	None	None
Wilson's snipe	<i>Gallinago delicata</i>	N	M	None	None
Common loon	<i>Gavia immer</i>	N	M	None	None
Common yellowthroat	<i>Geothlypis trichas</i>	N	S	None	None
Bald eagle	<i>Haliaeetus leucocephalus</i>	N	S	None	T
Barn swallow	<i>Hirundo rustica</i>	N	S	None	None
Wood thrush	<i>Hylocichla mustelina</i>	N	S	None	None
Yellow-breasted chat	<i>Icteria virens</i>	N	S	None	None
Baltimore oriole	<i>Icterus galbula</i>	N	S	None	None
Orchard oriole	<i>Icterus spurius</i>	N	S	None	None
Least bittern	<i>Ixobrychus exilis</i>	N	M	None	E
Dark-eyed junco	<i>Junco hyemalis</i>	N	W	None	None
Herring gull	<i>Larus argentatus</i>	N	M	None	None
Ring-billed gull	<i>Larus delawarensis</i>	N	M	None	None
Hooded merganser	<i>Lophodytes cucullatus</i>	N	S	None	None
White-winged crossbill	<i>Loxia leucoptera</i>	N	W	None	None
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	N	Y	None	None
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	N	Y	None	None
Swamp sparrow	<i>Melospiza georgiana</i>	N	Y	None	None
Lincoln's sparrow	<i>Melospiza lincolni</i>	N	M	None	None
Song sparrow	<i>Melospiza melodia</i>	N	Y	None	None
Common merganser	<i>Mergus merganser</i>	N	W	None	None

Common Name	Scientific Name	Native or Introduced	Seasonal Occurrence	Federal Status	PA Status
Red-breasted merganser	<i>Mergus serrator</i>	N	M	None	None
Northern mockingbird	<i>Mimus polyglottus</i>	N	Y	None	None
Black-and-white warbler	<i>Mniotilta varia</i>	N	S	None	None
Brown-headed cowbird	<i>Molothrus ater</i>	N	Y	None	None
Great crested flycatcher	<i>Myiarchus crinitus</i>	N	S	None	None
Yellow-crowned night heron	<i>Nyctanassa violacea</i>	N	M	None	E
Black-crowned night heron	<i>Nycticorax nycticorax</i>	N	S	None	E
Connecticut warbler	<i>Oporornis agilis</i>	N	M	None	None
Kentucky warbler	<i>Oporornis formosus</i>	N	S	None	None
Eastern screech owl	<i>Otis asio</i>	N	Y	None	None
Ruddy duck	<i>Oxyura jamaicensis</i>	N	M	None	None
Osprey	<i>Pandion haliaetus</i>	N	S	None	T
Northern parula	<i>Parula americana</i>	N	S	None	None
House sparrow	<i>Passer domesticus</i>	I	Y	None	None
Indigo bunting	<i>Passerina cyanea</i>	N	S	None	None
Ring-necked pheasant	<i>Phasianus colchicus</i>	I	Y	None	None
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	N	S	None	None
Downy woodpecker	<i>Picoides pubescens</i>	N	Y	None	None
Hairy woodpecker	<i>Picoides villosus</i>	N	Y	None	None
Eastern towhee	<i>Pipilo erythrophthalmus</i>	N	S	None	None
Scarlet tanager	<i>Piranga olivacea</i>	N	S	None	None
Horned grebe	<i>Podiceps auritus</i>	N	M	None	None
Pied-billed grebe	<i>Podilymbus podiceps</i>	N	S	None	None
Black-capped chickadee	<i>Poecile atricapillus</i>	N	Y	None	None
Carolina chickadee	<i>Poecile carolinensis</i>	N	Y	None	None
Blue-gray gnatcatcher	<i>Polioptila caerulea</i>	N	S	None	None
Sora	<i>Porzana carolina</i>	N	S	None	None
Purple martin	<i>Progne subis</i>	N	S	None	None
Common grackle	<i>Quiscalus quiscula</i>	N	Y	None	None
Ruby-crowned kinglet	<i>Regulus calendula</i>	N	W	None	None
Golden-crowned kinglet	<i>Regulus satrapa</i>	N	Y	None	None
Bank swallow	<i>Riparia riparia</i>	N	S	None	None
Eastern phoebe	<i>Sayornis phoebe</i>	N	S	None	None

Common Name	Scientific Name	Native or Introduced	Seasonal Occurrence	Federal Status	PA Status
American woodcock	<i>Scolopax minor</i>	N	S	None	None
Ovenbird	<i>Seiurus aurocapillus</i>	N	S	None	None
Louisiana waterthrush	<i>Seiurus motacilla</i>	N	S	None	None
Northern waterthrush	<i>Seiurus noveboracensis</i>	N	M	None	None
American redstart	<i>Setophaga ruticilla</i>	N	S	None	None
Eastern bluebird	<i>Sialia sialis</i>	N	Y	None	None
White-breasted nuthatch	<i>Sitta carolinensis</i>	N	Y	None	None
Red-breasted nuthatch	<i>Sitta canadensis</i>	N	Y	None	None
American tree sparrow	<i>Spizella arborea</i>	N	W	None	None
Fox sparrow	<i>Spizella iliaca</i>	N	M	None	None
Chipping sparrow	<i>Spizella passerina</i>	N	S	None	None
Field sparrow	<i>Spizella pusilla</i>	N	Y	None	None
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	N	W	None	None
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	N	S	None	None
Eastern meadowlark	<i>Sturnella magna</i>	N	S	None	None
European starling	<i>Sturnus vulgaris</i>	I	Y	None	None
Tree swallow	<i>Tachycineta bicolor</i>	N	S	None	None
Carolina wren	<i>Thryothorus ludovicianus</i>	N	Y	None	None
Brown thrasher	<i>Toxostoma rufum</i>	N	S	None	None
Lesser yellowlegs	<i>Tringa falvipes</i>	N	M	None	None
Greater yellowlegs	<i>Tringa melanoleuca</i>	N	M	None	None
Solitary sandpiper	<i>Tringa solitaria</i>	N	M	None	None
House wren	<i>Troglodytes aedon</i>	N	S	None	None
Winter wren	<i>Troglodytes troglodytes</i>	N	Y	None	None
American robin	<i>Turdus migratorius</i>	N	Y	None	None
Eastern kingbird	<i>Tyrannus tyrannus</i>	N	S	None	None
Barn owl	<i>Tyto alba</i>	N	Y	None	None
Golden-winged warbler	<i>Vermivora chrysoptera</i>	N	S	None	None
Tennessee warbler	<i>Vermivora peregrina</i>	N	M	None	None
Blue-winged warbler	<i>Vermivora pinus</i>	N	S	None	None
White-eyed vireo	<i>Vireo griseus</i>	N	S	None	None
Yellow-throated vireo	<i>Vireo flavifrons</i>	N	S	None	None
Red-eyed vireo	<i>Vireo olivaceus</i>	N	S	None	None
Philadelphia vireo	<i>Vireo philadelphicus</i>	N	M	None	None
Blue-headed vireo	<i>Vireo solitarius</i>	N	S	None	None
Canada warbler	<i>Wilsonia canadensis</i>	N	M	None	None
Wilson's warbler	<i>Wilsonia pusilla</i>	N	M	None	None

Common Name	Scientific Name	Native or Introduced	Seasonal Occurrence	Federal Status	PA Status
Mourning dove	<i>Zenaida macroura</i>	N	Y	None	None
White-throated sparrow	<i>Zonotrichia albicollis</i>	N	W	None	None
White-crowned sparrow	<i>Zonotrichia leucophrys</i>	N	W	None	None

Sources: National Geographic 1987, Cornell 2010, PNHP 2010

Notes on Seasonal Occurrence: Y = Year round resident, W = Winter resident, S = Summer resident, M = Spring/fall migrant only

Notes on Native or Introduced status: N = Native, I = Introduced

Notes on Federal Status: E = Endangered, T = Threatened

Notes on PA Status: E = Endangered, T = Threatened

Bird surveys were conducted from 1972 to 1985 steadily and have continued on a less regular basis to the present day. Since it is ongoing there are no last observed dates but just a running checklist. The person who collects the observations (Rob Blye of Normandeau) has observed most of these species multiple times over the years.

TABLE 3: MAMMALS IDENTIFIED ON FACILITY

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Short-tailed shrew	<i>Blarina brevicauda</i>	N	None	None	1978
Opossum	<i>Didelphis virginiana</i>	N	None	None	2006
Red bat	<i>Lasiurus borealis</i>	N	None	None	1978
Groundhog	<i>Marmota monax</i>	N	None	None	2010
Striped Skunk	<i>Mephitis mephitis</i>	N	None	None	2010
Meadow vole	<i>Microtus pennsylvanicus</i>	N	None	None	1978
House mouse	<i>Mus musculus</i>	I	None	None	1978
Long-tailed weasel	<i>Mustela freata</i>	N	None	None	1978
White-tailed deer	<i>Odocoileus virginianus</i>	N	None	None	2010
Muskrat	<i>Ondatra zibethicus</i>	N	None	None	1978
White-footed mouse	<i>Peromyscus leucopus</i>	N	None	None	2010
Eastern pipitrel	<i>Pipistrellus subflavus</i>	N	None	None	1978
Raccoon	<i>Procyon lotor</i>	N	None	None	2006
Norway rat	<i>Rattus norvegicus</i>	I	None	None	1978
Eastern mole	<i>Scalopus aquaticus</i>	N	None	None	1978
Gray squirrel	<i>Sciurus carolinensis</i>	N	None	None	2006
Eastern cottontail	<i>Sylvilagus floridanus</i>	N	None	None	2006
Eastern chipmunk	<i>Tamias striatus</i>	N	None	None	1978
Red squirrel	<i>Tamiasciurus hudsonicus</i>	N	None	None	1978
Gray fox	<i>Urocyon cinereoargenteus</i>	N	None	None	1978
Red fox	<i>Vulpes vulpes</i>	N	None	None	2010
Meadow jumping mouse	<i>Zapus hudsonicus</i>	N	None	None	1978

Source: PNHP 2010

Notes on Native or Introduced status: N = Native, I = Introduced

Notes on Federal Status: E = Endangered, T = Threatened

Notes on PA Status: E = Endangered, T = Threatened

TABLE 4: REPTILES AND AMPHIBIANS IDENTIFIED ON FACILITY

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Reptiles					
Common snapping turtle	<i>Chelydra serpentina</i>	N	None	None	2010
Eastern painted turtle	<i>Chrysemys picta</i>	N	None	None	1975
Spotted turtle	<i>Clemmys guttata</i>	N	None	None	1975
Wood turtle	<i>Clemmys insculpta</i>	N	None	None	1978
Northern black racer	<i>Coluber constrictor</i>	N	None	None	1979
Northern ring-necked snake	<i>Diadophis punctata</i>	N	None	None	1975
Northern water snake	<i>Nerodia sipedon</i>	N	None	None	1978
Stinkpot	<i>Sternotheros odoratus</i>	N	None	None	1978
Eastern box turtle	<i>Terrapene carolina</i>	N	None	None	1975
Eastern garter snake	<i>Thamnophis sirtalis</i>	N	None	None	1976
Amphibians					
American toad	<i>Bufo americanus</i>	N	None	None	1975
Fowler's toad	<i>Bufo fowleri</i>	N	None	None	1978
Dusky salamander	<i>Desmognathus fuscus</i>	N	None	None	1978
Northern two-lined salamander	<i>Eurycea bislineata</i>	N	None	None	1975
Long-tailed salamander	<i>Eurycea longicauda</i>	N	None	None	1978
Red-spotted newt	<i>Notophthalmus viridescens</i>	N	None	None	1978
Red-backed salamander	<i>Plethodon cinereus</i>	N	None	None	1975
Spring peeper	<i>Pseudacris cucifer</i>	N	None	None	1975
Red salamander	<i>Pseudotriton ruber</i>	N	None	None	1978
Bullfrog	<i>Rana catesbeiana</i>	N	None	None	1975
Green frog	<i>Rana clamitans</i>	N	None	None	2009
Pickerel frog	<i>Rana palustris</i>	N	None	None	2010
Northern leopard frog	<i>Rana pipiens</i>	N	None	None	1978

Source: PNHP 2010

Notes on Native or Introduced status: N = Native, I = Introduced

Notes on Federal Status: E = Endangered, T = Threatened

Notes on PA Status: E = Endangered, T = Threatened

TABLE 5: TERRESTRIAL INVERTEBRATES IDENTIFIED ON FACILITY

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed
Spotted apatelodes	<i>Apatelodes torrefacta</i>	N	None	N/A	2010
Clouded sulphur	<i>Colias philodice</i>	N	None	N/A	2006
Darner	Family Aeshnidae	N	U	N/A	2006
Viceroy	<i>Limenitis archippus</i>	N	None	N/A	2006
Southern dogface	<i>Phoebis sennae</i>	N	None	N/A	2006
Pearl crescent	<i>Phyciodes tharos</i>	N	None	N/A	2006
Cabbage white	<i>Pieris brassicae</i>	N	None	N/A	2006

Source: PNHP 2010

Notes on Native or Introduced status: N = Native, I = Introduced

Notes on Federal Status: E = Endangered, T = Threatened, U = Unknown status (not identified to genus or species, status cannot be determined)

Notes on PA Status: N/A = Not applicable (no PA agency has been assigned to develop regulations to protect terrestrial invertebrates although a Federal status may exist for some species)

TABLE 6: FISH IDENTIFIED ON FACILITY

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed	Area observed
Alewife	<i>Alosa pseudoharengus</i>	RI	None	None	1989	Schuylkill River
American shad	<i>Alosa sapidissima</i>	RI	None	None	1989	Schuylkill River
Rock bass	<i>Ambloplites rupestris</i>	I	None	None	2009	Schuylkill River
White catfish	<i>Ameiurus catus</i>	N	None	None	1983	Schuylkill River
Yellow bullhead	<i>Ameiurus natalis</i>	N	None	None	2009	Schuylkill River
Brown bullhead	<i>Ameiurus nebulosus</i>	N	None	None	2009	Schuylkill River
Bowfin	<i>Amia calva</i>	N	None	C	1983	Schuylkill River
American eel	<i>Anguilla rostrata</i>	N	None	None	2009	Schuylkill River
Goldfish	<i>Carassius auratus</i>	I	None	None	1988	Schuylkill River
Minnow hybrid	<i>Carassius X Cyprinus</i>	I	None	None	1983	Schuylkill River
Quillback carpsucker	<i>Carpionodes cyprinus</i>	N	None	None	1985	Schuylkill River
White sucker	<i>Catostomus commersoni</i>	N	None	None	2009	Schuylkill River
Spotfin shiner	<i>Cyprinella spiloptera</i>	N	None	None	2009	Schuylkill River
Common carp	<i>Cyprinus carpio</i>	I	None	None	2009	Schuylkill River
Creek chubsucker	<i>Erimyzon oblongus</i>	N	None	None	1983	Schuylkill River
Redfin pickerel	<i>Esox americanus</i>	N	None	None	1981	Schuylkill River
Muskellunge	<i>Esox masquinogy</i>	I	None	None	1976	Schuylkill River
Esox hybrid	<i>Esox masquinogy X E. lucius</i>	I	None	None	1985	Schuylkill River
Chain pickerel	<i>Esox niger</i>	N	None	None	1981	Schuylkill River
Tessellated darter	<i>Etheostoma olmstedi</i>	N	None	None	2009	Schuylkill River
Cutlips minnow	<i>Exoglossum maxillingua</i>	N	None	None	1985	Schuylkill River
Banded killifish	<i>Fundulus heteroclitus</i>	N	None	None	2009	Schuylkill River

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed	Area observed
Northern hogsucker	<i>Hypentelium nigricans</i>	N	None	None	2009	Schuylkill River
Channel catfish	<i>Ictalurus punctatus</i>	I	None	None	2009	Schuylkill River
Redbreast sunfish	<i>Lepomis auritus</i>	N	None	None	2009	Schuylkill River
Green sunfish	<i>Lepomis cyanellus</i>	I	None	None	2009	Schuylkill River
Pumpkinseed	<i>Lepomis gibbosus</i>	N	None	None	2009	Schuylkill River
Bluegill	<i>Lepomis macrochirus</i>	I	None	None	2009	Schuylkill River
Sunfish hybrid	<i>Lepomis</i> sp	B	None	None	2009	Schuylkill River
Common shiner	<i>Luxilus cornutus</i>	N	None	None	2009	Schuylkill River
Smallmouth bass	<i>Micropterus dolomieu</i>	I	None	None	2009	Schuylkill River
Largemouth bass	<i>Micropterus salmoides</i>	I	None	None	2009	Schuylkill River
Golden shiner	<i>Notemigonus crysoleucas</i>	N	None	None	2009	Schuylkill River
Comely shiner	<i>Notropis amoenus</i>	N	None	None	2009	Schuylkill River
Spottail shiner	<i>Notropis hudsonius</i>	N	None	None	2009	Schuylkill River
Swallowtail shiner	<i>Notropis procerus</i>	N	None	None	2009	Schuylkill River
Margined madtom	<i>Noturus insignis</i>	N	None	None	2009	Schuylkill River
Rainbow trout	<i>Oncorhynchus mykiss</i>	I	None	None	1976	Schuylkill River
Yellow perch	<i>Perca flavescens</i>	N	None	None	1988	Schuylkill River
Bluntnose minnow	<i>Pimephales notatus</i>	N	None	None	2009	Schuylkill River
Fathead minnow	<i>Pimephales promelas</i>	I	None	None	1988	Schuylkill River
White crappie	<i>Pomoxis annularis</i>	I	None	None	1987	Schuylkill River
Black crappie	<i>Pomoxis nigromaculatus</i>	I	None	None	2009	Schuylkill River
Flathead catfish	<i>Pylodictis olivaris</i>	I	None	None	2009	Schuylkill River

Common Name	Scientific Name	Native or Introduced	Federal Status	PA Status	Year last observed	Area observed
Blacknose dace	<i>Rhinichthys atratulus</i>	N	None	None	2010	Possum Hollow Run
Longnose dace	<i>Rhinichthys cataractae</i>	N	None	None	1984	Schuylkill River
Brown trout	<i>Salmo trutta</i>	I	None	None	1985	Schuylkill River
Brook trout	<i>Salvelinus fontinalis</i>	N	None	None	1987	Schuylkill River
Walleye	<i>Sander vitreus</i>	I	None	None	1986	Schuylkill River
Creek chub	<i>Semotilus atromaculatus</i>	N	None	None	2009	Schuylkill River
Fallfish	<i>Semotilus corporalis</i>	N	None	None	1988	Schuylkill River

Source: PNHP 2010

Notes on Native or Introduced status: N = Native, I = Introduced, RI = Reintroduced native, B = Both (native or introduced status depends on the species that hybridize)

Notes on Federal Status: E = Endangered, T = Threatened

Notes on PA Status: E = Endangered, T = Threatened, C = Candidate for listing (animal that could become threatened or endangered in the future due to their rarity, limited distribution, or biology)

TABLE 7: AQUATIC MACROINVERTEBRATES IDENTIFIED ON FACILITY

Genus	Year last observed
Acari	2009
Acentrella (Pseudocleoen)	2009
Acroneuria	1988
Actinobdella	1986
Agnatina (Phasganophora)	2009
Agraylea	1974
Alasmidonta	1975
Alboglossiphonia	1988
Allocapnia	1988
Allognosta	1987
Ameletus	1986
Amnicola	2009
Amphinemura	1988
Anax	1985
Ancyronyx	2009
Anodonta	1987
Anthopotamus (Potomantus)	2009
Antocha	2009
Argia	2009
Atherix	1984
Baetis	2009
Batracobdella	1987
Belostoma	1976
Berosus	2009
Caecidotea (Asellus)	2009
Caenis	2009
Calopteryx	1986
Cambarus	2009
Campeloma	1988
Ceraclea	1987
Chelifera	2009
Cheumatopsyche	2009
Chimarra	2009
Chironomini	2009
Corbicula	2009
Corydalus	1988
Crangonyx	1988

Genus	Year last observed
Dineutus	1986
Diplectrona	1984
Dromogomphus	1988
Dubiraphia	2009
Dugesia	2009
Ectopria	1985
Elliptio	1986
Enallagma	1974
Epeorus	1988
Ephemera	1976
Ephemerella	2009
Erpobdella	2009
Erythemis	1984
Eurylophella	2009
Ferrissia	2009
Gammarus	2009
Glossosoma	1988
Gomphus	2009
Goniobasis	2009
Gyraulus	1988
Helichus	1975
Heliosoma	1987
Helobdella	1988
Helophorus	1987
Hemerodromia	2009
Hexagenia	1988
Hydatophylax	1988
Hydracarina	1973
Hydrobius	1988
Hydrolimax	2009
Hydroporus	1986
Hydropsyche	2009
Hydroptila	1987
Ischnura	1988
Isonychia	2009
Isoperla	1973
Lampsilis	1985
Lanthus	1986
Lepidostoma	2009

Genus	Year last observed
Leucotrichia	2009
Leucrocuta	2009
Libellula	1987
Limnophila	1985
Limonia	1973
Lymnaea	1988
Maccaffertium	2009
Macromia	1987
Macronemum	1984
Macronychus	1988
Manayunkia	1985
Metrobates	1986
Microcyллоopus	2009
Micromenetus (Menetus)	2009
Molophilus	1987
Musculium	1988
Mystacides	1986
Nectopsyche	1984
Nematoda	2009
Nemotelus	1986
Neureclipsis	1987
Nigronia	1987
Oecetis	1988
Oligochaeta	2009
Ophiogomphus	1987
Optioservus	2009
Orconectes	2009
Ormosia	1974
Paraleptophlebia	1987
Peltodytes	1974
Pericoma	1985
Perlesta	1988
Petrophila (Paragyractis)	2009
Physa	2009
Piscicolaria	1974
Pisidium	2009
Placobdella	1984
Plauditus	2009
Polycentropus	1986

Genus	Year last observed.
Prosimulium	2009
Prostoma	2009
Protoptila	2009
Psephenus	2009
Pseudolimnophila	1975
Psychoda	1984
Psychomyia	1976
Ptilostomis	1985
Rhyacophila	1976
Sialis	1988
Simulium	2009
Sphaerium	2009
Stenacron	2009
Stenelmis	2009
Stratiomys	1987
Stygobromus	1987
Stylogomphus	2009
Stylurus	1976
Taeniopteryx	1976
Tanytarsini	2009
Telmatoscopus	1986
Tetragoneuria	1985
Tipula	1988
Triaenodes	1987
Tricorythodes	2009

2.2. Timeline of Completed Activities and Future Goals

Past:

August 2007

Erected artificial Avian and Raptor Nesting Structures (See Appendix I)

- Monitoring has been performed at least biannually on these structures

April 2009

Biodiversity evaluation of possum hollow (See Appendix J)

- No monitoring – performed an informal survey of the wildlife and aquatic life of Possum Hollow as an indication of the “environmental” health of the creek

August 2009

Fish removal to the Schuylkill River (See Appendix L)

- Monitoring takes place daily to see increase in population and will again occur when an increase is noted

December 2009

Partnership with Limerick Elementary School (See Appendix M)

- No monitoring – will review as requested or when completed

June 2010

Frog fence installation to reduce amphibian casualties (See Appendix K)

- Monitoring will take place in 1st quarter 2011 to see if any additional barriers are needed or if any need to be repositioned

Present:

October 2010

Wood duck box installation

- Monitoring will be performed biannually on these structures

November 2010

Handling of wildlife

- No monitoring will be required

Future:

February 2011

General Recycling Drive to increase Environmental Stewardship onsite

April 2011

Electronic recycling drive to remove more of the outdated electronics that are currently building onsite

May 2011

Fishing Tournament for Kids to increase Limerick's exposure to the surrounding communities

June 2011

Onsite wildlife habitat by reclamation of Land Onsite for Small Wildlife to beautify the site as well as support local small wildlife

October 2011

Bird/Bat Boxes Upgrade to increase onsite wildlife habitats by replacing or fixing currently installed bat and bird boxes

January 2011 – December 2011

Removal of non native species (Canadian Goose) to decrease the risk for a fecal coli form non-compliance

January 2011 – December 2011

PA Wildlife Rehabilitators to improve Limerick's public exposure with wildlife presentations

January 2011 – December 2012

Install an automatic sheen detector at the Hold Pond to decrease risk in the event of an oil spill

January 2011 – December 2012

Install electric hand dryers as well as touch free faucets and occupancy sensors in the office buildings onsite to decrease energy consumption

January 2011 – December 2014

Start design of new Information Center to increase Limerick's involvement with the community

3. Implementation

3.1. Mission of Limerick's Wildlife at Work program

To establish sustainable environmental stewardship through wildlife habitat enhancement, employee participation, and public outreach at Exelon Corporation's Limerick Generating Station.

- **Project 1.** Erecting Artificial Avian and Raptor Nesting Structures (See Appendix I)

Reasoning Behind Project: Throughout the nation and locally avian species have experienced significant declines. In Pennsylvania, the largest issue responsible for the decline of bird populations is extensive habitat loss and fragmentation. Limerick Generating Station property provides both grassland and forestland to support and encourage an increased number of resident songbirds and raptors.

Project's Background Information: The project involves the installation of artificial nesting structures for both song bird and raptor species. The song bird structures are installed at the northern side of the station which also serves as the main entrance. The structures are optimally located for avian use as well as visually observable by both the employees and public. Raptor structures were installed in remote areas conducive to habitation/use.

- **Objective 1** Preserve, protect and enhance nesting structures onsite for avian and raptors
 - **Prescriptions:**
 - Construct, install, monitor, record and maintain artificial nest boxes and platforms for avian species.
 - **Essential habitat Components:**
 - **Food:** The structures are located to support the natural food requirements of the species. Bird houses are adjacent to a semi-developed grass field. The field provides the habitat for various insects desired by birds. The bat, owl, and raptor structures are located in remote and forested areas to provide optimal food supplies as well.
 - **Water:** The area surrounding the station is more than adequately supplied with fresh water. Adjacent to the site is the Possum Hollow Creed as well as the Schuylkill River.

- Food: This walk down confirmed the existence of grasses, crustaceans, amphibians, and a variety of small mammal life which are in the food cycle for the wildlife which inhabit the hollow.
 - Water: This walk down confirmed Possum Hollow Creek supplies a continuous supply of fresh water. Various runoff points from plant property and the parking lot were examined to confirm they are clean and unobstructed. This creek is a tributary to the Schuylkill River and contributes fresh water to the river. The creek has sufficient erosion control by plant roots and rocks to prevent undue sedimentation and erosion from occurring.
 - Cover: Low growth shrubs, grasses, small trees and a mature hardwoods provide ample range of cover for the hollow and its inhabitants. The hollow contains several old logs and rocky areas which were in use by small mammal population. The sighting of a turkey, ground hog, and signs of deer show they are actively using the cover available to them.
 - Space: This walk down covered approximately a 6 acre sampling of a much larger space available at the power plant site for wildlife habitat.
 - **Monitoring:**
 - No monitoring – performed an informal survey of the wildlife and aquatic life of Possum Hollow as an indication of the “environmental” health of the creek.
 - Ongoing interviews with personnel who have reported the sighting of owls, bats, deer, and other wildlife.
 - Update walk downs as necessary to ensure Possum Hollow is kept free of rubbish or other debris which could deter wildlife usage of the hollow and adjoining areas.
- **Project 3.** Removal of Fish from the LGS Hold Pond (See Appendix L)

Reasoning Behind Project: The fish were removed due to there being an overabundance of fish in the area and not enough food for the population.

Project’s Background Information: The Hold Pond is located on LGS Property (map noting location is attached) as the last holding basin before water is released from site.

 - **Objective 1** Locate fish to a more suitable area to ensure continued procreation of the species.
 - **Prescriptions:**
 - Maintain habitat succession within the property to uphold and increase biodiversity on the property.
 - **Essential habitat Components:**
 - Food: Decreases the population onsite to an allowable number for the food supply available.
 - Water: Water is always present in the Hold Pond and can not be shut off, in addition it can not overflow.

- Cover: There is no cover over the pond from the Red Tail Hawk that is onsite.
 - Space: The Pond is 400,000 gallons which allows for a large size fish population to accumulate.
 - **Monitoring:**
 - Monitoring takes place daily to see increase in population and will again occur when an increase is noted.
 - The Hold Pond is expected to be seined approximately once a year when the level of fish observed increases. This area is accessed at least once a day by individuals onsite who look for an increase in population. When the population is seen to increase then fish will be relocated to the Schuylkill River. There is no means for the pond to be completely emptied and all fish removed. Also fish will continue to migrate to this pond even if the fish population was 100% removed at any one point in time.
- **Project 4.** Limerick Generating Station Outdoor Classroom (See Appendix M)

Reasoning Behind Project: Limerick Elementary School is the closest school to Limerick Generating Station and has been the focus of several outreach events over the past year including Earth Day Presentation and NA-YGN drawing contest. We have a close relationship with the school and this project will cement this relationship and allow us to enhance our visibility in the community. The school as described below has undertaken a major project to enhance an internal courtyard that was not being used for an outdoor classroom and other environmental areas including a butterfly garden and fish pond. The outdoor classroom, which we would sponsor, will be the central focus area of the courtyard and help the students learn in a new and interesting environment. This project combines two of our major contribution focus areas, education and environment, into one project.

Project's Background Information: The project is limited to the Elementary School.

 - **Objective 1** Increase environmental stewardship and energy conservation outreach.
 - **Prescriptions:**
 - Fund reeducational programs.
 - **Essential habitat Components:**
 - Food: Not Applicable.
 - Water: Pond was added.
 - Cover: Trees and shrubs were added.
 - Space: Space is an outdoor classroom.
 - **Monitoring:**
 - No monitoring – will review as requested or when completed.
 - Will support the school as needed for environmental projects pertaining to education.
- **Project 5.** Frog Fencing (See Appendix K)

Reasoning Behind Project: As part of Limerick's continued environmental biodiversity, members of the Environmental Stewardship Committee (ESC) conducted a walk down of Possum Hollow. The area's wildlife was evaluated and the eastern portion of the lower parking area was measured for a seasonal barrier to reduce the number of amphibians (frogs and toad) that attempt to cross the parking lot. A 300 foot fencing barrier along the southeastern portion of the lower parking area was installed. The purpose of the fencing is to reduce the number of amphibians that cross the parking lot during the spring. The frogs and toads attempt to cross the roadway during springtime mainly because it is mating season. Unfortunately, springtime is also outage time at Limerick and with the number of vehicles, many of the frogs and toads are unsuccessful in crossing the parking lot.

Project's Background Information: The project location was an approximate 500 ft stretch of land along the lower southeastern portion of the plant perimeter.

- **Objective 1** Reduce the number of amphibian casualties from Possum Hollow.
 - **Prescriptions:**
 - Maintain habitat succession within the property to uphold and increase biodiversity on the property.
 - **Essential habitat Components:**
 - This project was not specifically selected based on the listed habitat requirements. Instead, the project was selected based on ways to increase the survival rate and protect a specific species.
 - **Monitoring:**
 - Monitoring will take place in 1st quarter 2011 to see if any additional barriers are needed or if any need to be repositioned.
 - Future plans for this project includes:
 - Periodic inspection of the fencing integrity;
 - Assessment of the projects success; and
 - Maintenance of the fencing as needed.

4. Evaluation and Project Status

Since the Wildlife at Work program inception of the Environmental Committee at LGS there has been an increase in sensitivity for the wildlife on LGS property.

- **Project 1.** Erecting Artificial Avian and Raptor Nesting Structures (See Appendix I)
 - **Date (month/year) the project was started:**
 - August 2007
 - **Number of employees and volunteers involved in this project (include the names of organizations, agencies, or community groups involved in this project):**
 - A total of five Limerick employees participated in the installation of the various artificial habitat structures. Since that time additional personnel have participated in the monitoring of the structures.
 - **Explain whether native plantings are being used:**

- This project scope included identification of species in need for habitat structures, installation of the structures, and monitoring of the structures. No plantings were incorporated at this time.
 - **Explain whether invasive species are being controlled:**
 - No invasive species are being controlled as part of this project.
- **Project 2. Biodiversity Evaluation of Possum Hollow (See Appendix J)**
 - **Date (month/year) the project was started:**
 - April 2009
 - **Number of employees and volunteers involved in this project (include the names of organizations, agencies, or community groups involved in this project):**
 - Two employees plus one supervisor involved directly. Approximately 50-60 involved indirectly through casual reporting and feed back.
 - **Explain whether native plantings are being used:**
 - Native plantings were not added as part of this walk down effort.
 - **Explain whether invasive species are being controlled:**
 - Control of invasive species was not a direct objective of this specific project during the walk down effort.
- **Project 3. Removal of Fish from the LGS Hold Pond (See Appendix L)**
 - **Date (month/year) the project was started:**
 - August 2009
 - **Number of employees and volunteers involved in this project (include the names of organizations, agencies, or community groups involved in this project):**
 - Five individuals from Normandeau Associates, two Exelon employees were involved.
 - **Explain whether native plantings are being used:**
 - Not Applicable.
 - **Explain whether invasive species are being controlled:**
 - Not Applicable.
- **Project 4. Limerick Generating Station Outdoor Classroom (See Appendix M)**
 - **Date (month/year) the project was started:**
 - December 2009
 - **Number of employees and volunteers involved in this project (include the names of organizations, agencies, or community groups involved in this project):**
 - Three employees from the site were involved with the school.
 - **Explain whether native plantings are being used:**
 - Not Applicable.
 - **Explain whether invasive species are being controlled:**
 - Not Applicable.
- **Project 5. Frog Fencing (See Appendix K)**
 - **Date (month/year) the project was started:**
 - June 2010

- **Number of employees and volunteers involved in this project (include the names of organizations, agencies, or community groups involved in this project):**
 - A total of four employees/volunteers, including a supervisor, were involved in this project.
- **Explain whether native plantings are being used:**
 - Native plantings were not used in this project.
- **Explain whether invasive species are being controlled:**
 - The control of invasive species was not needed as part of this project.

4.1. New Projects

There are two projects that are left to be implemented in 2010. They are the wood duck box installation and handling of wildlife.

Project #1 Wood Duck Box Installation

Time Frame: September – October 2010
 Persons Involved: Ed Kriner, Jeremy Thoryk, Leanne Birkmire, Tom Rohlfig, Maricarmen Trexler
 Any outstanding issues: Prep work on 6 Wood Duck Boxes, fill out digging permit, exact installation date TBD
 Completed: All materials have been purchased and directions on installation are complete

Project #2 Handling of wildlife

Time Frame: October – November 2010
 Persons Involved: Ed Kriner, Lisa MacDonald, Leanne Birkmire, Tom Rohlfig, Lamar Weikel
 Any outstanding issues: Need to identify vendor for wildlife handling
 Completed: Group that is interested on learning on how to handle wildlife that has been injured at home or work has been identified.

There are ten proposed projects for 2011 and beyond which are as follows:

Project #1 Start design of new Information Center

Mission/Benefit:

Increase Limerick's involvement with the community.

Method:

Repair the information center, design a new layout for technology exhibits, and then implement the new designs in order to make the information center a hub for the community and for Exelon Nuclear Environmental Stewardship.

Total Cost of Activity:

\$20,000 for 2011 for design phase, total cost of project unknown at this time expected to take 3-4 years to complete.

Project #2 General Recycling Drive

Mission/Benefit:

Increase Environmental Stewardship onsite.

Method:

Take part in Nike's shoe recycling drive.

Total Cost of Activity:

\$1,000 for mailing of the sneakers.

Project #3 Electronic recycling drive

Mission/Benefit:

Remove more of the outdated electronics that are currently building onsite.

Method:

Hire a company to remove all of Limerick's electronic waste.

Total Cost of Activity:

\$5,000 for the cost of recycling.

Project #4 Fishing Tournament – Kids

Mission/Benefit:

Increase Limerick's exposure to the surrounding communities.

Method:

Sponsor a local fishing tournament (Boyertown Rod and Gun Club).

Total Cost of Activity:

\$2,500 for fish stocking and prizes for the kids.

Project #5 Onsite wildlife habitat

Mission/Benefit:

Reclamation of Land Onsite for Small Wildlife to beautify the site as well as support local small wildlife.

Method:

Onsite support as well as local organizations (i.e. Boy Scouts) to plant trees and bushes around the Exelon sign at the entrance to LGS or around the information center.

Total Cost of Activity:

\$2,500 for material

Project #6 Removal of non native species (Canadian Goose)

Mission/Benefit:

Removal of an invasive species from the Bradshaw Dam. The increase of these species at a location that is normally unoccupied has increased the risk for a fecal coli form non-compliance. Discussions with PADEP indicate a favorable agreement for removal.

Method:

Hire a company to police the area with a dog on a rotational basis to drive away the geese.

Total Cost of Activity:

\$6,000 for one year

Project #7 Bird/Bat Boxes Upgrade

Mission/Benefit:

Increase onsite wildlife habitats by replacing or fixing currently installed bat and bird boxes.

Method:

Limerick's Environmental Stewardship council to perform the work.

Total Cost of Activity:

\$1,000 for materials and supplies.

Project #8 PA Wildlife Rehabilitators

Mission/Benefit:

Improve Limerick's public exposure with wildlife presentations.

Method:

To work with a local wildlife rehabilitation such as Hawk Mountain and sponsor live wildlife presentations at local schools and events.

Total Cost of Activity:

\$2,000 for approximately 8 events.

Project #9 Sheen sluth for Holding Pond

Mission/Benefit:

Install an automatic sheen detector to decrease risk in the event of an oil spill.

Method:

Install an oil sheen detection system to enhance detectability at all times even at night.

Total Cost of Activity:

\$75,000 including cost of engineering.

Project #10 Decrease Energy Consumption

Mission/Benefit:

Decrease energy consumption at LGS.

Method:

Install electric hand dryers as well as touch free faucets and occupancy sensors in the office buildings onsite.

Total Cost of Activity:

\$40,000 including cost of installation.

5. Documentation

- Appendix A – Application Pictures
- Appendix B – Site Overview Questionnaire
- Appendix C – Reference Questionnaires
- Appendix D – Media Information Sheet
- Appendix E – 2006 WHC Site Assessment
- Appendix F – 2008 Environmental Stewardship Committee Minutes
- Appendix G – 2009 Environmental Stewardship Committee Minutes
- Appendix H – 2010 Environmental Stewardship Committee Minutes
- Appendix I – Bird and Bat House Project Summary
- Appendix J – Possum Hollow Walkdown Project Summary
- Appendix K – Frog Fence Outreach Project Summary
- Appendix L – Fish Project Summary

Appendix M	–	Environmental Outreach Project Summary
Appendix N	–	Habitat Pictures
Appendix O	–	Water Diversion
Appendix P	–	Frick's Lock
Appendix Q	–	LGS Environmental Stewardship Training

E2-35: Enclosure 2: Terrestrial Ecology, item H

Wildlife Habitat Council (WHC). 2006. Site Assessment and Wildlife Management Opportunities. 100 pp. LGS-R-278.

Exelon Response

The requested document is provided.



WILDLIFE HABITAT COUNCIL™

**SITE ASSESSMENT AND
WILDLIFE MANAGEMENT
OPPORTUNITIES
FOR
EXELON CORPORATION'S
LIMERICK GENERATING STATION**

Report submitted to:

**LIMERICK GENERATING STATION
EXELON CORPORATION
Limerick, Pennsylvania**

Report submitted by:

**WILDLIFE HABITAT COUNCIL
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AUGUST 2006

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With further assistance from the staff of the Wildlife Habitat Council

The Wildlife Habitat Council (WHC) commends EXELON CORPORATION for its commitment to improving habitat for wildlife through the initiation of a wildlife habitat enhancement program at the LIMERICK GENERATING STATION.

We thank Jim Bolte and Lamar Weikel for their hospitality during WHC's site visit.

The WILDLIFE HABITAT COUNCIL (WHC) is an independent, nonprofit assemblage of corporations, conservation organizations, and individuals dedicated to protecting and enhancing wildlife habitat.

Created in 1988 and based in the greater Washington DC area, WHC strives to promote responsible environmental stewardship within the corporate management culture through the provision of expertise and resources to companies concerned with the protection of wildlife habitat on private landholdings. Over two million acres of private land is currently managed for wildlife through WHC-assisted projects in North America and around the world.

WHC also works to broaden understanding of wildlife values through the incorporation of environmental education, volunteer participation, and community outreach programs.

NONDISCLOSURE STATEMENT

This document contains confidential and proprietary information. WHC will not distribute this report to others without express written consent from Exelon Corporation. We also recommend that discretion be used when distributing this document to others.

This report is intended solely as a guidance tool for implementing wildlife habitat enhancement programs on corporate sites. WHC therefore cannot assume responsibility for local, state, and federal regulatory programs and authorizations. WHC strongly recommends that site managers consult with state and federal experts with regard to regulatory requirements in the region prior to implementing any activity in a regulated habitat. WHC can assist with the identification of appropriate regulatory contacts, if necessary.

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EXECUTIVE SUMMARY

The Wildlife Habitat Council's (WHC) *Wildlife at Work*SM program focuses on involving company employees, community members, conservation organizations, and government agencies in the long-term, active management of company property to improve wildlife habitat and raise environmental awareness. Exelon Corporation and other private landowners play a significant role in species conservation. It has recently been estimated that traditional reserves such as parks, wildlife refuges, and other designated natural areas will, at best, secure roughly five percent of the world's species (Rosenzweig, 2003). Creation of wildlife habitat in and around areas that also feature economic activities can promote biodiversity conservation at local, regional, and even global scales.

Exelon Corporation joined the Wildlife Habitat Council as a one-year member in March 2005, further exemplifying a company-wide commitment to investigating and improving wildlife habitat conditions through the classification, understanding and potential enrichment of habitat areas within the company's landholdings. The following excerpt, which further illustrates a corporate commitment to sustainable business, is taken directly from the Exelon Corporation web site:

“Exelon understands that being a business leader involves more than being a reliable provider of energy services. It also means being an important part of the communities we serve and working to sustain our environment. We recognize the importance of balancing the need for reliable energy with our responsibility to ensure that the quality of our environment is preserved. We have partnered with many environmental stakeholders to create and support environmental preservation initiatives, we are committed to using technology to more effectively utilize our limited natural resources and to minimize the production of waste, we continuously seek to improve our work practices to further ensure the integrity of the environment, and we are pursuing how we can create value for our shareholders through environmental performance in order to ensure economic growth and environmental sustainability for future generations.”

The Limerick Generating Station is the seventh site to begin participation in WHC programs. WHC believes that, through continued partnership with this organization and with other interested groups and agencies, Exelon's Limerick Generating Station can realize a multitude of benefits including habitat preservation and enhancement, protection of local biodiversity, expansion of positive relationships with the surrounding community, and increases in the amount and extent of positive PR surrounding the site; and thereby continue to demonstrate leadership throughout the community.

Induction into the *Wildlife at Work* program will enable the Wildlife Habitat Council to assist employees at the Limerick Generating Station in their efforts to improve wildlife habitat at the site. Furthermore, partnership with WHC provides Exelon Corporation with an opportunity to demonstrate responsible corporate environmental stewardship by formulating and implementing a balanced and operative wildlife management program.

To assist in the development of a biodiversity assessment and wildlife habitat management plan, representatives from the Limerick Generating Station invited a WHC biologist to visit the site on June 28, 2006. This report, *Site Assessment and Wildlife Management Opportunities for Exelon Corporation's Limerick Generating Station*, was created with information compiled from the site visit, discussions with employees, and independent research. It is intended to present and outline historical and current information pertaining to the ecological communities surrounding the Limerick facility, focusing on a review of critical habitats and species on site, while outlining opportunities for future enhancement recommendations that are designed to augment food, water, cover, and space resources – the four basic components species require from their habitat. The “Wildlife Team” – or assemblage of interested employees and community members - may choose to implement any projects deemed appropriate for the property, and are encouraged to explore additional habitat enhancement opportunities in the future. Projects suggested for the Limerick Generating Station Wildlife Team to consider in the future include:

- Identifying and managing any invasive, exotic species on site;
- Use Best Management Practices of Right-of-Ways and linear corridor habitats throughout the site,
- Enhancing riparian habitats for wildlife,
- Partnering with neighboring land managers to enhance early successional, grassland habitats for local wildlife species including birds, mammals and pollinators,
- Considering the creation of a nest box monitoring program for cavity nesting species including songbirds, raptors and bats,
- Planning and initiation of habitat enhancement projects to benefit native amphibian and reptile species.

The program started at the Limerick Generating Station will be eligible to apply for Habitat Program Certification through the Wildlife Habitat Council when at least one habitat enhancement project has been implemented and monitored for a minimum of one year. WHC's *Corporate Wildlife Habitat Certification/International Accreditation* program is designed to recognize exceptional corporate wildlife habitat programs and supply third-party credibility for environmental stewardship. As WHC Habitat Certification review procedures are rigorous, employees and volunteers at the Limerick Generating Station are advised to keep textual and photographic documentation of site habitat enhancement projects and public outreach programs in order to increase its prospects for certification.

Wildlife habitat enhancement, employee participation, and public outreach are the primary objectives of the *Wildlife at Work* program. WHC is confident that employees at the Limerick Generating Station can achieve these goals through the assessment of resources available to wildlife on site, the planning and development of a wildlife habitat management

plan to govern open areas of the property, and the implementation of appropriate habitat enhancement projects.

The staff members of the Wildlife Habitat Council commend employees at the Limerick Generating Station for their demonstrated commitment to protecting biodiversity and improving site wildlife habitat resources through the implementation of a team-designed wildlife habitat management plan, and anticipate the formation of a sustained association with site participants. Please contact Sue Wolinsky or WHC staff with inquiries regarding the wildlife management plan, additional habitat enhancement opportunities, and WHC certification procedures.

1. OVERVIEW

WHC requires a site visit by a staff wildlife biologist prior to recommending a wildlife habitat management plan, and prior to offering site assessment and characterization information. The purpose of the site visit is to accurately assess the current habitat conditions of the site and to subsequently determine which habitat enhancement projects would be most appropriate for these particular conditions in accordance with management objectives. Therefore, it is standard procedure during the site visit that the visiting WHC biologist meet with company personnel to ascertain the objectives of the site's wildlife program and to present initial habitat enhancement opportunities. This overview contains the proceedings of the site visit, as well as a detailed site description and review of local area cultural and natural history.

Figure 1. Limerick Generating Station Entrance Road

Photo by Sue Wolinsky, WHC Wildlife Biologist/Certification Program Manager

1.1 SITE VISIT

On June 28, 2006, WHC Wildlife Biologist/Certification Program Manager Sue Wolinsky and WHC Wildlife Biologist Julie Kates met with Exelon Corporation representatives Jim Bolte and Lamar Weikel to discuss site biodiversity and wildlife habitat opportunities at the Limerick Generating Station. Following arrival on site, Mr. Bolte, Mr. Weikel, Ms. Kates and Ms. Wolinsky met with site representatives to review and discuss the site map over lunch. After lunch the group conducted a comprehensive tour of the Limerick Generating Station property, including areas bordering Possum Hollow Creek, spray ponds, property along the Schuylkill River, areas adjacent to the sewer plant, pump stations, holding ponds, and filling yards.

Figure 2. Flooded Riparian Corridor Habitat at the Limerick Generating Station

Photo by Sue Wolinsky, WHC Wildlife Biologist/Certification Program Manager

In addition, the group assessed ballfields, switchyards, the property and parking lot near the training facility and information center, areas of mowed lawn as well as other un-maintained edge habitats, grasslands, riparian corridors, and woodlands on site. The group walked a majority of the property, discussing the layout of buildings and operations in relation to the undeveloped, potential habitat areas.

Figure 3. Parking Lot Adjacent to ROW

Photo by Sue Wolinsky, WHC Wildlife Biologist/Certification Program Manager

1.2 SITE DESCRIPTION

Exelon Corporation's Limerick Generating Station, which employs approximately 800 employees, is located on approximately 600 acres in Montgomery County, Pennsylvania. The Limerick facility is approximately 40 miles northwest of Philadelphia in southeastern Pennsylvania. Neighboring land uses include light residential development, in a largely rural setting of woodlands, old fields and agricultural lands. The site is also cut by a variety of linear corridors, including utility distribution ROWs and railroad tracks.

The facilities, offices and operational areas at the Limerick Generating Station take up a large percentage of the site's total acreage. Facilities include the generators, administrative office buildings, operations buildings, a training facility and an information center. The facilities reactors, Unit 1, which was built in 1986 and Unit 2, which was built in 1990, are licensed to operate until 2024 and 2029, respectively (www.exeloncorp.com).

The Limerick Generating Station property offers a variety of habitat resources and wildlife habitat enhancement potential throughout its undeveloped acreage. Habitat types on site noted during the site visit include wooded riparian corridors, early-successional old fields and grasslands, as well as ponds and water resources. Additional habitat enhancement opportunities exist, not only within these habitats, but also in the more formally landscaped and mowed lawn portions of the site.

1.3 SITE HISTORY AND COMMUNITY BACKGROUND

Exelon Corporation's Limerick Generating Station lies in an area that was likely historically forested before being cleared for agricultural purposes, as is the case with much of the landscapes common throughout southeastern and central Pennsylvania. Today, cleared forestlands often include stands of young to mature trees as well as edge habitats and grasslands that include a variety of native species and colonizing weed species, some of which are invasives and others are considered somewhat naturalized although they are not native. Cooling water collected for site operations is drawn from the Schuylkill River. According to the site's web page "both of Limerick's units are boiling water reactors designed by General Electric", with each able to generate energy for over two-million typical homes (www.exeloncorp.com). Energy resources generated on site are then distributed throughout southeastern Pennsylvania, New Jersey and Maryland.

Figure 4. Satellite Image Depicting Limerick Township

Satellite imagery courtesy of City-data.com

The Limerick facility is located approximately two miles southeast of Pottstown, which is within Montgomery County, Pennsylvania. Limerick Township, which the facility is within, is the second largest municipality within Montgomery County (www.limerickpa.org).

Figure 5. Limerick Township Map

Map courtesy of City-data.com

In addition to lying within Limerick Township, the facility is within the boundaries of Montgomery County. The County Seat of Montgomery County is Norristown, Pennsylvania. According to US Census information, the county was occupied by an estimated 750,097 people in 2000, making it the third largest county in the Commonwealth. Estimates for 2005 indicate a population growth to about 795,618 people. The county, which was originally part of Philadelphia County, was officially created on September 10, 1784.

According to the United States Census Bureau, the county has a total area of 487 square miles; with approximately 483 square-miles being classified as terrestrial resources and the remaining area consisting of water resources., making it a valuable County to wildlife species as well.

2. BIODIVERSITY ASSESSMENT OF THE LIMERICK GENERATING STATION

Preservation of natural biodiversity has long been a global priority, and WHC supports Exelon Corporation's desire to understand site biodiversity and create an effective wildlife habitat management and biodiversity protection plan. Biodiversity is defined in general as the number and variety of living organisms, and is often assessed by documenting the species composition and defining characteristics of a habitat. In addition, through the following sections WHC will link site habitat conditions and biological information to state and national conservation efforts.

To support wildlife conservation projects at the state level, each state offers a variety of potential funding sources, or grants, for sound wildlife management projects. However, in order to more accurately identify project priorities, wildlife needs, and current habitat influences, Congress has required every state to complete a Comprehensive Wildlife Conservation Strategy. The completed Strategy addresses statewide conservation concerns in an effort to make better use of federal funds that are appropriated to conservation projects. Each state-specific strategy assesses the condition of wildlife in the state, the extent and condition of habitats in the state, specific management problems, existing information gaps and future research needs, actions recommended to conserve species and the habitats over time, and potential project partners.

Furthermore, Congress identified eight elements that must be addressed in each state's Strategy. These elements include: specific data on species abundance and distribution; the description, location, and condition of habitats and natural communities; a description of the problems that face wildlife managers and ways to prioritize problems; recommendations for conservation actions; proposed monitoring plans; a description of procedures used to evaluate and improve the Strategy over time; plans for coordinating every aspect of the Strategy within the state; and an affirmation that at each step in the formulation of the plan,

public participation has been a priority. Taken together, the assemblage of these state plans creates a national assessment of species, habitats, and wildlife needs.

Pennsylvania's Comprehensive Wildlife Conservation Strategy (CWCS) was drafted through collaboration between the Pennsylvania Game Commission (PGC), the Pennsylvania Fish and Boat Commission (PFBC) and numerous other state agencies, wildlife managers and partnering organizations. "The Goal of the Strategy is to preserve Pennsylvania's native wildlife and habitats through proactive measures emphasizing voluntary and incentive-based programs" (PA-CWCS, 2005). The plan was submitted to the U.S. Fish and Wildlife Service (USFWS) in 2005. Although in complete, drafted form, in order to be most effective and sustainable over time, the Strategy will regularly be evaluated and improved upon. The entire Comprehensive Wildlife Conservation Strategy is available for download through the following link: <http://www.pgc.state.pa.us/pgc/cwp/view.asp>.

2.1.1 Description of Ecoregion

The United States Department of Agriculture (USDA) uses a land classification system of terrestrial ecoregions as described by Robert G. Bailey (Bailey 1995). This classification of terrestrial ecoregions is hierarchical, and is based on elements of climate, geology, topography and vegetation. This widely recognized system separates the U.S. into large Domains, followed by Divisions. Both Domains and Divisions are described based on broader ecological and climatological characteristics. Divisions are more specifically delineated in the Province classification, and each Province is further classified into several more descriptive Sections. This classification system is useful in demonstrating historic natural, biological systems present in each region.

For Bailey's purposes, Exelon's Limerick Generating Station is located within the Humid Temperate Domain, which is characterized by four pronounced seasons. This Domain supports forests of broadleaf deciduous and needleleaf evergreen trees. Within this domain, the site sits in the Eastern Broadleaf Forest (Oceanic) Province, and nearly adjacent to the Central Appalachian Broadleaf Forest – Coniferous Forest – Meadow Province. **Figure 6** provides an overview of where the Limerick facility sits in relation to Bailey's ecoregion

designations. A list of wildlife species common in this ecoregion, and in the transitional ecosystems that occupy this particular area, is provided in **Appendix II** of this report. The Eastern Broadleaf Forest Province extends from northern Maryland to southern Maine, covering portions of seven states and including ecosystems such as those characteristic of the Appalachian plateau, New England lowland, Mid-Atlantic coastal plains, and piedmont plateau. Appalachian oak forests are the dominant forest type, with an abundance of white oak and red oak. These areas are described as being slightly hilly to mountainous and range in altitude from approximately 1,000 feet to more than 3,000 feet.

Figure 6. Limerick Generating Station Ecoregion Map

Map by Tanya Lubansky, WHC Research Assistant

Deciduous forests dominated by a dense population of broadleaf, canopy-forming species are common throughout the region. Densely foliated trees prosper throughout spring and summer, then shed their leaves in fall; in the spring that follows the winter season, low-growing forbs and small shrubs are permitted to prosper, while broad-leaved trees reconstruct the forest canopy. Forest vegetation throughout the region has been described by the Forest Service as being part of one of three distinct types: mixed mesophytic forest, Appalachian oak forest, and pine-oak forest. According to the Forest Service, mixed mesophytic forests are typically characterized by the greatest species diversity of any forest association within the province. This type of forest is generally found within moist, well-drained areas of the Appalachian plateau. Typical vegetation in this area includes American beech, tuliptree (**Figure 7**), sugar maple, sweet buckeye, eastern hemlock, many oaks (particularly red and white), as well as several types of basswood. In areas where these indicator species are identified, there are often at least an additional 20 to 30 vegetative species present.

Figure 7. Tuliptree Bark and Leaf Example

Photo by Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database

Appalachian oak forests are generally found in areas just east of the mountain range and are typified by a diversity of oaks, such as northern red oak and white oak. The American chestnut was formerly an important member of forest communities in this forest type; a chestnut blight introduced from China wiped out the population during the early part of the twentieth century. American chestnuts are still known to sprout from existing root systems, but few trees reach maturity. Several American chestnut reforestation programs, such as the one sponsored by the American Chestnut Foundation, currently assist landowners in the re-establishment of these trees, planting new strains of the species that are engineered to be infallible to the blight.

Pine-oak forests, also known commonly as Pine Barrens, are also found within dry, sandy soils in the region. The remaining portions of this forest type are most often found in coastal areas of the ecoregion and along the Northern Coastal Plain. Pine Barrens habitat is characteristic of Exelon Corporation's Oyster Creek Generating Station, which is located in New Jersey. This type of forest cover, featuring a diverse population of shrub undergrowth, also frequently features Atlantic white cedar swamplands. In addition, there are transitional habitats in areas of this ecoregion between southern oak-hickory forests and northern, mixed hardwood-conifer forests. Southern tree species, such as sweet gum, river birch, Spanish oak, and red mulberry, are near their northern range limits in this region. Species composition of vegetative communities varies depending on the local climatic and soil conditions of each specific area.

The Eastern Broadleaf Forest (Oceanic) Province has relatively high species richness, due in part to the presence of a diversity of mesophytic vegetation as well as pockets of specialized hydrophytic (water-dependant) and xerophytic (drought tolerant) vegetation that have specific soil moisture requirements. The ecoregion reportedly supports more than 750 species, including at least seven species that are considered to be endemic to the region. The Northern Coastal Forests ecoregion lies along a major corridor for migratory birds, the Atlantic Flyway, and also includes many important foraging and nesting areas for shorebirds and songbirds. It ranks first among 18 similarly classified ecoregions in terms of bird species diversity, supporting more than 250 species of birds. The ecoregion also provides a

significant amount of habitat for the bog turtle, whose northern subspecies is a candidate for listing as a federally threatened species.

Unfortunately, few examples of intact Eastern Broadleaf Forest (Oceanic) Province habitat remain. Eastern forests have been intensively harvested since the earliest colonists settled in the area. More than 98 percent of natural habitat has been lost to human development. Existing habitat remnants are highly fragmented with little connectivity between habitat patches. The ecoregion is devoid of old growth forest, and there are no intact habitat remnants greater than 96.5 square miles. Important areas of intact habitat include the 1,700-acre Devil's Den Nature Preserve in Connecticut, the 7,956-acre Cape May National Wildlife Refuge in southern New Jersey, and the 3,000-acre Great Swamp Management Area in Rhode Island.

The Omernick Classification, which is accepted and used by the U.S. Environmental Protection Agency (EPA), also includes variable such as land use and demography in its classification system, making a useful indicator of current land use and present habitat extent and condition. Omernick's classification places the Limerick Generating Station in the Ridge and Valley Ecoregion. This ecoregion is described as having a diversity of habitat and wildlife values, which occur between generally higher, more mountainous terrain. According to Omernick's assessment, approximately half of the ecoregion remains forested, as it was historically.

In addition to these classification systems, the Pennsylvania State Plan also identifies, describes and characterizes the condition and extent of various habitat types that have been identified throughout the state. The Strategy attempts to apply a statewide, integrated approach to perspectives and management efforts governing the state's fish and game populations. The CWCS also presents geographic information, species information and identifies habitat priorities in order to inspire comprehensive results in fish and wildlife habitat conservation. To achieve on the ground results, the Strategy recommends that "regional and local conservation organizations partner to identify priority species and habitats that fall within their jurisdiction, set goals and objectives for their organization's

involvement, identify local issues and opportunities, and develop strategies for implementing local conservation actions” (PA-CWCS).

2.1.2 Watershed Description

In addition to being located in the Eastern Broadleaf Forest (Oceanic) Province, Exelon Corporation’s Limerick Generating Station is situated within the Schuylkill River Watershed, which is illustrated in **Figure 8**. The Schuylkill River Watershed is managed through the Schuylkill Watershed Conservation plan, which was developed through the cooperative efforts of many Pennsylvania State departments and agencies as well as through collaboration with organizational partners including the Conservtion Fund, Natural Lands Trust and local groups such as the Schulykill Riverkeepers and Schuylkill River Greenway Association. The Plan sets forth the following goals for watershed management:

- Identify conservation issues important to local communities and governing agencies,
- Conduct a broad scale inventory and assessment of land and water resources to establish priorities;
- Make recommendations for a watershed-wide conservation agenda to guide future studies and actions at the site-specific, local community level; and
- Make recommendations for a management structure to implement the recommendations of the report.

Figure 8. Schuylkill River Watershed Map

Map excerpted from the Schuylkill River Watershed Conservation Plan

The watershed itself includes portions of the following counties: Schulykill, Berks, Montgomery, Chester, Philadelphia, Carbon, Lehigh, Lebanon, Lancaster, Bucks and Delaware. According to information summarized in the Schuylkill Watershed Conservation Plan, the watershed is approximately 80 miles long and 25 miles wide, and encompasses an area of approximately 1,916 square miles.

Land uses throughout the watershed are varied, and include areas of forestlands, former and active agricultural lands, abandoned iron and coal mines, residential developments and industrial locations. According to the Schuylkill River Conservation Plan (2001), "Forest cover in the Schuylkill subwatersheds in the early 1990s ranged from over 70 percent forest cover in Schuylkill County and a few other isolated areas to less than 33 percent in agricultural and developed sections." Other than development of lands for agricultural, residential, commercial and industrial purposes, watershed quality and habitat availability are being altered by the persistent encroachment of several non-native and invasive plant species and pathogens. "There are also imbalances in the watershed's fauna, including localized increased in deer density that affect habitat quality for other animals and plants, and the invasion of exotic species such as the gypsy moth and the Asiatic earthworm" (SWCP, 2001).

In order to improve water quality and the productiveness of both terrestrial and aquatic ecosystems within and around the river, the Schuylkill River Watershed Conservation Plan (2001) identifies the following watershed management recommendations:

- Implement urban best management practices to maximize the infiltration of water and reduce urban non-point source pollution,
- Encourage homeowners and small businesses to reduce non-point pollution,
- Implement nutrient management practices,
- Implement agricultural best management practices,
- Implement timber harvesting best management practices,
- Protect and restore riparian forest buffers,
- Protect and restore wetlands and areas of hydric soils,
- Identify and enforce sediment and erosion control problems and violations,
- Establish uniform, watershed-wide criteria for permitted discharges from sewage treatment plants,
- Monitor nutrients from all sewage treatment plants,
- Promote tertiary treatment of sewage effluent,

- Identify and control discharges of untreated sewage from “wildcat systems” and combined sewer overflows (CSOs),
- Establish septic education, registration, inspection, and maintenance programs,
- Size and maintain culverts and bridges to ensure minimal impact to streams; and,
- Conduct inventories and studies to identify and remove dams where restoration benefits outweigh present uses and effects.

2.1.3 Climatic Conditions

The Eastern Broadleaf Forest (Oceanic) Province ecoregion lies within what scientists have termed the Humid Temperate Domain. Climatic conditions of the domain are influenced by both tropical and polar air masses due to its location in the middle latitudes. Strong annual, continental climate cycles of temperature and precipitation result in pronounced seasons throughout the domain, including a distinctive winter season that tropical climates lack. The Humid Temperate Domain is split into six divisions based on the varying influence of winter frost: warm continental, hot continental, subtropical, marine, prairie, and Mediterranean. The Limerick Generating Station is located in the Hot Continental Division.

Average annual temperatures in this division reportedly range between 40° Fahrenheit and 60° Fahrenheit. Precipitation in the province generally measures between 35 inches to more than 60 inches annually, typically with regular, measurable precipitation year-round. Although there is frequently precipitation year-round, summertime droughts are not uncommon in many portions of the division.

2.1.4 Soil Conditions

There are eleven major soil groups recognized in the world soil classification system that are characterized, described, and mapped based on the presence or absence of distinctive horizons, or layers, commonly present in the soil for any given location. Alfisols are the predominant soil order in the Eastern Broadleaf Forest (Oceanic) Province and are characterized by the presence of an accumulation of silicate clays within the soil, in what is termed the argillic horizon.

This soil type is predominant beneath deciduous forests within the Humid Temperate Domain. In addition, alfisols reportedly make up approximately 13.4 percent of the land area within the United States and are most often found within croplands and forests in the region. Alfisols are common throughout the Midwest, in Ohio, Indiana, Wisconsin, Minnesota, and Michigan; however, they are also found in a narrow belt east of the Mississippi River, where they formed in loess, or silt. Alfisols are generally described as moderately weathered, with a medium to high base of soil saturation.

2.1.5 Ecological Communities Described On Site

The Eastern Broadleaf Forest (Oceanic) Province supports diverse grassland and forestland habitats. Furthermore, the USDA places central and southern portions of Pennsylvania within Plant Hardiness Zone Six. The USDA's Plant Hardiness Zones are determined based on each area's average minimum winter temperature. Zone Six reportedly has average minimum winter temperatures of between -10° Fahrenheit and 0° Fahrenheit. The American Horticultural Society (AHS) has also developed a system to identify plant hardiness and, therefore, planting recommendations based on the determination of heat zones within the nation. Heat zones are calculated based on the average number of days the temperature exceeds 86° Fahrenheit each year. This system places central and southern Pennsylvania in AHS Heat Zone Six, meaning that there are typically an average of between 45 and 60 days each year that exceed 86° Fahrenheit. Knowing both the USDA Plant Hardiness Zone and AHS Heat Zone for a given area can assist planners when determining what type of plant species will most likely be identified within, and most easily readily adapt and thrive, on site.

While it is important to understand and consider area temperatures and soil condition, the diversity of vegetative communities will also depend on precipitation amounts, which vary regionally. Within Exelon's corporate landholdings at the Limerick Generating Station, there are a diversity of habitat types including grassy and shrubby rights-of-way, other managed landscapes including the mowed lawns adjacent to facility operations buildings, unmanaged old field and early successional grasslands, riparian corridor resources that are providing early

successional habitat, shrub-scrub communities, and forested resources as well as drier upland woodlands, pond habitats and wetland areas. These habitat types and the species associated with them are discussed in greater detail in the following sections.

2.1.5.1 Right-of-Ways and Linear Landscapes

The Limerick Generating Station has a number of right-of-ways that pass through the property, distributing power from the plant to the community. In addition, there are railroad corridors on site property as well. A well-organized energy transmission and distribution system, while essential to the safe and reliable delivery of power, also has adverse effects on the ecosystems through which it passes. The creation of linear elements, such as ROWs, throughout the landscape has a direct consequence, in the form of landscape fragmentation. Such fragmentation happens when a large expanse of habitat is transformed into a number of smaller patches, amounting to less total area than that originally available. Generally, the remnant patches are surrounded by a landscape that is transformed for agricultural uses or for development purposes. This decrease in area available to wildlife can jeopardize the survival of species requiring large expanses of unbroken habitats. Moreover, the linear elements can act as impassable barriers to general movement, migration, or dispersal of some species.

Fragmentation has many sources, and is directly linked to habitat loss. Therefore, WHC recommends that the Limerick Generating Station work with ComEd, the subsidiary company charged with maintaining the ROWs, in order to enhance the corridors for wildlife species whenever possible. The following table briefly highlights wildlife habitat management issues derived from common establishment and maintenance activities of right-of-ways.

Table 1. Documented Effects of Linear Projects on Wildlife

MAJOR TYPE	GENERAL ISSUES OF CONCERN
PLANTS	Initial clearing negatively impacts native vegetation in the ROW. Microclimate change and soil disturbances in the cleared ROW make it difficult to restore desired vegetation.
BIRDS	Creation of edge habitat, or the "edge effect," is responsible for increased nest predation and nest parasitism in adjacent forest. Narrow pipeline corridors (10 to 65 feet) do not significantly affect avian composition or abundance as much as wider corridors. Drastic change in habitat types available can be particularly detrimental to grassland and forestland-nesting birds.

AMPHIBIANS AND REPTILES	Amphibians requiring moist environments may not migrate across the R-O-W, which is typically dryer and hotter.
MAMMALS	R-O-Ws may create barriers to movement. Generally leads to a lesser abundance of small mammals in cleared areas, although higher numbers are documented along edges. Open canopy increases vulnerability to predators.

Linear developments, such as those resulting from utility ROW construction and maintenance, can also have beneficial effects on wildlife habitats. When the proper mitigation measures are taken, ROW corridors can be sites of increased habitat diversity, can be used by wildlife as travel lanes between isolated patches of suitable habitats, can increase the amount of early successional habitat available to species, and much more. Effective management is simply a matter of bringing together the needs of power generation and reliable transmission with the living requirements of targeted wildlife species. Past experience and research has demonstrated that these goals are perfectly compatible and strongly recommended.

2.1.5.1.1 Grasslands in ROWs

The grasslands of the United States have undergone many changes since colonial times. This type of habitat, critical to many bird species, was favored by traditional agricultural expansion. In Pennsylvania, forests were transformed to pasturelands and croplands on a large scale, offering a majority of habitat opportunities to early successional wildlife species. As land use activities and agricultural practices have changed dramatically since the turn of the century, remaining grasslands have become smaller and increasingly more isolated (Jones and Vickery 1997). Grasslands are now recognized by many as the most imperiled ecosystem worldwide (Winter et al. 2001). Managing ROWs with the objective of maintaining and enhancing grasslands can provide habitat that, with specific management practices, will offer valuable nesting, brood rearing and cover opportunities to wildlife.

Figure 9. Grassy ROW Adjacent to Limierck Facility and Parking Area

Photo by Sue Wolinsky, WHC Wildlife Biologist/Certification Program Manager

In order to manage ROWs for grassland habitat, **Table 2** presents the following recommended best management practices.

Table 2. ROW Best Management Practices for Grasslands

Best Management Practice	
1	Use only species native to the ecoregion in which the ROW is located when restoring grassland habitats.
2	Control invasive and non-native species where possible.
3	Maintain early successional vegetation.
4	If isolated portions of the ROW and adjacent grasslands are smaller than 25 acres, allow the ROW to revert to shrub-shrub and manage sections accordingly (see Section 3.1.2).
5	Avoid fragmenting grasslands with the addition of roads, buildings, tree corridors, or row crops.
6	Where grasslands are bordered by forested tracts, develop a feathered edge between the forest and the grassland. This will provide cover for animals and reduce nest predation.
7	If mowing is necessary to maintain the grassland stage, it should only be done during September to March. Use a cutting height of at least 10 inches.
8	In the border zone, woody cover should be kept to a maximum of 5% in grassland habitat. When covering a proportion greater than 5%, tall trees should be removed.
9	Establish a cover of warm-season grass as the dominant grass type. Such grasses will grow during the summer, rather than in the cooler spring and fall months, forming clumps surrounded by more open spaces that provide habitat heterogeneity.
10	Use a mixture of warm-season grasses. Avoid monotypic stands. Native forbs and wildflowers should also be added to increase vegetation diversity.

2.1.5.1.2 Shrublands in ROWs

Shrub habitat, sometimes referred to as scrub-shrub or even as scrub habitat, is generally dominated by low-growing shrubs and young trees (USFWS 1999). The management principles discussed here can be applied when creating feathered or soft edges as a transition between an herbaceous pipe-zone and adjacent forest. The success of selective herbicide control in scrublands has been demonstrated (Marshall and VanDruff, Confer 2002, Hill et al. 1995). While mechanical means of control destroy nesting cover and desirable food sources (Burns 2001), low-basal and low-volume herbicide application allow a targeted approach that does not negatively affect desirable adjacent vegetation.

Figure 10. Shrub-Scrub Habitat in ROW

Photo by Sue Wolinsky, WIC Wildlife Biologist/Certification Program Manager

In order to manage ROWs for scrubland habitat, the following best management practices are recommended:

Table 3. ROW Best Management Practices for Shrublands

Best Management Practice	
1	Selectively use herbicides to control tall-growing species in order to maintain a shrub community of 12 feet or less in height. Selective basal application or low-volume basal application is indicated in this situation.
2	After herbicide application, pruning must be done. Desirable species must be topped if grown more than 10 to 12 feet in height. The whole plant should be cut down if more than one-third of it is to be removed.
3	Along the ROW edges, tall trees need only to be topped enough so they do not represent a danger of roots reaching the pipe. Trunks should be girdled to kill the trees. These will provide additional wildlife habitat (figure 15).
4	When corridors are first cleared, avoid a clearing and grubbing operation in which all vegetation is cut down and soil and roots are disturbed. Leave shrubs and preferred low-growing trees.
5	Trees cut down during clearing or maintenance activities should be placed along the corridor edge to form brush piles. Canopy branches are ideal for this operation. Log piles are also of wildlife value.
6	If chipping occurs, residue can be left on site but at a rate no thicker than 2 to 3 inches in any area.

2.1.5.2 Early Successional Grassland and Old Field Habitats

Grasslands, meadows, and old-field habitats are common throughout much of southeastern and central Pennsylvania, and can be found in areas considered to be former agricultural production-lands, in expansive fields that are routinely mowed or burned, and in patches of transitional ecosystems that, if left undisturbed, progress into thicket, shrub-scrubland, and woodland habitats. If left to follow the course of succession without the controlling forces of fire, mowing, or other disturbance, it will take a meadow habitat approximately 150 years to progress into a mature forest. Grassland and meadow habitats in this region evolved as a result of routine intentional and wild fires, which were common throughout the ecoregion.

During springtime, the dominant meadow and grassland species in Pennsylvania, as well as within the old-fields that surround the Limerick Generating station, are weeds and cool-season grasses such as Timothy, fescue, orchardgrass, rye, and bluegrass. These grasses are not native to the area, and have been historically planted by farmers and homeowners for a variety of reasons such as animal forage, aesthetics, and immediate erosion control. Cool-

season grasses are most prolific between April and June, and begin to die back in late June and early July.

Following the dieback of these non-natives, native warm-season grasses and wildflowers are permitted to grow when present in the seed bank. Native warm-season grasses such as Indian grass, broom sedge, switchgrass, and bluestems dominate the landscape between July and late October. In addition, these bunch-forming grasses remain standing, providing cover resources through the winter. Their deep-penetrating root systems, sometimes in excess of five feet, have immense soil-holding capabilities. In addition, native warm-season grasses increase soil fertility over time due to their ability to regenerate root systems and contribute humus to the soil. Native wildflowers of varying heights, colors, and densities experience active growing and blooming periods throughout the summer and fall seasons as well. Wildflowers common to southeastern Pennsylvania, and the Limerick site, include black-eyed Susan, goldenrods, sunflowers, and asters.

In order to provide additional wildlife benefits, managers at the Limerick facility could consider incorporating additional native warm season grasses and wildflowers, in place of invasives and weeds. In addition to being beneficial to soil structure and aesthetically pleasing, native warm-season grass and wildflower habitats provide significant wildlife benefits. Warm-season grasses provide optimal habitat for grassland birds, especially when compared to the cover offered by cool-season grasses. Many cool-season grasses are sod forming and, therefore, limit the ability of wildlife species to seek cover and food resources. Grassland nesting birds will utilize grassland, meadow, and field habitats that offer native warm-season grasses in the springtime for nesting and brood rearing. Young birds depend on the insect-attracting abilities of native grasses and wildflowers for food; during autumn, a diversity of wildlife rely on the seeds generated by these native plants. During winter months, resident wildlife populations seek food and shelter in the cover offered by natives. These habitats also provide necessary requirements for a diversity of pollinators, including butterflies and bees. Wildlife species that rely on grassland and meadow habitats in southeastern Pennsylvania include northern bobwhite quail, bobolink, eastern meadowlark, many sparrows, bats and other small mammals, and a variety of butterflies and moths.

Figure 11. Old Fields with Small Trees and Shrubs at Limerick

Photo by Sue Wolinsky, WHC Wildlife Biologist/Certification Program Manager

WHC recommends that the Limerick Generating Station manage old-field, grassland edge, and meadow habitats for native warm-season grasses and wildflower species in order to provide maximum benefits for local wildlife species. Managers can begin by removing invasive species and re-seeding with native grasses and wildflowers. Species recommended for use in southeastern Pennsylvania are provided in **Table 4**. In addition, managers must keep in mind that grassland and meadow habitats are transitional ecosystems and, in order to maintain them for wildlife benefits, one must exert control over the landscape to prevent succession. Non-native, cool-season grasses could be controlled by mowing fields and meadows in late June to early July, which will remove the dying grasses and provide growing space and resources required for native grasses and wildflowers. Mowing should only be conducted once to twice during the year; mowing more than twice a year will encourage the further establishment of cool-season grasses. Mowing should be done in early summer, following the nesting season, because a springtime mowing is detrimental to the nesting and rearing activities of native birds, while fall mowing does not allow vegetation enough time to regenerate and provide maximum value in the following season, and winter mowing decimates critical winter cover resources. Grasslands should be mowed to a height of six to eight inches during the growing season and, if additional mowing is required, to a height of four to six inches during the dormant season.

Table 4. Natives Grasses and Wildflowers

COMMON NAME	HEIGHT	BLOOM PERIOD AND COLOR	WILDLIFE VALUES
Wild columbine	1 to 3'	Apr-June / red and yellow	Pollinators, hummingbirds
Swamp milkweed	2 to 4'	July-Aug / rose	Important butterfly plant
Common milkweed	2 to 6'	July-Aug / pink and red	Important butterfly plant
Butterfly milkweed	1 to 3'	May-Sept / orange	Important butterfly plant
New England aster	2 to 6'	Aug-Oct / purple	Important butterfly plant
Turtlehead	1 to 3'	Jul-Sept / white	Pollinators, hummingbirds
Joe-pye weed	3 to 6'	Aug-Sept / purple	Pollinators, other insects
White snakeroot	2 to 3'	Jul-Oct / white	Pollinators, other insects
Sunflower	4 to 6'	Jul-Sept / yellow	Birds, pollinators, insects
Oxeye sunflower	1 to 5'	Jul-Sept / yellow	Important butterfly plant

COMMON NAME	HEIGHT	BLOOM PERIOD AND COLOR	WILDLIFE VALUES
Cardinal flower	2 to 5'	Jul-Sept / scarlet	Butterfly and hummingbird
Great blue lobelia	1 to 3'	Jul-Oct / blue	Pollinators, hummingbirds
Partridge berry	<1'	Jun-Jul / white	Evergreen, edible berries
Bee balm	2 to 5'	Jul-Aug / red	Important pollinator plant
Phlox	1 to 5'	May-Oct / purple, pink, blue	Important pollinator plant
May apple	1 to 2'	May / white	Ground cover, edible fruit
Solomon's seal	1 to 3'	Apr-Jun / yellow	Edible, blue berries, birds
Black eyed-Susan	2 to 3'	May-Sept / yellow, orange	Long bloom, insects
Golden ragwort	1 to 2'	May-Jul / yellow	Wetland plant, insects
Goldenrod	2 to 6'	Jul-Nov / yellow	Pollinators, other insects
New York ironweed	3 to 6'	Jul-Sept / purple, blue	Pollinators, other insects
Golden Alexanders	1 to 2'	Apr-Jun / gold	Pollinators, other insects
Big bluestem	3 to 5'	Jun-Sept	Clump forming, winter cover
Lurid sedge	1 to 2'	Jun-Oct	Wetland plant, seeds eaten
Bottlebrush grass	2 to 4'	Jun-Aug	Shade-tolerant native grass
Riverbank wild rye	3 to 5'	Jul-Sept	Stream side native grass
Virginia wild rye	2 to 4'	Jul-Sept	Grass tolerant of many soils
Switchgrass	3 to 6'	Aug-Sept	Erosion control benefits
Little bluestem	2 to 4'	Jul-Sept	Important winter cover
Indian grass	3 to 6'	Aug-Sept	Clump forming grass

2.1.5.3 Riparian Corridors and Woodlands

The transition zones between a creek, stream or river and upland areas, also commonly referred to as riparian areas, are crucial to maintaining water quality and overall creek health. A well-vegetated stream bank will act as a buffer between the river and upland areas, decreasing both the velocity of floodwater, downstream flooding and peaks, and surface runoff. Wet-soil plants including grasses, shrubs, wildflowers, and trees act as vegetative buffer strips around water bodies. Plants function to stabilize the soil banks, allowing for less erosion and consequently, less water turbidity. Fast-growing species such as willows are especially effective for erosion control, and can have high wildlife value. Deep-rooting grasses contribute to the root mat and absorb nutrients; warm-season grasses in particular have very deep root systems that extend three to twelve feet below the surface. Additionally, vegetation slows overland runoff, buffering surface water pollution.

Figure 12. Flooded Riparian Corridor Habitat Adjacent to the Limerick Facility

Photo by Sue Wolinsky, WHC Wildlife Biologist/Certification Program Manager

Riparian buffer areas are also important for both in-stream and terrestrial wildlife communities. A high-quality stream bank provides valuable habitat for a distinct community of species including a wide variety of birds and mammals, as well as salamanders, frogs, and turtles, many of which are declining at alarming rates. The overhanging trees create shade, lowering the stream temperature and raising the oxygen content for a variety of fishes and aquatic organisms. The resulting leaf litter adds nutrients and cover for macroinvertebrates such as caddis flies and mayflies. The leaf litter also acts as a sink for phosphorus, and helps decrease the toxicity from metals and pesticides.

Stream and river-side forests are highly productive, diverse ecosystems that provide habitat for a diversity of species while providing numerous valuable services. Whenever possible, a 50-foot buffer of trees and shrubs should be maintained along the perimeter of the island in order to improve suitability for wildlife and overall water quality. In addition, cover can be created for fish and other aquatic wildlife by placing brush piles, rock piles and basking logs along the shoreline and in ponded areas surrounding the island. Underwater brush piles and rock piles can provide escape cover for fish while also providing breeding areas for amphibians and, depending on the depth of the water, perching areas for foraging birds. Basking logs will also provide breeding areas for amphibians while providing cover for small fish. The same structures placed in upland areas will provide escape cover and breeding sites for terrestrial wildlife. In addition, in the State of Pennsylvania, cost share assistance may be available to properly manage and enhance forested riparian corridors and wetlands on site.

Figure 13. Flooded Drainage Channel at the Limerick Generating Station

Photo by Sue Wolinsky, WHC Wildlife Biologist/Certification Program Manager

Much of the riparian corridors at the Limerick Generating Station include woodland and shrub habitats. Patches of woodland habitats help to provide habitat for a number of southeastern Pennsylvania's native wildlife species, especially when linked to existing conservation and natural areas. The wildlife species attracted to small segments of forest, tree and shrub thickets and scrubby woodland edge habitats have specific food, cover and vegetative species composition requirements that are different than those of large-tract forestland habitats, and different than those of grassland and wetland dependent species. In addition, these habitat "islands" of woods also provide habitat for migratory species when effectively linked to other forested corridors and stream courses.

As recently as 1992, over half of Pennsylvania was dominated by forested landscapes, including about 16 million acres of commercially productive forests. According to the USDA Forest Service, in 1992, "no other state has a greater volume of select hardwood species, including white ash, red and white oak, black cherry and hard maple." Because of commercial pressure and increased development and subsequent habitat fragmentation, Pennsylvania forests, and the wildlife species that rely on them, have become increasingly threatened. Forests provide habitat opportunities for a diversity of species while stabilizing soils and improving soil structure, improving air quality and filtering stormwater runoff. In addition, another critical resource in Pennsylvania, recreational fish and game species, including freshwater fish, white-tailed deer, wild turkey and ruffed grouse, are sustained by the food and cover resources that forests offer. In addition, riparian woodlands, forested habitats and forested edge habitats that display a myriad of tree, shrub, grass and wildflower species also provide a diversity of benefits to wildlife. **Table 5** provides examples of common trees and their corresponding wildlife values. In addition, the **Managing Forested Landscapes** document, which can be accessed under the "Technical Reference Documents" menu of the Report CD, provides guidance concerning the management of forested landscapes.

Table 5. Common Wildlife Value of Native Trees and Shrubs

Common Name	Height/ Width	Conditions	Wildlife Value
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*SITE ASSESSMENT AND WILDLIFE MANAGEMENT OPPORTUNITIES FOR EXELON CORPORATION'S
LIMERICK GENERATING STATION*

Common Name	Height/ Width	Conditions	Wildlife Value
Shadblow serviceberry	6-20'/10'	Moist, forest edge or border plant.	Fruit used by songbirds, leaf by browsers.
Red chokeberry	6-10'/3-5'	Many soil types, sun to part shade.	Red berries eaten by a variety of songbirds.
Black chokeberry	6-10'/3-5'	Many soil types, good for borders.	Black berries eaten by a variety of birds.
Common sweetshrub	6-9'/6-12'	Many soil types, deep, shade or sun.	Highly used by insects.
Summersweet clethra	3-8'/4-6'	Moist to wet soil, full sun to shade.	Limited values.
Red osier dogwood	7-9'/10'	Many soil types, establish cuttings.	High value for mammals and songbirds.
Vernal witchhazel	6-10'	Moist soil, full sun to part shade.	High value for squirrels.
Inkberry	6-8'/8-10'	Moist acidic soils, good for borders.	Berries used by a variety of wildlife.
Winterberry	6-10'	Moist, organic soils.	Used extensively by songbirds.
Virginia sweetspire	3-5'/6-8'	Moist well-fertilized soil, sun-shade.	Fruit used by some songbirds.
Mountain laurel	7-15'	Moist, well-drained soil, sun-shade.	Evergreen, used by mammals and birds.
Sweetbay magolia	10-20'	Wet, acidic soils.	Foliage used by birds, seeds eaten by some.
Northern bayberry	5-12'	Adaptable to many soil conditions.	Fruit eaten by a variety of birds.
Bush cinquefoil	1-4'/2-4'	Full sun, fertile, moist soils.	Limited value, may be used by insects.
Carolina rhododendron	3-6'	Moist, well-drained soils, part shade.	Limited browse by deer /songbird cover
Rosebay rhododendron	4-10'	Moist, well-drained soils, part shade.	Limited browse by deer /songbird cover
Sweet azalea	8-20'	Many soil types, flowers late spring.	Minimal value to insects.
Flame azalea	4-8'/10-15'	Many soil types, flowers May-June.	Minimal value to insects.
Piedmont azalea	3-6'	Many soil types, flower early spring.	Minimal value to insects.
Plumleaf azalea	8-10'	Many soil types, flowers summer.	Minimal value to insects.
Swamp azalea	1-8'/3-8'	Wet soils, flowers late spring.	Minimal value to insects.
Fragrant sumac	2-6'/6-10'	Many soil types, fast cover.	Important for mammals and birds.
Highbush blueberry	6-12'/8-12'	Moist, well-drained soil, sun-shade.	Used heavily by grouse /songbirds.
Mapleleaf viburnum	4-6'/3-4'	Range of soil and light conditions.	Used by birds, squirrel and deer.
Arrowwood virburnum	6-8'/6-15'	Well-drained soils, good hedge.	Used by birds, squirrel and deer.

*SITE ASSESSMENT AND WILDLIFE MANAGEMENT OPPORTUNITIES FOR EXELON CORPORATION'S
LIMERICK GENERATING STATION*

Common Name	Height/ Width	Conditions	Wildlife Value
Nannyberry	9-18'/6-10'	Wide range of conditions.	Used by birds, squirrel and deer.
Blackhaw viburnum	9-15'/8-12'	Many soil types, sun or shade.	Used by birds, squirrel and deer.
American cranberry	8-12'	Well-drained, moist soils.	Used by birds, squirrel and deer.
Eastern redbud	20-30'/25-25'	Moist, well-drained soils, sun.	Limited wildlife value.
White fringetree	12-10'	Moist, fertile soils, full sun.	Limited wildlife value.
Flowering dogwood	20'/15-20'	Well-drained soil, full sun to shade.	Important food for songbirds.
Franklin tree	10-20'/6-15'	Moist, acidic well-drained soils.	Limited wildlife value.
Carolina silverbell	30-40'/25-25'	Rich, moist, well-drained acid soils.	Limited value, seeds used by some birds.
Common witchhazel	15-20'	Moist soil, sun to partial shade.	Limited wildlife value.
American holly	15-30'/18-25'	Moist, well-drained soil, sun-shade.	Food/cover used extensively by songbirds.
Sourwood	25-30'/20'	Peat, moist, acidic, well-drained soils.	Limited wildlife value.
Mountain ash	10-30'/10-15'	Adaptable to many soil types.	Fruit valuable winter food for songbirds.
Mountain stewartia	10-15'	Moist, acidic soil, full sun to shade.	Limited wildlife value.
Red maple	40-60'	Slightly acidic, moist soil.	Flowers and buds food for mammals/birds
Silver maple	50-70'/40-50'	Tolerant of many soil types.	Flowers and buds food for mammals/birds
Sugar maple	60-70'/20-40'	Shade tolerant, moist soils.	Flowers and buds food for mammals/birds
Sweet birch	40-55'/35-45'	Deep, rich, acid, moist soils.	Foliage used by browsers, birds.
River birch	40-70'/40-60'	Moist soil conditions.	Foliage used by browsers, birds.

*SITE ASSESSMENT AND WILDLIFE MANAGEMENT OPPORTUNITIES FOR EXELON CORPORATION'S
LIMERICK GENERATING STATION*

Common Name	Height/ Width	Conditions	Wildlife Value
Shagbark hickory	60- 80'/40- 60'	Woodland border tree, varied soils.	Important food source for mammals and several kinds of birds.
Common hackberry	40-60'	Rich, moist soil; will tolerate dry.	Fruit important, especially for winter birds.
Persimmon	35- 60'/20- 35'	Rich, moist soil; will tolerate dry.	Fruit used by mammals and songbirds.
American beech	50-70'	Moist soil, full sun to part shade.	Nuts eaten by birds and mammals.
White ash	50-80'	Deep, well-drained soil; full sun.	Moderate value to songbirds and waterfowl.
Green ash	50- 60'/25- 30'	Range of soil conditions.	Moderate value to songbirds and waterfowl.
Common honeylocust	30-70'	Rich, moist bottomlands.	Limited wildlife value.
Black walnut	50-75'	Rich, moist soils; often bottomlands.	Nuts eaten by mammals, woodpeckers.
Eastern redcedar	40-50'/8- 20'	Deep, moist soil; windbreak/hedge.	Seeds eaten by birds, foliage used for nests.
American sweetgum	60- 75'/20- 35'	Deep, moist, acidic soils.	Winged seeds eaten by songbirds.
Tuliptree	70- 90'/30- 50'	Full sun, well-drained soil.	Purple finch and cardinal primary users.
Black gum	30- 50'/20- 30'	Moist, acidic soil full sun, part shade.	Fruit very high value to songbirds.
White spruce	40- 60'/10- 30'	Moist, loam soil, full sun, part shade.	Used by browsers, rabbits, nuthatches etc.
White pine	50- 80'/20- 40'	Adaptable to range of soil types.	Needles for nesting, seeds for many birds.
Sycamore	75-150'	Deep, moist, rich soils.	Purple finch, goldfinch and squirrels use.
White oak	100'/50- 80'	Moist, well0-drained soils.	Very high wildlife values for many species.
Pin oak	60- 70'/25- 40'	Adaptable to many soil types.	Very high wildlife values for many species.
Willow oak	40- 60'/30- 40'	Moist soils, adaptable.	Very high wildlife values for many species.

Common Name	Height/ Width	Conditions	Wildlife Value
Red oak	60- 75'/40- 50'	Prefers loamy, well-drained soil.	Very high wildlife values for many species.
American linden	60- 80'/30'- 40'	Deep, moist soil, full sun part shade.	Limited wildlife value.
Eastern hemlock	40- 70'/25- 35'	Moist, well-drained soils.	Excellent cover source, birds eat seeds.

2.1.5.4 Seasonally Flooded Wetland Habitats

In Pennsylvania, wetlands cover less than two percent of the total land area. Over the past 200 years, development and agricultural expansion has led to a loss, or the degradation of, over half of the wetland habitats in Pennsylvania. Wetlands have several values, including the ability to prevent floods and manage stormwater. They provide support to groundwater systems, assist in the removal, transformation, and detention of various environmental pollutants, provide critical habitat to a variety of resident and migratory wildlife species, and wetlands often serve to connect various ecosystems. Even wetlands smaller than one acre in size have the ability to support an abundance of wildlife, particularly waterfowl, amphibian, and fish species. Wetland ecosystems also provide humans with educational and recreational opportunities, open space, and aesthetic enjoyment. Wetland communities identified at the Limerick Generating Station include riparian forest buffers, which are described in the previous section, and seasonally wet areas.

Seasonally wet portions of the site, also termed ephemeral or vernal pools, may occupy some areas of the riparian corridor on site, including in areas that were flooded at the time of the Site Visit. Vernal pools are depressions in the earth that fill with water in the spring or rainy season and dry out by summer's end (making them distinct from ponds, which remain full). These wetlands, referred to by some as ephemeral wetlands, are critical habitat for many aquatic macroinvertebrates, such as mosquito-controlling dragonflies, and amphibians. These species thrive in this environment largely because vernal pools are unable to support fish, which feed on the eggs and larvae of amphibians and invertebrates. Seasonally wet

areas have, however, become a vanishing natural feature due to land development, thus contributing to the alarming decline of frog and salamander populations. WHC suggest that the managers at the Limerick Generating Station identify, monitor and protect any seasonal wetlands identified on site, adding basking structures and hibernacula as necessary.

Figure 14. Flooded Riparian Habitat at the Limerick Facility

Photo by Sue Wolinsky, WHC Wildlife Biologist/Certification Program Manager

2.1.5.5 Ponds and Wetlands

There are some holding ponds and borrow ponds at the Limerick Facility. Water resources that are compatible with wildlife habitat uses can often be enhanced in order to benefit fish and other aquatic wildlife. If employees and volunteers are interested increasing the value of ponds and wetlands on site, WHC recommends that the Limerick Generating Station create additional cover and nesting resources by placing brush piles, rock piles, and basking logs in the water resources on site. Underwater brush piles and rock piles will provide escape cover for fish while also providing breeding areas for amphibians and (depending on the depth of the water) perching areas for foraging birds. Basking logs will also provide breeding areas for amphibians while providing cover for small fish. The same structures placed in upland areas will provide escape cover and breeding sites for terrestrial wildlife.

2.1.6 Species to Consider Before Formulating Management Plans

In Pennsylvania, state biodiversity is considered rich, with more than 10,000 species of plants and animals identified. "As inventories continue, it is estimated that the total number of known plants and animals in Pennsylvania will reach 20,000 species" (PA-CWCS).

According to the CWCS, in addition to having such a diversity of habitats and species, an estimated six million Keystone State residents enjoy outdoor recreation activities, which translates into a significant contribution to the economy (PA-CWCS). For example, the 50,000 or so birdwatchers that visit the Hawk Mountain Sanctuary each year contribute an estimated \$3 million to communities surrounding the attraction. Furthermore, the "total economic effect of nonconsumptive bird and waterfowl recreation alone is estimated at more than \$450 million per year in Pennsylvania" (PA-CWCS). In addition the Strategy indicates that, the state ranks number one in the nation for residents time spent hunting, and number three throughout the country in residents time based watching wildlife, further illustrating a statewide commitment to wildlife.

Table 6. Wildlife Species in Pennsylvania

TYPE	NUMBER OF SPECIES FOUND WILD IN PA*
Mammal	73
Bird	394/186**
Amphibian	36
Reptile	37
Fish	217/160**
Mussel	165
Invertebrate	11,722?

Table excerpted from the PA-CWCS.

*Totals include both native and non-native species identified in PA.

**Totals include known resident and migratory species.

Native wildlife species associated with the Limerick facility's surrounding ecoregion include many small mammals such as mice, squirrels, beaver and raccoons as well as larger mammals such as white-tailed deer, bobcat and coyote. Other common mammals include opossum, eastern cottontail, and fox. Avian species associated with the region year round include vultures, Canada geese, mallards, red-tailed hawks, wild turkeys, and mourning doves. Other year-round bird residents include red-bellied woodpeckers, killdeer, blue jays, Carolina wrens, American robins, European starlings, mockingbirds, song sparrows, northern cardinals, meadowlarks and house sparrows. Avian species that are known to frequent the region during breeding and nesting seasons in the spring and summer include green herons, ospreys, American woodcocks, common nighthawks, chimney swifts, ruby-throated

hummingbirds, eastern phoebes, eastern kingbirds, great crested flycatchers, vireos, tree swallows, purple martins, bank swallows, barn swallows, Baltimore orioles and several sparrows. Common avian winter residents include many ducks and wetland wading birds, such as grebes, wigeons, ring-necked ducks, common goldeneyes, gulls and mergansers, as well as other migratory birds such as rough-legged hawks, short-eared owls, long-eared owls, purple finches, pine siskins and several sparrows.

Common amphibian species found in the region include the northern slimy salamander, red salamander, spring peeper, American toad, Fowler's toad, gray treefrog, green frog, wood frog and bullfrog, while common reptiles include the common musk turtle, wood turtle, eastern box turtle, eastern painted turtle, snapping turtle, five-lined skink, and northern water snake, eastern garter snake, eastern hognose snake, northern ringneck snake, northern black racer, black rat snake, northern copperhead, and eastern milk snake. Common butterflies include the tiger swallowtail, monarch, cabbage white, orange sulphur, striped hairstreak, southern dogface, pearl crescent, and common wood nymph.

Throughout Pennsylvania, the PGC and PFBC recognize that there are approximately 85 species of game animals that are actively managed for, as well as over 400 species of non-game wildlife, including birds, fish, reptiles, mammals, insects and aquatic organisms. 27 species in the Keystone State are the beneficiaries of more target management efforts because they are classified as state or federally threatened and/or endangered. In addition, there are believed to be at least 10,000 different vegetative species spread throughout the Commonwealth (PA-CWCS).

In order to help safeguard the remaining biodiversity throughout the state, WHC recommends that employees at the Limerick Generating Station work with community volunteers to develop and implement a wildlife habitat management plan that identifies the characteristic species found on site, and describes intended ways to enhance and protect the resources they depend on. To do this, WHC asks that managers of the Limerick Generating Station consider the species background information presented in the following sections and develop action plans to manage the site for native species, attempting to remove and reduce

the amount of non-natives and invasives, and attempt to promote wildlife through specific habitat enhancement practices.

2.1.6.1 Identify and Manage Non-Native, Exotic, Invasive, and Nuisance Species

Invasive plant species are among greatest threats to the world's biodiversity, and the issue of controlling them has become a priority for the scientific community. Several federal acts, such as the Federal Noxious Weed Act of 1974 and the Alien Species Prevention and Enforcement Act of 1992, have been passed to direct the control of invasives. In 1999, President Clinton signed Executive Order 13112 to address the challenge that invasive species present to the nation's environment and economy, and to create a National Invasive Species Council.

While native species are those that have naturally and historically been found in a particular locale, Executive Order 13112 defines invasive species as those species not native, or exotic, to a particular ecosystem that, upon introduction, are "likely to cause economic or environmental harm or harm to human health". Species are introduced in a variety of ways to areas in which they do not historically occur. Some have been introduced intentionally for ornamental or commercial use; others have been accidentally brought from foreign countries because they were mistaken for native plants that are similar in appearance. The vast majority of plant species introduced from other regions of the world do not become established outside their native ecosystem simply because the conditions they require and find in their native environments are not found in their new locations. The few species that do manage to survive, however, can aggressively invade and threaten native ecosystems.

Exotic invasive species can spread quickly due to a combination of two major factors. First, they possess a suite of life history traits that allow them to spread rapidly. Invasive plants can be prolific seed producers, and they may develop extensive underground seed banks and root systems so that they can spread vegetatively. They are often successful in areas with poor soil quality, and are thus able to outcompete native species that are more "selective". The second factor is that exotic species are, by definition, colonizers from elsewhere. Often, these plants spread to new areas of the world, but their primary competitors, predators, and

diseases from their native ecosystems do not follow them, making their establishment and success all the more likely.

As their populations grow out of control, they can have devastating ecological and economic impacts. The natural and economic damage caused by encroachment of invasive species can be matched only by that resultant from floods, hurricanes, earthquakes, mudslides and wildfires. Invasive species often come to dominate local ecosystems, reducing diversity and crowding out native species. When a plant community is dominated by one species, the diversity of food sources decreases and thus native birds, mammals, and other animals can suffer. Furthermore, less diverse communities are more susceptible to environmental stresses and are less resilient to disturbance than healthy, native ecosystems that contain a wide variety of vegetation.

Two techniques can be employed to mitigate the problems associated with exotic invasive plants: prevention and eradication. Unfortunately, preventing spread is often difficult. The seeds of invasive plants frequently migrate to new areas via roadways, in seed mixtures, or are carried by the birds and mammals that consume them. Eradication often requires repeated action and monitoring to achieve success, but can be accomplished if the problem is addressed while populations are still manageable. **Table 7** provides a list of common invasive species in Pennsylvania according to the Pennsylvania Department of Conservation and Natural Resources.

Table 7. PA Invasive Plant Species

THREAT LEVEL	COMMON NAME	SCIENTIFIC NAME
Moderate	Goutweed	<i>Aegopodium podagraria</i>
	Fiveleaf akebia	<i>Akebia quinata</i>
	Porcelain-berry	<i>Ampelopsis brevipedunculata</i>
	Japanese barberry	<i>Berberis thunbergii</i>
	European barberry	<i>Berberis vulgaris</i>
	Cheatgrass	<i>Bromus tectorum</i>
	Russian olive	<i>Elaeagnus angustifolia</i>
	Dame's rocket	<i>Hesperis matronalis</i>
Moderate	Border privet	<i>Ligustrum obtusifolium</i>
	Common privet	<i>Ligustrum vulgare</i>
	Bell's honeysuckle	<i>Lonicera morrowii</i> ssp. <i>tatarica</i>

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THREAT LEVEL	COMMON NAME	SCIENTIFIC NAME
	Eurasian water-milfoil	<i>Myriophyllum spicatum</i>
	Star-of-Bethlehem	<i>Omithogallum nutans</i>
	Wild parsnip	<i>Pastinaca sativa</i>
	Beefsteak plant	<i>Perilla frutescens</i>
	Reed canary grass	<i>Phalaris arundinacea</i>
	Lesser celandine	<i>Ranunculus ficaria</i>
	Common buckthorn	<i>Rhamnus catharticus</i>
	Glossy buckthorn	<i>Rhamnus frangula</i>
	Wineberry	<i>Rubus phoenicolasius</i>
	Siberian elm	<i>Ulmus pumila</i>
Serious	Norway maple	<i>Acer platanoides</i>
	Tree-of-heaven	<i>Ailanthus altissima</i>
	Garlic mustard	<i>Alliaria petiolata</i>
	Musk thistle	<i>Carduus nutans</i>
	Oriental bittersweet	<i>Celastrus orbiculatus</i>
	Canada thistle	<i>Cirsium arvense</i>
	Bull thistle	<i>Cirsium vulgare</i>
	Jimsonweed	<i>Datura stramonium</i>
	Autumn olive	<i>Elaeagnus umbellata</i>
	Goatsrue	<i>Galega officinalis</i>
	Giant hogweed	<i>Heracleum mantegazzianum</i>
	Japanese honeysuckle	<i>Lonicera japonica</i>
	Amur honeysuckle	<i>Lonicera maackii</i>
	Morrow's honeysuckle	<i>Lonicera morrowii</i>
	Standish honeysuckle	<i>Lonicera standishii</i>
	Tartarian honeysuckle	<i>Lonicera tartarica</i>
	Purple loosestrife	<i>Lythrum salicaria virgatum</i>
	Japanese stilt grass	<i>Microstegium viminem</i>
	Common reed	<i>Phragmites australis</i>
	Japanese knotweed	<i>Polygonum cuspidatum</i>
	Mile-a-minute vine	<i>Polygonum perfoliatum</i>
	Kudzu	<i>Pueraria lobata</i>
	Multiflora rose	<i>Rosa multiflora</i>
	Shattercane	<i>Sorghum bicolor ssp. Drummondii</i>
	Johnson grass	<i>Sorghum halepense</i>
Threats to Southeast PA	Maiden grass	<i>Miscanthus sinensis</i>
	Water chestnut	<i>Trapa natans</i>
	Winged euonymus	<i>Euonymus alatus</i>
	Japanese spiraea	<i>Spiraea japonica</i>
	Guelder rose	<i>Viburnum opulus var. opulus</i>
	Sycamore maple	<i>Acer pseudoplatanus</i>
	Empress tree	<i>Paulownia tomentosa</i>
	Callery pear	<i>Pyrus calleryana</i>

2.1.6.1.1 General Management Options for Controlling Invasive Species

When designing an invasive species management plan, it is important to consider options that will both fit with current landscape management practices as well as minimize the impact of invasive plants. Any attempts to control vegetation must be based on the major factors that control vegetative forces in the area, such as available light, water, inorganic nutrients, and growing space. Therefore, a successful management plan will include a strategy for increasing the amount of available space and resources for desirable, native plants while limiting the space in which invasives can take over.

There are several different types of management strategies to consider when formulating an invasive species management plan; these methods include physical controls and manual removal, chemical controls, biological controls, and integrated methods that combine various control methods. Those integrated programs that utilize a coordinated effort to control and eradicate invasives are typically more effective than using one method in an attempt to achieve total control.

2.1.6.1.1.1 Physical Control Methods

Physical methods of control and removal include manual pulling and digging of individual invasive plants, using heavy equipment to destroy or remove individuals, mowing, cutting, and clipping. The manual removal of individual invasive species can be effective, but it is generally only realistic to employ when dealing with small, isolated areas of infestation. Furthermore, there are few cases in which removing individual plants by pulling and digging will ultimately control the growth of an invasive. In addition to hand pulling, other physical removal methods, such as pulling with a tractor, can be effective in removing individual trees and mature shrubs. The most important objective when employing physical removal methods to remove individual invasives species is to remove as much of the root structure as possible, as remaining material may allow the individual invasive to re-establish. Therefore, the degree of measurable success in invasives control, when using the pulling or digging method, will depend on the thoroughness of individual plant removal.

Other physical control methods, such as cutting and mowing, can be effective in limiting the growing space and resources available to invasive plants. These methods impose limited

success in controlling invasives because the act of cutting and/or mowing will effectively remove the food-producing portion of individual plants, thereby limiting their ability to take over an area. However, because root and stem portions of the plant remain, invasives will likely resprout and continue to spread with time. Therefore, cutting and mowing are most effective as control techniques when coupled with selectively applied chemical controls.

Cutting may be more effective because managers can selectively target invasive plants, while mowing will reduce the growing ability of all plants in an area. Cutting is reportedly most effective when attempting to control invasives in moderately to heavily wooded areas. This is because the surrounding woodland vegetation will assist control efforts by reducing the amount of resources available to the cut invasive. The cut plant must, therefore, rely on resources stored in the roots for repair and refoliation efforts, significantly weakening the plant's ability to effectively spread for a period of time. Cutting is reportedly less effective in controlling invasives in open areas and edge habitats, where repeated cutting would be required to obtain minimal controls. Cutting is most effective when performed in late fall and winter months. When including cutting as part of an invasive species management plan, managers are advised to plan on re-evaluating cut areas annually to assess the need for repeated control efforts.

Mowing is less selective and will effectively put all plants in an area on an equal basis to compete for sunlight, water, and other essential resources. The effectiveness of mowing is difficult to assess because individual plant species have differing growth rates and responses to disturbance. Therefore, mowing will favor those species that are most prolific in refoliating and spreading quickly, which includes many invasive plants. Mowing can be an effective control, particularly when coupled with chemical controls, in open areas where manual plant removal is not an option. Initial treatment with mowing may require the individual, manual removal of those species that are too large to mow. Mowing should be conducted on a regular basis, and the growth rates and spread of invasives should be closely monitored.

Fire can also be used in conjunction with other physical and biological controls of invasives. Whenever possible, prescribed fire should be considered as a component of an invasive

species management plan. One of the benefits of using fire as a control technique in several native landscapes is that it often gives a distinct advantage to the native grasses, trees, and shrubs that have evolved in the region. Drawbacks of using prescribed fires to manage invasive species include a perceived lack of acceptance among citizens and local governments; however, many local fire departments and county and state extension services are prepared and willing to assist with such control options. In addition, public education regarding the importance of fire as a natural management tool and concerning the planned burn strategy can help in alleviating opposition. In order to be effective, prescribed burns must be executed only when specific weather and plant fuel conditions are met, and should only be carried out by trained professionals.

2.1.6.1.1.2 Chemical Controls

Chemical controls of invasive plants include the selective use of herbicides that are designed to effectively kill weed species. However, it is important to note that most herbicides will also negatively impact desirable, non-target vegetation, and should be used and applied in a responsible and selective manner. The long-term, exclusive use of herbicides is not generally considered to be an effective control technique for most invasive plants for several important reasons. First, coupled with the exclusive use of herbicides is a short-term, "once and over" attitude that simply does not fit with a long-term management plan, which is essential for successful invasive species removal and control. In addition, the inherent, toxic nature of herbicides can impair an individual's ability to successfully deliver a required amount of chemical to the correct area of a plant during the appropriate time in its growing cycle, without posing a potential risk to neighboring vegetation and wildlife resources. However, when safely administered and monitored, and used in conjunction with other physical or biological control methods, herbicides can be an essential component to an invasive species management plan.

To safely administer herbicides in an infested area, it is recommended that personnel first remove as much of the above ground plant material as possible before applying chemicals, unless the targeted species dictates a foliar application. To control small invasive trees, shrubs, and vines, first cut stems, then after about two weeks, apply an herbicide with glyphosate directly to the re-sprouting stems and/or stumps and monitor plants in the weeks

to come. To eradicate individual, mature trees, cut the tree in the fall or winter and apply herbicide, such as RoundUp[®] or Garlon[®], directly to the fresh cut stump. For control of invasive vegetation in larger, open areas, moderate infestations may be controlled through use of a broadleaf herbicide, such as Banvel[®] or 2-4-D[®]. Severe large-scale infestations may require mowing coupled with herbicide application, followed with plowing, discing, and an additional herbicide application. If this intensive method is required to remove invasive plants, it will be important to quickly establish desirable, native plants following the last discing of the site in order to reduce the likelihood that invasives will successfully reestablish.

2.1.6.1.1.3 Biological Controls

Biological controls involve the use of other living organisms to control invasive species, such as planting and interseeding native plants, or introducing biological control agents, such as insect pests, in an effort to control and manage invasive species for the long term. For example, the planting of trees and shrubs to further vegetate wooded areas may help to effectively limit the availability of resources to lower growing invasive species in the area. In addition, the interseeding of meadows and fields with native grasses and wildflowers can help minimize the establishment and further spread of invasive vegetation. It is likely that this method, coupled with long-term monitoring, cutting and mowing, can severely limit the impact of a moderate invasive species infestation over the period of a few years.

Furthermore, the establishment of native plants immediately after physical or chemical removal methods will significantly reduce the ability of an invasive species to resprout. Evergreen trees are especially effective in producing fast shade to reduce the ability of invasive plants to reestablish, particularly when planted along south and westward facing forest edges where invasive species are often most prolific. Planting additional evergreen tree and shrub species will also serve to diversify wildlife habitats on site. Following the addition of trees and shrubs to the landscape, managers should continue to mow invasive undergrowth regularly for several years, until the new plants are well established. Other biological control measures include the use of pest populations to control invasive species. These methods often rely on other invasive or genetically engineered pest species that are known to selectively target the non-desirable invasive. Much of the technology surrounding

this method is used for the control of invasive and nuisance species that plague large-scale agricultural production.

2.1.6.1.2 Managing Tree-of-Heaven

Eliminating tree-of-heaven (*Ailanthus altissima*) from a site requires long-term monitoring and management, no matter the control method, due to the high reproductive capacity of the species. Control areas should be checked one or more times a year during the growing season. It is fairly easy to kill or remove the aboveground portion of *Ailanthus* trees, but the root system must also be seriously damaged in order to prevent resprouting.

Young tree-of-heaven seedlings are best controlled by hand pulling or digging when the soil is moist. This allows for removal of the entire plant and root system, which will vigorously resprout if left in the ground (including root fragments). After about three months of development, the taproot develops to the point that hand pulling is extremely difficult. Hand pulling is not an efficient method for large areas of infestation.

Girdling and applying a water-soluble herbicide is an effective method to remove older *Ailanthus* trees. Girdling involves manually cutting away bark (cork cambium) and vascular cambium tissue in a ring around the trunk. This is a relatively inexpensive method and can be done using an ordinary ax in the spring when the trees are actively growing. Hardwoods are known to resprout after girdling unless the cut is treated with herbicide, such as RoundUp®.

Manually cutting tree-of-heaven stands will not be effective on its own, as the stands will produce a large quantity of sprouts from stumps and root suckers. However, repeated cutting over several years will exhaust energy reserves in the roots and may be a successful method. Cutting should occur in late spring or early summer when plants begin flowering. At this time energy reserves are low and seeds have not been produced. Herbicide should be applied directly to the freshly cut stumps in order to kill the root system. Application must occur within five to 20 minutes of cutting to ensure effective translocation to the roots.

Herbicide can also be applied as a foliar broadcast in areas where *Ailanthus* is dense and widely distributed. The broadcast method, however, is non-selective and will affect desirable vegetation along with target species. Spraying should be performed when trees are in full leaf to ensure maximum effectiveness.

2.1.6.1.3 Managing Common Reed

Common reed (*Phragmites australis*) is a wetland grass frequently found throughout North America. Although it prefers freshwater habitat that is neither particularly acidic nor basic, its ability to grow and spread under substandard conditions allows it to dominate compromised habitats, such as those with brackish (between salt and fresh), alkaline, and acidic waters. Areas with high nutrient concentrations, particularly nitrates, as well as areas near roads that receive salt runoff, are commonly invaded. Common reed is also tolerant of anoxic conditions (conditions in which oxygen is absent).

Common reed is identified by its characteristic stalks, which can grow up to 13 feet tall, and by its feathery inflorescence. It spreads rapidly by rhizomes, which form a thick mat under the soil surface, crowding out other plants. These rhizomes can reach a depth of nearly six feet, allowing the plant to use moisture stored deep in the soil. A build-up of litter underneath the plant also prevents other species from colonizing the area.

Figure 15. Common Reed Infestation

John M. Randall, The Nature Conservancy

Although found in North America for thousands of years, it is believed that the more invasive, exotic strains of common reed have colonized only recently. While it does have some value to wildlife and not all strains of common reed are unmanageable and invasive, it is nonetheless viewed as problematic because it spreads quickly and usually forms a dense monoculture, displacing other native vegetation that has greater wildlife value. A stand of common reed is deemed invasive if it has invaded an area characterized by habitat alteration or pollution, or if the stand continues to expand at the expense of other wetland vegetation.

Given that common reed has been identified at the Limerick Generating Station, and managing smaller infestations is easier, a control program should be started as soon as possible. The program should be designed with provisions for both initial control and management over the long term.

Common reed sets seed between July and September, and the seeds are dispersed between November and January. Subsequently, nutrients are translocated down to the rhizomes and leaves drop off for the winter. Seeds are an important mechanism of dispersal to new sites, but once a site has been invaded, spreading occurs primarily by vegetative means. Therefore, common reed control must combine methods that destroy both the above- and below-ground portions of the plant.

As methods such as biological control and prescribed burning are generally not effective for eliminating or reducing common reed stands, chemical control should be used. One method of controlling common reed is the application of a non-persistent glyphosate herbicide, such as Rodeo®, that is safe for use in and around wetlands. Rodeo® and other glyphosate herbicides must be mixed with a surfactant and clean, preferably distilled, water. Clean water is important because the isopropylamine salt in the herbicide will bind to any soil particles in the water and be rendered ineffective if the water contains sediment.

Herbicide should not be used if rain is anticipated within 12 hours of application, as it will be washed off the leaves before it begins acting on the plant. Herbicide should also not be applied during windy conditions to prevent the spray from drifting to areas where application is not desired. Rodeo® is not selective; therefore, if exposed, surrounding plants will also be killed. Given that common reed typically occurs in nearly monotypic stands, the benefits of common reed eradication often outweigh the risks of eradicating desirable species.

Apply herbicides directly onto the plants when they are allocating nutrients to their root systems (called the tasseling stage) in August or September. Applying the herbicide at this time will ensure that the chemicals are translocated to the rhizomes, killing the plant. If annual pre-tassel cutting is performed for several years, the colony may be entirely eliminated

(Marks, et al. 1993). Herbicide can be applied with a backpack sprayer, by truck, or aerially, depending on the size of the area and how selective you need to be in avoiding desirable plants. Not all plants will be in the tasseling stage at exactly the same time, and because subdominant plants are protected by canopy plants in dense stands, it will probably be necessary to repeat the process 15 to 30 days later to ensure complete control. Following herbicide application, the standing stalks should be mowed and removed; often this is done in late winter or early spring of the following year. Mowing the plants will enable sunlight to penetrate to the soil and allow dormant seeds of native, non-invasive plants to germinate.

In areas containing a diverse soil seed bank, a flush of growth may occur following phragmites removal, with an increase in native plant diversity (Ailstock, et al. 2001). If after four to six weeks, no growth has been recorded, it may be necessary to seed or plant the area with small plants or “plugs” of native species. Plugs are small containers of a species that can be purchased directly through many catalogs. Establishing a ground cover is important to ensure that common reed does not immediately re-invade the area. Keep in mind that this is a difficult species to eradicate and it may take more than one season to control. Following initial eradication, it is important to continually monitor for common reed, as seeds can remain viable in the soil for up to five years. Wind and wildlife can bring in new seeds as well.

2.1.6.2 Avian Species Management

Throughout the nation, many historically common avian species have experienced significant declines. Many of these individual species declines are attributable to habitat degradation and loss. According to information available from the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) and the Pennsylvania Ornithological Records Committee, the official state bird list includes 394 wild bird species, including 186 residential species and other winter residents, transients, and occasional visitors. Throughout the nation, many historically common avian species have experienced significant declines. One native species has become extinct, the passenger pigeon, while five of the state's native species are presumed to have been extirpated from the state, including the greater prairie chicken, piping plover, olive sided flycatcher, Bewick's wren, and Bachman's sparrow. Historically, overhunting has led to the endangerment and near extinction of

several species, including wild turkey, which have rebounded remarkably since nearing extirpation from the state in the 19th century.

In Pennsylvania, the largest issue responsible for the decline of bird populations is extensive habitat loss and fragmentation, particularly within wetland habitats. According to research published by the Pennsylvania Biological Survey, since 1790, the state has lost 56 percent of all wetlands, leading to significant decreases in the abundance and diversity of wetland birds throughout the state. Emergent wetlands, such as marshes and bogs, are of particular importance to both migratory and resident avian species as foraging habitat.

In Pennsylvania, the Ornithological Technical Committee is responsible for proposing and maintaining the list of endangered and threatened birds, birds that are candidates for future listing, as well as the list of exotic birds. For more information about Pennsylvania's endangered and threatened avian populations and the regulations surrounding them, please refer to **Section 2.3**. Pennsylvania lists five known nesting, exotic bird species: rock dove, European starling, house sparrow, mute swan, and ring-necked pheasant. The first three on the list are considered to be "abundant and widespread pests," while exotic mute swans have been introduced for ornamental and aesthetic reasons, and pheasants were intentionally introduced for gaming purposes. Starlings and house sparrows are especially offensive because they compete with native birds for limited nesting and cavity space and often prey on eggs and nestlings. Mute swans are known for causing extensive destruction to wetland ecosystems and to the native wading and nesting birds that they displace.

Exelon Corporation's Limerick Generating Station lies within the Atlantic Flyway, which is one of four major North American flyways. Besides being located within an important migratory route, the Limerick Generating Station may provide habitat for a number of resident songbirds and important grassland and forestland species. In addition to providing the grassland and forestland habitats required of avian species at the Limerick Generating Station, the property may also provide habitat for a diversity of riparian-corridor species.

2.1.6.2.1 Cavity Nesting Species Management Options

In Pennsylvania, birds associated with deciduous forest habitats and shrublands are considered to be in relatively stable populations, as least when compared to the practices of massive deforestation that were common in the nineteenth century. However, birds associated with conifer forests and associated peatlands and swamplands have suffered serious declines. There have been some efforts towards the recovery of bird species common in conifer and peatland habitat types, although they have not been as successful as those undertaken in deciduous habitat areas. Ongoing forest management practices will likely continue to favor species of early successional forests rather than those sensitive species that require more mature, old growth forests.

Changes in land management objectives will continue to shape the landscape and, therefore, influence avian populations and the diversity that each habitat can support. Exelon's Limerick Generating Station can help preserve, protect, and enhance avian habitat and the resources on which they depend in a variety of ways, including through the placement of artificial nesting structures, roosting platforms, perches, and poles, establishment of native vegetation with high wildlife values, improvement of water resources on site, and continued education regarding avian species habitat requirements and individual importance. If employees at the Limerick Generating Station opt to establish and monitor nest boxes at the site, WHC encourages them to participate in Pennsylvania's Cavity Nester Survey and Colonial Bird Registry programs.

Table 8. Cavity Nesting Species in PA

COMMON NAME	SCIENTIFIC NAME
Northern saw-whet owl	<i>Aegolius acadicus</i>
Wood duck	<i>Aix sponsa</i>
Tufted titmouse	<i>Baeolophus bicolor</i>
Turkey vulture	<i>Cathartes aura</i>
Brown creeper	<i>Certhia Americana</i>
Chimney swift	<i>Chaetura pelagica</i>
Northern flicker	<i>Colaptes auratus</i>
Pileated woodpecker	<i>Dryocopus pileatus</i>
American kestrel	<i>Falco sparverius</i>
Hooded merganser	<i>Lophodytes cucullatus</i>
Red-bellied woodpecker	<i>Melanerpes carolinus</i>

COMMON NAME	SCIENTIFIC NAME
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>
Great crested flycatcher	<i>Myiarchus crinitus</i>
Eastern screech owl	<i>Otus asio</i>
Black-capped chickadee	<i>Parus atricapillus</i>
Carolina chickadee	<i>Parus carolinensis</i>
Downy woodpecker	<i>Picoides pubescens</i>
Hairy woodpecker	<i>Picoides villosus</i>
Purple martin	<i>Progne subis</i>
Prothonotary warbler	<i>Protonotaria citrea</i>
Eastern bluebird	<i>Sialia sialis</i>
Red-breasted nuthatch	<i>Sitta Canadensis</i>
White-breasted nuthatch	<i>Sitta carolinensis</i>
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>
Barred owl	<i>Strix varia</i>
Tree swallow	<i>Tachycineta bicolor</i>
Bewick's wren	<i>Thryomanes bewickii</i>
Carolina wren	<i>Thryothorus ludovicianus</i>
House wren	<i>Troglodytes aedon</i>
Winter wren	<i>Troglodytes troglodytes</i>
Barn owl	<i>Tyto alba</i>

WHC recommends that employees at the Limerick Generating Station consider adopting a formalized nest box monitoring program, starting by constructing and placing boxes for wood ducks, eastern bluebirds and owls. For more information about constructing, building and appropriately placing nest boxes, please contact the Wildlife Habitat Council.

2.1.6.2.2 Raptor Habitat Management Options

“Raptor” is a general term that refers to birds of prey. In general, raptors are fairly large, possess strong beaks and talons, and have sharp hearing and eyesight. These birds are often at the top of the food chain in ecological systems, and because of their value state and federal laws protect raptors. Raptors include hawks, eagles, falcons, harriers, kites, accipiters and buteos. Although many raptor species have shown decline, in large part due to their tendency to accumulate biotoxins, which result in egg thinning and severe reductions in reproductive success, efforts to conserve viable raptor habitat and the banning of certain chemicals have allowed some raptor species to begin to recover.

The State of Pennsylvania is very well known for the annual hawk flights that take place throughout the region, and for the efforts of the Hawk Migration Association and Hawk

Mountain, which is a world leader in the pursuit of raptor inventories, monitoring, education, and conservation efforts. In addition, knowledge about bald eagles, osprey, and loggerhead shrikes has greatly increased in recent years due to the establishment of funding sources for research and restoration projects. A list of native Pennsylvania birds of prey is provided in **Table 9** and should be consulted when developing considerations for potential target species in habitat enhancement efforts on site. Representatives at the Limerick Generating Station can conserve habitat for raptors by protecting early successional, wooded, and wetland habitats on site; furthermore, placing artificial nesting structures and brush piles may lead to habitat enhancements for raptors. Please contact WHC for more information about raptor habitat enhancements. The common owl species of Pennsylvania are found most often in their preferred nesting habitats and can be identified by sound and behavior. In addition owls are most easily identified during the nesting season, when they are more actively hunting and subsequently more vocal.

Table 9. Common Birds of Prey in PA

TYPE	COMMON NAME	SCIENTIFIC NAME
Falcon (Falconidae)	Merlin	<i>Falco columbarius</i>
	American kestrel	<i>Falco sparverius</i>
Hawk/Eagle (Accipitridae)	Cooper's hawk	<i>Accipiter cooperii</i>
	Northern goshawk	<i>Accipiter gentiles</i>
	Sharp-shinned hawk	<i>Accipiter striatus</i>
	Golden eagle	<i>Aquila chrysaetos</i>
	Red-tailed hawk	<i>Buteo jamaicensis</i>
	Rough-legged hawk	<i>Buteo lagopus</i>
	Red-shouldered hawk	<i>Buteo lineatus</i>
	Broad-winged hawk	<i>Buteo platypterus</i>
	Northern harrier	<i>Circus cyaneus</i>
Osprey (Pandionidae)	Osprey	<i>Pandion haliaetus</i>
Owl (Tytonidae)	Barn owl	<i>Tyto alba</i>
Owl (Strigidae)	Northern saw-whet owl	<i>Aegolius acadicus</i>
	Short-eared owl	<i>Asio flammeus</i>
	Long-eared owl	<i>Asio otus</i>
	Snowy owl	<i>Bubo scandiacus</i>
	Great horned owl	<i>Bubo virginianus</i>
	Eastern screech owl	<i>Otus asio</i>
	Barred owl	<i>Strix varia</i>
Vulture (Cathartidae)	Black vulture	<i>Coragyps atratus</i>
	Turkey vulture	<i>Cathartes aura</i>

In order to promote the presence of raptors on site, employees and volunteers associated with the Limerick Generating Station can place nesting platforms and boxes, as well as maintain natural snags and place artificial perches in appropriate areas of the site. For more information on potential raptor habitat enhancement projects, please contact WHC staff. In addition, the **Artificial Nesting Structures** document, which can be accessed under the "Technical Reference Documents" menu of the Report CD, provides guidance on how to do this for a variety of native bird species.

2.1.6.3 Small Mammal Habitat Management Options

The State of Pennsylvania has a rich diversity of mammal species that are commonly found throughout various habitats within the state. "In 1989 the Mammal Technical Committee, along with the Ornithological Technical Committee, was designated by the Pennsylvania Game Commission (PGC) as an official scientific advisory committee to the Commission. Under the terms of a Memorandum of Understanding between the Biological Survey and the PGC, representatives of these two technical committees and the Game Commission meet annually to discuss matters relating to the Commonwealth's mammals and birds" (PA Biological Survey, 2003). Committee initiatives include the comprehensive identification and assessment of mammal species in the state, as well as specific studies regarding species of special concern throughout the state. In addition, the Pennsylvania Biological Survey is working towards identifying and classifying Important Mammal Areas throughout the state, and developing a Biodiversity Monitoring network to highlight all of the species information that has been collected thus far.

According to historical records and the committee's findings, Pennsylvania has seventy-one native species of mammal, representing seven orders and 16 families. Of the 71 total species, 11 have been extirpated, including the gray wolf, bison, lynx, and mountain lion. Three species that were once extirpated, the beaver, elk and fisher, have been successfully re-established throughout parts of their historic range in the state (PA Biological Survey). "Three species, or subspecies, of mammals are state-listed as Endangered within the Commonwealth: the Indiana bat, Delmarva fox squirrel, and least shrew (and) another three are state-listed as Threatened: the eastern small-footed bat, West Virginia water shrew and

Allegheny woodrat (PGC, 1995). The Indiana bat and Delmarva fox squirrel are listed as endangered under the Federal Endangered Species Act.

Today, the greatest threat to Pennsylvania's diversity of mammals is the ongoing degradation and loss of habitat. Habitat degradation and loss is especially harmful to those species that require specific habitat conditions; continued loss of large tracts of habitat will likely lead to the eventual extirpation of many species.

Table 10. Common Mammals in PA

COMMON NAME	SCIENTIFIC NAME
Virginia opossum	<i>Didelphis virginiana</i>
Masked shrew	<i>Sorex cinereus</i>
Smokey shrew	<i>Sorex fumeus</i>
Northern short tailed shrew	<i>Blarina brevicauda</i>
Eastern mole	<i>Scalopus aquaticus</i>
Star nosed mole	<i>Condylura cristata</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
New England cottontail	<i>Sylvilagus transitionalis</i>
Eastern chipmunk	<i>Tamias striatus</i>
Woodchuck	<i>Marmota monax</i>
Gray squirrel	<i>Sciurus carolinensis</i>
Fox squirrel	<i>Sciurus niger</i>
Red squirrel	<i>Tamiasciurus hudsonicus</i>
Southern flying squirrel	<i>Glaucomys volans</i>
Northern flying squirrel	<i>Glaucomys sabrinus</i>
Beaver	<i>Castor canadensis</i>
Deer mouse	<i>Peromyscus maniculatus</i>
White-footed mouse	<i>Peromyscus leucopus</i>
Meadow vole	<i>Microtus pennsylvanicus</i>
Pine vole	<i>Microtus pinetorum</i>
Muskrat	<i>Ondatra zibethicus</i>
Norway rat	<i>Rattus norvegicus</i>
House mouse	<i>Mus musculus</i>
Porcupine	<i>Erethizon dorsatum</i>
Eastern coyote	<i>Canis latrans</i>
Red fox	<i>Vulpes vulpes</i>
Gray fox	<i>Urocyon cinereargenteus</i>
Black bear	<i>Ursus americanus</i>
Raccoon	<i>Procyon lotor</i>

COMMON NAME	SCIENTIFIC NAME
Long tailed weasel	<i>Mustela nivalis</i>
Mink	<i>Mustela vison</i>
Striped skunk	<i>Mephitis mephitis</i>
River otter	<i>Lutra Canadensis</i>
White-tailed deer	<i>Odocoileus virginianus</i>

In order to enhance and conserve habitat opportunities for small mammals at the Limerick Generating Station, employees and habitat program volunteers can place brush piles in selected areas of the site. Many species of ground-nesting birds, songbirds, mammals, reptiles, and invertebrates use brush piles for loafing and escape cover, and some species even build their dens within them. Brush piles are also used by some small wildlife species in cooler regions of the country to survive during winter months. They will increase the prey base for raptors by providing cover and perching sites for birds, small mammals and reptiles. Ideally, brush piles should be placed near the edges of forests and fields so that wildlife feeding in these areas will not be too far from cover. Stones, cinder blocks, and old tires with holes cut out of them make a good base for a brush pile. These items allow wildlife to navigate through the brush piles, and many small mammals often build dens in these structures. Woody debris collected from the property can be used to construct the piles, but hardwood tree species are usually more durable and rot-resistant than conifers. The pile should be constructed with the largest plant material on the bottom and smaller limbs and twigs composing the top, as shown in **Figure 16**. Plant materials should be laid in rows with each stack perpendicular to the one below, forming a mound shape.

Figure 16. Example Brush Pile

Collecting discarded Christmas trees from employees is a good way for the wildlife team to obtain brush pile components and promote recycling. It should be noted, however, that any conifers used in the brush pile should be thoroughly dried before placement to prevent bark beetles from breeding in the piles. A general rule for brush pile size and placement is three to four piles per acre, each being four to eight feet in height, 10 to 20 feet in diameter, and 100 to 150 feet apart. Brush piles that are too small will not provide adequate cover for

wildlife. When the brush pile is completed, it should be loose enough for wildlife to navigate through, but dense enough to provide adequate cover.

2.1.6.3.1 Bat Habitat Management Options

Despite the many misconceptions people have about them, bats are actually a unique group of mammals that play a vital role in natural ecosystems. There are more than 1,000 different kinds of bats throughout the world, amounting to approximately ¼ of all mammal species. Many people have the mistaken idea that contact with a bat will result in rabies contraction. In fact, research indicates that the incidence of rabies is only about 0.5 percent in bat populations. Bats will not usually bite unless threatened, and since most of those bats that do contract rabies exhibit the paralytic form of the virus, a rabid bat is unlikely to attack humans.

Bats are important in seed dispersal and pollination of both wild and agricultural plants, and are a major predator of night-flying insects, including mosquitoes; approximately 70 percent of all bats are considered to be insectivorous. A single bat can eat up to 1,000 or more insects in an hour, potentially reducing the need for pesticides and lowering the risk of insect-borne diseases such as West Nile Virus.

Of the more than 1,000 bat species throughout the world, only 12 species live in Pennsylvania all or part of the year. All of them are insect eaters and feed on mosquitoes, as well as many crop damaging corn border and cutworm moths. Therefore, Pennsylvania bats generally hibernate or migrate when insect populations begin to dwindle. Bats common in the region are generally small, only two to four inches in length with average wingspans of up to twelve inches and often weigh less than one ounce.

In spite of their beneficial and relatively innocuous nature, more than half of the bat species in America are considered to be endangered or in rapid decline. Pesticide use, habitat destruction, and disturbance of colonies during hibernation and breeding are among the biggest threats to these populations. Placing and monitoring artificial roosting structures are steps that the Limerick Generating can take to support bat populations and to help slow or even reverse, their downward population trend. **Table 11** provides a list of the bats species

that are commonly observed in Pennsylvania. In addition, **Figure 17** provides the habitat ranges of those species noted in Montgomery County.

Table 11. Bats Found in PA

COMMON NAME	SCIENTIFIC NAME	STATUS
**Big brown bat	<i>Eptesicus fuscus</i>	Common
**Little brown bat	<i>Myotis lucifugus</i>	Common
Indiana bat	<i>Myotis sodalíst</i>	Endangered
Hoary bat	<i>Lasiurus cinereus</i>	Undetermined
Silver-haired bat	<i>Lasionycteris noctivagans</i>	Rare
Long-eared bat	<i>Myotis keenii</i>	Rare
Pink-faced bat	<i>Myotis sodalis</i>	Endangered
Red bat	<i>Lasiurus borealis</i>	Undetermined
Small-footed bat	<i>Myotis leibii</i>	Threatened
Eastern pipistrelle	<i>Pipistrellus subflavus</i>	Secure
*Seminole bat	<i>Lasiurus semionoles</i>	Undetermined
*Evening bat	<i>Nycticeius humeralis</i>	Rare

* Species has been documented in Pennsylvania, but is not considered a regular resident.

**Species have been documented using bat houses.

Figure 17. Bat Ranges around the Limerick Generating Station

Bat boxes may be used for establishment of nursery colonies during the summer months, for roosting, or for hibernating. Once a location is established, bat populations will generally return to the same bat box every year. The bats can be monitored by looking up into the box during the day with a flashlight to count the number of occupants, and by counting the number of bats that emerge in the evening. To count pups, wait until the adults have emerged in the evening, and then use a flashlight to attempt to count the pups remaining. Each breeding female usually has one pup per year. The pups are born hairless and unable to fly, and are dependent on the mother for protection and milk. The mother will leave the pup alone in the colony at night to feed, but will return to nurse. The young will begin to leave the colony for short flights when six to eight weeks old, usually in late July.

Bats that do not use boxes are generally tree bats, meaning they roost and have their young under loose bark or foliage in trees. These species may be attracted to an area by attaching a 24- to 36-inch wide piece of fiberglass, plastic, or sheet metal around the trunk of a tree. In addition, standing dead trees (known as snags) in different degrees of decay can provide the

loose bark that these bats require for roosting and reproduction. If snags are not naturally present at the site, members of the Wildlife Team can enhance bat habitat opportunities by creating additional cavities through the girdling of live trees.

Figure 18. Little Brown Bats in a Roosting Box

Photo by Marcia Maslonek, Director of Biodiversity, WHC.

Although bats are not usually aggressive, they should never be handled. Occasionally young may fall from the roost, or adults may be injured when hit by cars. While less than half of one percent of the population carries the rabies virus, as noted above, any downed bat should be treated as a potential carrier. To capture an injured bat, wear gloves, place a coffee can over the bat, and then slide a piece of cardboard under the can. An obvious juvenile can then be placed back in the box as long as the person does not come into direct contact with the bat. For injured or ill bats, contact the health department or a local wildlife rehabilitator. If there are any issues with this, WHC and the other partners can be contacted for help. In addition, the **Bats** document, which can be accessed under the "Technical Reference Documents" menu of the Report CD, provides guidance enhancing bat habitats. The **Bats** document, which can be accessed under the "Technical Reference Documents" menu of the Report CD, gives details for building a bat box and more general information about bats. Bat Conservation International (BCI) can also provide information about bat boxes, if desired. Constructed boxes or kits that are approved by BCI are also available from Bat Conservation and Management, Inc. Contact information for Bat Conservation International and Bat Conservation and Management, Inc. can be found in **Appendix III**.

2.1.6.4 Pollinator Habitat Management Options

The steady decrease in native pollinators is of great concern within the scientific community because of their important role in propagating both agricultural and wild plant species; while some plants are pollinated by the wind or self-pollinated, most flowering plants require a pollinator in order to set fruit and seed. Butterflies and hummingbirds are both important

groups of pollinators, but bees are the group responsible for pollinating the greatest number and diversity of native plants. On a typical foraging trip, a bee may visit hundreds of flowers, pollinating each of them inadvertently while drinking nectar. Native bees are fundamentally responsible for maintaining the vigor of natural plant communities and the wildlife that depend on them.

Table 12. Butterflies of Montgomery County

COMMON NAME	SCIENTIFIC NAME
Red spotted purple	<i>Limenitis arthemis astyanax</i>
White admiral	<i>Limenitis arthemis</i>
Viceroy	<i>Limenitis archippus</i>
Hackberry emporer	<i>Asterocampa celtis</i>
Tawny emperor	<i>Asterocampa clyton</i>
Aphrodite fritillary	<i>Speyeria Aphrodite</i>
Great spangled fritillary	<i>Speyeria cybele</i>
Meadow fritillary	<i>Boloria bellona</i>
Regal fritillary	<i>Speyeria idalia</i>
Silver bordered fritillary	<i>Boloria selene</i>
Variegated fritillary	<i>Euptoieta Claudia</i>
Monarch	<i>Danaus plexippus</i>
Appalachian brown	<i>Satyrodes Appalachia</i>
Common wood nymph	<i>Ceryonis pegala</i>
Eyed brown	<i>Satyrodes Eurydice</i>
Little wood satyr	<i>Megisto cymela</i>
Northern pearly eye	<i>Enodia anthedon</i>
American snout	<i>Libytheana carinenta</i>
American lady	<i>Vanessa virginiensis</i>
Baltimore	<i>Euphydryas phaeton</i>
Common buckeye	<i>Junonia coenia</i>
Compton tortoiseshell	<i>Nymphalis vaualbum</i>
Eastern comma	<i>Polygonia comma</i>
Gray comma	<i>Polygonia progne</i>
Milbert's tortoiseshell	<i>Aglais milberti</i>
Mourning cloak	<i>Nymphalis antiopa</i>
Painted lady	<i>Vanessa cardui</i>
Question mark	<i>Polygonia interrogationis</i>
Red admiral	<i>Vanessa atalanta</i>
Silvery checkerspot	<i>Chlosyne nycteis</i>
Tawny crescent	<i>Phyciodes batesii</i>
Appalachian azure	<i>Celastrina neglecta-minor</i>
Eastern tailed blue	<i>Cupido comyntas</i>
Spring azure	<i>Celastrina ladon</i>
Summer azure	<i>Celastrina neglecta</i>
American copper	<i>Lycæna phlaeas</i>
Bronze copper	<i>Lycæna hyllus</i>

COMMON NAME	SCIENTIFIC NAME
Acadian hairstreak	<i>Satyrium acadia</i>
Banded hairstreak	<i>Satyrium calannus</i>
Brown elfin	<i>Callophrys augustinus</i>
Coral hairstreak	<i>Satyrium titus</i>
Eastern pine elfin	<i>Callophrys niphon</i>
Frosted elfin	<i>Callophrys irus</i>
Hickory hairstreak	<i>Satyrium caryaevorum</i>
Southern hairstreak	<i>Fixsenia favonius</i>
Striped hairstreak	<i>Satyrium liparops</i>
Harvester	<i>Feniseca tarquinius</i>
Northern metalmark	<i>Calephelis borealis</i>
Black swallowtail	<i>Papilio polyxenes</i>
Eastern tiger swallowtail	<i>Papilio glaucus</i>
Giant swallowtail	<i>Papilio cresphontes</i>
Pipevine swallowtail	<i>Battus philenor</i>
Spicebush swallowtail	<i>Papilio Troilus</i>
Zebra swallowtail	<i>Eurytides Marcellus</i>
Black dash	<i>Euphyes conspicua</i>
Broad winged skipper	<i>Poanes viator</i>
Clouded skipper	<i>Lerema accius</i>
Cobweb skipper	<i>Hesperia metea</i>
Common roadside skipper	<i>Amblyscirtes vialis</i>
Crossline skipper	<i>Polites origenes</i>
Delaware skipper	<i>Anatrytone logan</i>
Dun skipper	<i>Euphyes vestries</i>
Dusted skipper	<i>Atrytonopsis bianna</i>
European skipper	<i>Thymelicus lineola</i>
Fiery skipper	<i>Hylephila phyleus</i>
Hobomonk skipper	<i>Poanes hobomonk</i>
Indian skipper	<i>Hesperia leonardus</i>
Little glassywing	<i>Pompeius verna</i>
Long dash	<i>Polites mystic</i>
Mulberry wing	<i>Poanes massasoit</i>
Northern broken dash	<i>Wallengrenia egeremet</i>
Ocola skipper	<i>Panoquina ocola</i>
Peck's skipper	<i>Polites peckius</i>
Sachem	<i>Atalopedes campestris</i>
Swarthy skipper	<i>Nastra iberminier</i>
Tawny edged skipper	<i>Polites themistocles</i>
Two spotted skipper	<i>Euphyes bimacula</i>
Zabulon skipper	<i>Poanes zabulon</i>
Columbine duskywing	<i>Erynnis lucilius</i>
Common checkered skipper	<i>Pyrgus communis</i>
Common sootywing	<i>Pholisora catullus</i>
Hoary edge	<i>Achalarus lyciades</i>
Horace's duskywing	<i>Erynnis juvenalis</i>

COMMON NAME	SCIENTIFIC NAME
Juvenal's duskywing	<i>Erynnis juvenalis</i>
Mottled duskywing	<i>Erynnis martialis</i>
Northern cloudywing	<i>Thorybes pylades</i>
Persius duskywing	<i>Erynnis persius</i>
Silver spotted skipper	<i>Epargyreus clarus</i>
Sleepy duskywing	<i>Erynnis brizo</i>
Southern cloudywing	<i>Thorybes bathyllus</i>
Wild indigo duskywing	<i>Erynnis baptisiae</i>
Zarucco duskywing	<i>Erynnis zarucco</i>
Azalea sphinx	<i>Darapsa choerilus</i>
Hummingbird clearwing	<i>Hemaris thysbe</i>
Nessus sphinx	<i>Amphion floridensis</i>
Slender clearwing	<i>Hemaris gracilis</i>
Snowberry clearwing	<i>Hemaris diffinis</i>
Virginia creeper sphinx	<i>Darapsa myron</i>
Twin spotted sphinx	<i>Smerinthus jamaicensis</i>
Walnut sphinx	<i>Amorpha juglandis</i>
Yellow collared scape moth	<i>Cisseps fulvicollis</i>
Clouded sulphur	<i>Colias philodice</i>
Cloudless sulphur	<i>Phoebes sennae</i>
Little yellow	<i>Pyrisitia lisa</i>
Orange sulphur	<i>Colias eurytheme</i>
Sleepy orange	<i>Abaeis nicippe</i>
Southern dogface	<i>Zerene cesonia</i>
Cabbage white	<i>Pieris rapae</i>
Checkered white	<i>Pontia protodice</i>
Falcate orangetip	<i>Anthocharis midea</i>
Io moth	<i>Automeria io</i>
Cecropia silkmoth	<i>Hyalophora cecropia</i>
Luna moth	<i>Actias luna</i>
Polyphemus moth	<i>Antheraea polyphemus</i>

Loss of nesting habitat and nectar sources, combined with widespread pesticide use, has led to a decline in bees and other pollinators that has caused alarm amongst the scientific community. The drastic decline in domestic honeybees in the last few years due to mite parasitism has led to further cause for concern in protecting native bee populations.

The majority of North American bees are solitary and should not to be confused with honeybees, which nest in colonies and were introduced into the U.S. The distinction between native, solitary bees and introduced, social bees is important for public awareness of bee conservation because only social bees swarm to protect their hive; native pollen bees on

the other hand rarely ever sting and when they do, the sting tends to be mild. Native bees can generally be categorized as either soil dwellers or wood dwellers. Among the soil-dwelling bees are the bumble, sweat, digger, squash, alkali, and polyester bees. Wood-dwelling bees include orchard mason, horn-faced, leafcutter, and carpenter bees. In their natural habitat, wood-dwelling bees will excavate their nests in the soft central pith of stems and twigs, abandoned beetle borrows, or in dead standing trees. Soil-dwelling bees dig their nests in bare soil or construct domed nests out of mud. In addition, the **Butterflies** document, which can be accessed under the "Technical Reference Documents" menu of the Report CD, provides guidance enhancing pollinator habitats.

2.1.6.5 Herptile Habitat Management Options

"Herptile" is jargon that is typically employed to collectively refer to both amphibian and reptile groups. These two groups are often lumped together when discussing habitat because it is largely accepted that reptiles evolved from amphibians. Both reptiles and amphibians are cold-blooded animals that lay eggs; however, there are also several important differences between the two groups, and among individual species of each group.

Amphibians generally inhabit damp or wet environments such as marches, swamps, bogs, ponds, and larger water bodies. This is because two of the stages of amphibian metamorphosis, the egg stage and the tadpole stage, require aqueous environments. The major groupings of amphibian species include frogs and toads, and salamanders. Frogs and toads are commonly confused with one and other; however, toads generally have shorter legs than frogs, and their movements are described as hopping rather than the leaping common among frogs. In addition, toads generally do not live in as close proximity to water resources as frogs typically do, although both require aquatic environments for successful reproduction. Frogs and toads can be most readily identified through their calls, taking into consideration overall size, color and markings. Salamanders, the other common type of amphibian, are generally recognizable by their long, slender bodies and presence of four legs, making them easily distinguishable from toads and frogs. There are 38 species and subspecies of amphibians found in Pennsylvania. Representing nine families and 16 genera, they are only a part of the approximately 3,000 species of amphibians in the world.

Figure 19. Turtles Using Basking Logs

Photo by of Sue Wolinsky, WHC Wildlife Biologist/Certification Program Manager

Reptiles, the other component of the term “herptile,” are often separated into four main categories for study: crocodiles, lizards, snakes, and turtles. Reptile development and overall lifecycles are very different than those common among amphibians. Reptiles generally spend their lives in terrestrial environments and young do not go through an extended metamorphosis; rather they are born as miniature versions of adults. The crocodile category of reptiles includes the American alligator, while the “lizard” classification includes iguanas, geckos, skinks, and chameleons. Snakes, which are further described as legless reptiles that live in the ground, trees, or water, include earth snakes, common garter snakes, and copperheads. Turtles, which are the only reptiles with an external shell, include bog turtles, painted turtles, map turtles, and stinkpots. Reptiles can be identified by noting appearance and development characteristics as well as based on location and behavior. Now only a remnant of a formerly large group, reptiles today number just about 6,000 species worldwide, much less than during the time when reptiles dominated life on this planet.

The lack of vernal pools and other appropriate terrestrial and aquatic reptile and amphibian habitat resources across the country, which is attributed to the encroachment of development and the conversion of acreage to agricultural and residential lands, is partly responsible for the alarming decrease of reptiles and amphibians worldwide. Herptiles have been declining in increasing numbers throughout the last century. An ongoing monitoring project can help employees and volunteers at the Limerick Generating Station determine the status of herptile populations on site and identify the quality of habitat resources available for these sensitive species, while also contributing to important regional and national monitoring efforts, such as the compilation of research through the National Wildlife Federation and U.S. Geological Survey (USGS) -sponsored Frogwatch USA program. Frogwatch USA relies on volunteers to collect information regarding amphibian populations in neighborhoods across the nation. Monitoring activities such as this will not only benefit amphibians and reptiles, but also present an opportunity for partnership and public relations development. Frogs and toads can be most readily identified through their calls, taking into

consideration overall size, color, and markings. Reptiles are often easier to identify based on habitat types and other identifiable characteristics. Table 13 provides a list of the reptile and amphibian species that are native to Pennsylvania.

Table 13. Amphibians and Reptiles Native to PA

TYPE	COMMON NAME	SCIENTIFIC NAME
Amphibian	Northern cricket frog	<i>Acris crepitans</i>
	Jefferson salamander	<i>Ambystoma jeffersonianum</i>
	Spotted salamander	<i>Ambystoma maculatum</i>
	Marbled salamander	<i>Ambystoma opacum</i>
	Tiger salamander	<i>Ambystoma tigrinum</i>
	Green salamander	<i>Aneides aeneus</i>
	American toad	<i>Bufo americanus</i>
	Fowler's toad	<i>Bufo fowleri</i>
	Hellbender	<i>Cryptobranchus alleganiensis</i>
	Dusky salamander	<i>Desmognathus fuscus</i>
	Seal salamander	<i>Desmognathus monticola</i>
	Mountain dusky salamander	<i>Desmognathus ochrophaeus</i>
	Two lined salamander	<i>Eurycea bislineata</i>
	Longtail salamander	<i>Eurycea longicauda</i>
	Spring salamander	<i>Gyrinophilus porphyriticus</i>
	Four-toed salamander	<i>Hemidactylum scutatum</i>
	Spring peeper	<i>Hyla crucifer</i>
	Gray treefrog	<i>Hyla versicolor</i>
	Mudpuppy	<i>Necturus maculosus</i>
	Eastern newt	<i>Notophthalmus viridescens</i>
	Redback salamander	<i>Plethodon cinereus</i>
	Northern ravine salamander	<i>Plethodon electromorphus</i>
	Slimy salamander	<i>Plethodon glutinosus</i>
	Valley and ridge salamander	<i>Plethodon hoffmani</i>
	Wehrle's salamander	<i>Plethodon wehrlei</i>
	Mountain chorus frog	<i>Pseudacris brachyphona</i>
	Striped chorus frog	<i>Pseudacris triseriata</i>
	New Jersey chorus frog	<i>Pseudacris triseriata kalmi</i>
	Mud salamander	<i>Pseudotriton montanus</i>
	Red salamander	<i>Pseudotriton ruber</i>
	Bullfrog	<i>Rana catesbeiana</i>
	Green frog	<i>Rana clamitans</i>
	Pickerel frog	<i>Rana palustris</i>
	Northern leopard frog	<i>Rana pipens</i>
Coastal plain leopard frog	<i>Rana sphenoccephala</i>	
Wood frog	<i>Rana sylvatica</i>	
Eastern spadefoot	<i>Scaphiopus holbrookii</i>	

TYPE	COMMON NAME	SCIENTIFIC NAME	
Reptile	Copperhead	<i>Agkistrodon contortrix</i>	
	Smooth softshell	<i>Apalone mutica</i>	
	Spiny softshell	<i>Apalone spinifera</i>	
	Worm snake	<i>Carphophis amoenus</i>	
	Snapping turtle	<i>Chelydra serpentina</i>	
	Northern painted turtle	<i>Chrysemys picta</i>	
	Spotted turtle	<i>Clemmys guttata</i>	
	Kirtland's snake	<i>Clonophis kirtlandii</i>	
	Black racer	<i>Coluber constrictor</i>	
	Timber rattlesnake	<i>Crotalus horridus</i>	
	Ringneck snake	<i>Diadophis punctatus</i>	
	Rat snake	<i>Elaphe obsoleta</i>	
	Blanding's turtle	<i>Emys blandingii</i>	
	Coal skink	<i>Eumeces anthracinus</i>	
	Five-lined skink	<i>Eumeces fasciatus</i>	
	Broadhead skink	<i>Eumeces laticeps</i>	
	Wood turtle	<i>Glyptemys insculpta</i>	
	Bog turtle	<i>Glyptemys mublenbergii</i>	
	Map turtle	<i>Graptemys geographica</i>	
	Eastern hognose	<i>Heterodon platirhinos</i>	
	Eastern mud turtle	<i>Kinosternon subrubrum</i>	
	Common kingsnake	<i>Lampropeltis getula</i>	
	Milk snake	<i>Lampropeltis triangulum</i>	
	Smooth green snake	<i>Liochlorophis vernalis</i>	
	Reptile	Northern water snake	<i>Nerodia sipedon</i>
		Rough green snake	<i>Opheodrys aestivus</i>
		Redbelly turtle	<i>Pseudemys rubriventris</i>
Queen snake		<i>Regina septemvittata</i>	
Eastern fence lizard		<i>Sceloporus undulatus</i>	
Eastern massasauga		<i>Sistrurus catenatus catenatus</i>	
Stinkpot		<i>Sternotherus odoratus</i>	
Brown snake		<i>Storeria dekayi</i>	
Redbelly snake		<i>Storeris occipitomaculata</i>	
Eastern box turtle		<i>Terrapene carolina</i>	
Shorthead garter snake		<i>Thamnophis brachystomus</i>	
Eastern ribbon snake		<i>Thamnophis sauritus</i>	
Common garter snake		<i>Thamnophis sirtalis</i>	
Smooth earth snake		<i>Virginia valeriae</i>	
Mountain earth snake	<i>Virginia valeriae pulchra</i>		

2.2 PLANTS AND WILDLIFE IDENTIFIED AT THE LIMERICK GENERATING STATION

Table 14 lists some of the wildlife species that have been observed at the Limerick Generating Station. Comprised of species directly observed by the visiting WHC biologists as well as those identified previously by site employees, the list is intended to be used as a foundation for the development of a comprehensive inventory of plants and animals at the site. To facilitate the development of a species inventory, a sample list of species characteristic of the ecoregion in which the Limerick Generating Station is situated is provided alphabetically by scientific name in **Appendix II** of this report.

Table 14. Plants and Wildlife Identified at the Limerick Generating Station

TYPE	COMMON NAME	SCIENTIFIC NAME
Plant	Sugar maple	<i>Acer saccharum</i>
	Maple	<i>Acer</i> spp.
	Tree of heaven	<i>Ailanthus altissima</i>
	Indian hemp	<i>Apocynum cannabinum</i>
	Burdock	<i>Arctium minus</i>
	Creeper vine	<i>Campsis radicans</i>
	Catalpa	<i>Catalpa speciosa</i>
	Chicory	<i>Cichorium intybus</i>
	Thistle	<i>Cirsium</i> spp.
	Crown vetch	<i>Coronilla varia</i>
	Wild carrot	<i>Delphinium</i> spp
	Lovegrass	<i>Eragrostis curvula</i>
	Daisy fleabane	<i>Erigeron annuus</i>
	Wild strawberry	<i>Fragaria virginiana</i>
	Daylily	<i>Hemerocallis hybrida</i>
	Jewelweed	<i>Impatiens biflora</i>
	Mile-a-minute	<i>Ipomoea cairica</i>
	Black walnut	<i>Juglans nigra</i>
	Creeping cedar	<i>Juniperus horizontalis</i>
	Eastern red cedar	<i>Juniperus virginiana</i>
	Everlasting pea	<i>Lathyrus grandiflours</i>
	Lespedeza	<i>Lespedeza</i> spp.
	Tuliptree	<i>Liriodendron tulipifera</i>
	Japanese honeysuckle	<i>Lonicera japonica</i>
	Japanese stiltgrass	<i>Microstegium vimineum</i>
	Beard tongue	<i>Penstemon</i> spp.
	Common reed	<i>Phragmites australis</i>
American pokeweed	<i>Phytolacca Americana</i>	

SITE ASSESSMENT AND WILDLIFE MANAGEMENT OPPORTUNITIES FOR EXELON CORPORATION'S
LIMERICK GENERATING STATION

TYPE	COMMON NAME	SCIENTIFIC NAME
	Oaks	<i>Quercus</i> spp.
	Prairie coneflower	<i>Ratibida pinnata</i>
	Smooth sumac	<i>Rhus glabra</i>
	Staghorn sumac	<i>Rhus typhina</i>
	Wineberry	<i>Rubus phoenicolasius</i>
	Raspberry	<i>Rubus</i> spp.
	Black-eyed Susan	<i>Rudbeckia hirta</i>
	Curled dock	<i>Rumex crispus</i>
	Foxtail	<i>Setaria faberi</i>
	Lilac	<i>Syringa vulgaris</i>
	Common dandelion	<i>Taraxacum officinale</i>
	Yew	<i>Taxus baccata</i>
	Poison ivy	<i>Toxicodendron radicans</i>
	White clover	<i>Trifolium repens</i>
	Common mullein	<i>Verbascum thapsus</i>
Mammals	Opossum	<i>Didelphis virginiana</i>
	White-tailed deer	<i>Odocoileus virginianus</i>
	Raccoon	<i>Procyon lotor</i>
	Gray squirrel	<i>Sciurus Carolinensis</i>
	Eastern cottontail rabbit	<i>Sylvilagus floridanus</i>
	Red fox	<i>Vulpes vulpes</i>
Birds	Canada goose	<i>Branta Canadensis</i>
	Red tailed hawk	<i>Buteo jamaicensis</i>
	Northern cardinal	<i>Cardinalis cardinalis</i>
	Turkey vulture	<i>Cathartes aura</i>
	Killdeer	<i>Charadrius vociferous</i>
	Barn swallow	<i>Hirundo rustica</i>
	Purple martin	<i>Progne subis</i>
	Eastern bluebird	<i>Sialis sialis</i>
	European starling	<i>Sturnus vulgaris</i>
	Tree swallow	<i>Tachycineta bicolor</i>
Insects	Clouded sulphur	<i>Colias philodice</i>
	Darner	Family Aeshnidae
	Viceroy	<i>Limenitis archippus</i>
	Southern dogface	<i>Phoebis sennae</i>
	Pearl crescent	<i>Phyciodes tharos</i>
	Cabbage white	<i>Pieris brassicae</i>

2.3 THREATENED AND ENDANGERED SPECIES

Including invertebrates and plants, there are approximately 740 species that have been listed as endangered or threatened within the state of Pennsylvania. One example of an animal that was once common in Pennsylvania but has gone extinct is the passenger pigeon. Of the total number of endangered and threatened species designated in the state, 382 are vascular plants, 282 are invertebrates, 43 are fish, five are reptiles, five are amphibians, 16 are birds, and nine are mammals. The two most common causes of decline that ultimately leads to state and federal listing of species are habitat degradation and habitat loss. **Table 15** provides a summary of the types of species that are considered to be threatened and endangered in Pennsylvania, while **Table 16** actually lists Pennsylvania state-listed threatened and/or endangered species. More information is available about these species, and the federal and state programs designed to protect them, on the Pennsylvania DCNR web site: <http://www.dcnr.state.pa.us/wrcf/contents.aspx>.

Table 15. Summary of Threatened and Endangered Species in PA

TYPE	ENDANGERED	THREATENED	TOTAL NUMBER
Fish	28	15	43
Reptile	4	1	5
Amphibian	4	1	5
Bird	13	3	16
Mammal	5	4	9
Invertebrate*			282
Plants	283	99	382
Total			740

* No designation is given regarding the status of invertebrate species of special concern.

The Pennsylvania DCNR is the governing agency within the state charged with the power to designate endangered and threatened species, and subsequently with providing advice regarding the management, protection, and conservation of these species.

Table 16. Listing of Threatened and Endangered Species in PA

TYPE	COMMON NAME	SCIENTIFIC NAME	STATUS
Fish	Shortnose sturgeon	<i>Acipenser brevirostrum</i>	State Endangered
	Atlantic sturgeon	<i>Acipenser oxyrinchus</i>	State Endangered

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TYPE	COMMON NAME	SCIENTIFIC NAME	STATUS
Fish	Skipjack herring	<i>Alosa chrysochloris</i>	State Threatened
	Hickory shad	<i>Alosa mediocris</i>	State Endangered
	Black bullhead	<i>Ameiurus melas</i>	State Endangered
	Longnose sucker	<i>Catostomus catostomus</i>	State Endangered
	Cisco	<i>Coregonus artedii</i>	State Endangered
	Banded sunfish	<i>Enneacanthus obesus</i>	State Endangered
	Gravel chub	<i>Erimystax x-punctatus</i>	State Endangered
	Bluebreast darter	<i>Etheostoma camurum</i>	State Threatened
	Iowa darter	<i>Etheostoma exile</i>	State Endangered
	Spotted darter	<i>Etheostoma maculatum</i>	State Threatened
	Eastern sand darter	<i>Etheostoma pellucida</i>	State Endangered
	Tippecanoe darter	<i>Etheostoma Tippecanoe</i>	State Threatened
	Threespot stickleback	<i>Gasterosteus aculeatus</i>	State Endangered
	Goldeye	<i>Hiodon alosoides</i>	State Threatened
	Mooneye	<i>Hiodon tergisus</i>	State Threatened
	Northern brook lamprey	<i>Ichthyomyzon fossor</i>	State Endangered
	Northern brook lamprey	<i>Ichthyomyzon fossor</i>	State Endangered
	Mountain brook lamprey	<i>Ichthyomyzon greeleyi</i>	State Threatened
	Smallmouth buffalo	<i>Ictiobus bubalus</i>	State Threatened
	Bigmouth buffalo	<i>Ictiobus cyprinellus</i>	State Endangered
	Spotted gar	<i>Lepisosteus oculatus</i>	State Endangered
	Warmouth	<i>Lepomis gulosus</i>	State Endangered
	Longear sunfish	<i>Lepomis megalotis</i>	State Endangered
	Burbot	<i>Lota lota</i>	State Endangered
	Redfin shiner	<i>Lythrurus umbratilis</i>	State Endangered
	Silver chub	<i>Macrhybopsis storeriana</i>	State Endangered
	Spotted sucker	<i>Minytrema melanops</i>	State Threatened
	Bridle shiner	<i>Notropis bifrenatus</i>	State Endangered
	River shiner	<i>Notropis blennioides</i>	State Endangered
	Ghost shiner	<i>Notropis buchmanii</i>	State Endangered
	Ironcolor shiner	<i>Notropis chalybaeus</i>	State Endangered
	Bigmouth shiner	<i>Notropis dorsalis</i>	State Threatened
	Blackchin shiner	<i>Notropis heterodon</i>	State Endangered
	Mountain madtom	<i>Noturus eleutherus</i>	State Endangered
	Tadpole madtom	<i>Noturus gyrinus</i>	State Endangered
	Brindled madtom	<i>Noturus miurus</i>	State Threatened
	Northern madtom	<i>Noturus stigmus</i>	State Endangered
	Channel darter	<i>Percina copelandii</i>	State Threatened
	Gilt darter	<i>Percina eides</i>	State Threatened
	Longhead darter	<i>Percina macrocephalia</i>	State Threatened
	Southern redbelly dace	<i>Phoxinus erythrogaster</i>	State Threatened
	Reptile/Amphibian	Green salamander	<i>Aneides aeneus</i>
Red-bellied turtle		<i>Pseudemys rubriventris</i>	State Threatened
Rough green snake		<i>Opheodrys aestivus</i>	State Threatened
**Bog turtle		<i>Clemmys mublenbergii</i>	State Endangered
	Massasauga rattlesnake	<i>Sistrurus catenatus</i>	State Endangered

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TYPE	COMMON NAME	SCIENTIFIC NAME	STATUS
Invertebrate	Kirtland's snake	<i>Clonophis kirtlandii</i>	State Endangered
	New Jersey chorus frog	<i>Pseudacris triseriata kalmi</i>	State Endangered
	Coastal plain leopard frog	<i>Rana utricularia</i>	State Endangered
	Eastern mud salamander	<i>Pseudotriton m. montanus</i>	State Endangered
	*Northern riffleshell mussel	<i>Epioblasma torulosa rangiana</i>	State Endangered
	Clubshell mussel	<i>Pleurobema clava</i>	State Endangered
	*Dwarf wedgemussel	<i>Alasmidonta heterodon</i>	State Endangered
Bird	*Northern riffleshell	<i>Epioblasma torulosa rangiana</i>	Special Concern
	Regal fritillary	<i>Speyeria idalia</i>	Special Concern
	American bittern	<i>Botaurus lentiginosus</i>	State Endangered
	**Bald eagle	<i>Haliaeetus leucocephalus</i>	State Endangered
	Black tern	<i>Chlidonias niger</i>	State Endangered
	Great egret	<i>Casmerodius albus</i>	State Endangered
	King rail	<i>Rallus elegans</i>	State Endangered
	Least bittern	<i>Ixobrychus exilis</i>	State Endangered
	Loggerhead shrike	<i>Lanius ludovicianus</i>	State Endangered
	Osprey	<i>Pandion haliaetus</i>	State Threatened
	Peregrine falcon	<i>Falco peregrinus</i>	State Endangered
	Sedge wren	<i>Cistothorus platensis</i>	State Threatened
	Short-eared owl	<i>Asio flammeus</i>	State Endangered
	Upland sandpiper	<i>Bartramia longicauda</i>	State Threatened
Yellow-bellied flycatcher	<i>Empidonax flaviventris</i>	State Threatened	
Mammal	Yellow-crowned night heron	<i>Nyctanassa violacea</i>	State Endangered
	Common tern	<i>Sterna hirundo</i>	State Endangered
	Dicksissel	<i>Spiza Americana</i>	State Threatened
	*Delmarva fox squirrel	<i>Sciurus niger cinereus</i>	State Endangered
	Allegheny woodrat	<i>Neotoma magister</i>	State Threatened
	*Indiana bat	<i>Myotis sodaliter</i>	State Endangered
	Least shrew	<i>Cryptotis parva</i>	State Endangered
	Small footed bat	<i>Myotis leibii</i>	State Threatened
	West Virginia shrew	<i>Sorex Palustris Punctulatus</i>	State Threatened
	Plant (partial listing)	Box huckleberry	<i>Gaylussacia brachycera</i>
Canby's mountain lover		<i>Paxistima canbyi</i>	State Endangered
Eared false foxglove		<i>Tomanthera auriculata</i>	State Endangered
Glade spurge		<i>Euphorbia purpurea</i>	State Endangered
Hispid gromwell		<i>Lithospermum caroliniense</i>	State Endangered
Jacob's ladder		<i>Polemonium van bruntiae</i>	State Endangered
Jeweled shooting star		<i>Dodecatheon amethystinum fassett</i>	State Endangered
Large flowered marshillia		<i>Marshallia grandiflora</i>	State Endangered
Northeastern bulrush		<i>Scirpus ancistrochaetus Schuyler</i>	State Endangered
Serpentine aster		<i>Aster depauperatus Fern.</i>	State Endangered
Shale-barren evening primrose		<i>Oenothera argillicola Mackenzie</i>	State Endangered
Showy lady's slipper		<i>Cypripedium reginae Walt.</i>	State Endangered
Small whorled pogonia		<i>Isotria medeoloides Raf.</i>	State Endangered
Spreading globeflower		<i>Trollius laxus Salisb. Ssp. Laxus</i>	State Endangered
Swamp pink	<i>Arethusa bulbosa</i>	State Endangered	

TYPE	COMMON NAME	SCIENTIFIC NAME	STATUS
	Tall larkspur	<i>Delphinium exaltatum</i>	State Endangered
	Variable sedge	<i>Carex polymorpha</i> Muhl.	State Endangered
	White monkshood	<i>Aconitum reclinatum</i> Gray	State Endangered

*Species is also listed federally as Endangered

** Species is also listed as federally Threatened

2.3.1 Identify Endangered, Threatened, and Candidate Species

Corporations play a fundamental role in determining the fate of America's endangered species. One study, conducted by the Association for Biodiversity Information (now NatureServe) and The Nature Conservancy in 1993, found that half of the species listed under the Endangered Species Act (ESA) have 80 percent or more of their habitat on private lands. Exelon Corporation's Limerick facility may provide habitat that supports state and/or federal listed species, although none have been documented at this time.

According to research compiled by the PA DCNR, there are potentially six state-listed threatened and/or endangered species that may occur within Montgomery County. Table 17 lists species that have been designated by the state and federal governments as threatened and/or endangered, as well as their habitat requirements, which occur in Montgomery County.

Table 17. Potential Species of Concern in Montgomery County, PA

COMMON NAME	SCIENTIFIC NAME	HABITAT TYPE
Upland sandpiper	<i>Bartramia longicauda</i>	Large, fallow fields, pastures and grasslands
Yellow crowned night heron	<i>Nycticorax violaceus</i>	Streamsides and woodlands, primarily in the Susquehanna River and tributaries.
Bog turtle	<i>Clemmys muhlenbergii</i>	sphagnum bogs, swamps or marshy meadows with slow moving waterways with soft bottoms.
Coastal plain leopard frog	<i>Rana utricularia</i>	Protected waterways.
New Jersey chorus frog	<i>Pseudacris feriarum kalmi</i>	Small, relatively open bodies of water with a mix of shrubby and herbaceous aquatic vegetation.
Red bellied turtle	<i>Pseudemys rubriventris</i>	Relatively large, deep creeks, rivers, ponds, lakes and marshes with ample basking sites.

2.3.2 Develop Agreements for Listed or Candidate Species if Identified On Site

Many private landowners are concerned that identifying endangered or threatened species on their property will result in heavy land use restrictions being imposed upon them, and therefore avoid managing their property in ways that would enhance habitat and benefit these species. Protecting species is not, in fact, a punishment. Several programs, such as Safe Harbor and Candidate Conservation Agreements, have been specifically developed to address landowner concerns.

2.3.2.1 Safe Harbor Agreements

Safe Harbor Agreements are voluntary agreements between the U.S. Fish and Wildlife Service (US FWS) and private landowners specifying management actions that will result in a “net conservation benefit” for the covered endangered or threatened species. Such benefits may include reducing habitat fragmentation, increasing population numbers, or establishing buffers for protected areas. Prior to entering into a Safe Harbor Agreement, the FWS will determine a baseline for population levels or habitat, which conditions must not fall below. Any non-federal landowner can request the development of a Safe Harbor Agreement, and agreements do not impose significant restrictions in land use or future activity.

As an incentive for complying with Safe Harbor Agreements, the FWS will issue an “enhancement of survival” permit that allows the landowner, at the end of the agreement’s term, to use the land in any otherwise legal way as long as baseline conditions are maintained. Under section 10(a)(1)(A) of the Endangered Species Act (ESA), the FWS will also authorize landowners to “take” (incidentally harm) individuals or modify habitat in order to return the land to the baseline conditions at the end of the agreement. Before entering into a Safe Harbor Agreement, the U.S. FWS must be assured that the endangered or threatened wildlife species covered by the agreement will receive a measurable benefit from management practices imposed. For example, the U.S. FWS looks for projects that demonstrate some of the following benefits:

- reductions in habitat fragmentation,
- performance of the maintenance, restoration or enhancement activities necessary to improve existing habitat areas,

- increases in overall habitat connectivity,
- reductions in the effects of catastrophic events, such as floods,
- the creation or enhancement of buffers that border protected areas,
- and the delineation of areas that are dedicated to the development of new wildlife habitat management techniques.

2.3.2.2 Candidate Conservation Agreements with Assurances

These formal agreements essentially serve as an effort to prevent species from actually becoming endangered or threatened, thereby eliminating the need for future ESA protection as well as the costs and restrictions to landowners resulting from that status. Candidate Conservation Agreements for the Limerick Generation Station, if appropriate and necessary, would be made between the FWS and Exelon Corporation. The FWS would provide technical assistance in developing the agreements, which would outline specific actions that Exelon Corporation is voluntarily willing to commit to that would eliminate or reduce the threats to candidate and proposed wildlife species. These actions must, however, contribute significantly to a lessening of the need to list the species.

As with Safe Harbor Agreements, landowners that commit to Candidate Conservation Agreements are provided assurances that no additional restrictions will be imposed above those outlined in the agreement. Section 10(a)(1)(A) of the ESA allows landowners complying with Candidate Conservation Agreements to incidentally take individual of the species, or to alter habitat in order to return the land to the conditions outlined in the agreement, provided that the overall goal of precluding the need to list the species is adhered to. The U.S. FWS can provide further information on these programs. Contact information is provided in **Appendix III**.

3. USING WHC'S TEAM KIT TO DEVELOP A COMPREHENSIVE HABITAT ENHANCEMENT PROGRAM

The Limerick Generating Station may wish to purchase a WHC Team Kit to assist with the development of a comprehensive, employee-based habitat enhancement program. Information regarding volunteer recruitment tools, outreach ideas, guidance on writing a wildlife habitat management plan, and WHC programs such as the *Corporate Wildlife Habitat Certification/International Accreditation Program* are included with the WHC Team Kit.

3.1 BUILD A WILDLIFE TEAM

Creating a Wildlife Team is an important part of a successful habitat enhancement program. Employee participation increases interest and enthusiasm among workers and strengthens extended commitment to the enhancement program through the expansion of a sense of involvement, connection, and proprietary pride. The development of a site Wildlife Team is also an effective tool for promoting environmental awareness through active contribution.

WHC recommends that the Wildlife Team be structured with one team leader and several subcommittees for specific projects. Subcommittees can be created based on the individual interests of Wildlife Team members. A team structure in which subcommittee leaders communicate with the team leader facilitates information transfer between team members, team leaders, and site management. The *Wildlife at Work* Team Kit can provide Limerick Generating Station employees with information and materials that can be useful when establishing a Wildlife Team.

3.2 CONDUCT A WILDLIFE INVENTORY

Conducting a thorough inventory of the plants and animals present at the site should be a priority of the emerging Wildlife Team, as an initial inventory will help employees and volunteers associated with the wildlife program at the Limerick facility to become more familiar with some of the plants, animals and various habitats found at the site. A fundamental understanding of the natural characteristics of the site will, in turn, facilitate decision-making regarding the implementation process of projects described in this report and increase the confidence of participant employees. Furthermore, conducting a preliminary inventory will provide baseline data useful for comparison with ensuing data, thereby providing the Wildlife Team with a benchmark from which project success can be evaluated. Such information is also invaluable in shaping the future track of the site habitat enhancement program as a whole, and is essential for the development of environmental outreach and education programs.

The wildlife inventory should be a methodical and ongoing process. Essentially, the goal of the inventory is to identify as many plants and animals as possible, using seasonal inventories conducted in the spring (April), summer (July), and fall (September) to provide a relatively comprehensive list of resident and transitory (including migratory) species. As mentioned, **Appendix II** provides a list of characteristic species associated with the predominant ecoregion of the site locale. This list is not intended to be definitive, but rather it should be used as an indicator of the types of species that participants in the site inventory may encounter.

Resources the Limerick Generating Station Wildlife Team may find useful in conducting a site inventory include knowledgeable employees, local natural resource professionals, and conservation organizations. The Wildlife Team or WHC can contact outside organizations, such as the Natural Resources Conservation Service (NRCS), for possible assistance with inventories. Contact information for organizations that may provide assistance is included in **Appendix III** of this report. Ensure that external experts assisting in species inventories understand the importance of providing educational experiences for employees new to wildlife identification concepts.

There are, however, a few things you should keep in mind before you start your site inventory, and WHC suggests taking the following points into consideration before conducting the initial inventory:

Take Small Groups

By taking small groups of two or three you will reduce the amount of disturbance to wildlife. The quieter you are, the more wildlife you will see and the less you will trample.

Bring the Right Gear

It is important to have the proper gear. Field glasses, field guides (**Appendix I** lists a number of good field guides), note pads, pencils a site map, sunscreen, insect repellent, water, a first aid kit, and a hat are important to take along on your outing. You can pare down the list as you see fit, but the right equipment will make your inventory go smoothly.

Be Aware

Keep in mind that plants are wildlife and provide essential food and cover for animal species. Plan your route to minimize impact on vegetation. Beware of dangers that may exist on site. Each site has its own particular set of potential hazards, and it is very important to identify these before starting your inventory or wildlife program. In addition, familiarize yourself with plants such as poison ivy, and be cautious around any animals you encounter.

Vary Times

When planning your outings, keep in mind that animals are not always active during the day. Some species are most active at dusk and dawn, whereas others only appear at night. Ponds, waterways, and edges between fields and woodlands are great places to look. A good strategy is to plan outings at varying times of day: one in the early morning, one at mid-day, and one in the evening. A nighttime walk is a great way to hear the night sounds on your site and identify their sources.

I. Physical Characteristics

The best way to start your inventory is to record some of the physical characteristics of your site. Your record should include topography, soil type, weather and climate data, and land use information.

A. Topography

Describe the topography of your site in terms of rolling, flat, or mountainous. Note any cliffs, caves, marshes or open water on your site. All of these aspects can have effects on the structure and composition of the vegetation and the unique habitats that exist on your site. You may obtain information of the geology of your site from the US Geological Survey.

B. Soils

Plants species growth and composition are directly affected by soil characteristics. One way to estimate the soil types on your site is to obtain and use USDA Natural Resource Conservation Service (NRCS) soil survey maps. Soil type can also be determined by the types of vegetation found on site and their preferences. You may wish to have your soil tested by a local nursery or the NRCS. Soil structure, texture, and erosional potential can be identified through a soil test.

C. Weather and Climate

Seasonal and annual precipitation, temperature, and solar radiation are important to consider. These factors will determine what wildlife species are able to inhabit your site. Contact your local weather service for the information.

D. Land Use

Land use on surrounding areas as well as historical land use (e.g. farmland) of your site may reveal hints for identifying the types of species you can expect to see. You can obtain this information through zoning records, other government records, or by talking to your neighbors.

II. Vegetation

Site vegetation and landscape structure essentially determine habitat suitability and potential for wildlife. Classify areas of your site as habitats (e.g. meadow, wetland, woodland,

transitional etc.). When you are conducting your plant inventory, look for species composition, diversity, height, percent cover, and available and preferred food. In basic terms, this means:

- What types of plants occur?
- Is one species dominant or are there many species?
- How tall and dense is the vegetation?
- How much of the ground is under vegetative cover?
- Are the plant species food sources for wildlife?
- Are there plant species which are particularly attractive food sources (fruit, seeds, buds, flowers, browse, herbage)?

A. Sampling Techniques

WHC recommends using one of the following sampling techniques when doing your plant inventory. These techniques are often used by biologists to model community structure and to statistically compare sites based on foliar density, species diversity, etc. Your objective is much simpler, but using a sampling technique will result in accurate data for your inventory. Identify and list the plant species you encounter, and get a feel for diversity by comparing relative abundance of each plant species you find. The purpose of using a sampling method is to ensure that you get an objective and accurate look at the vegetation on your site. Otherwise, you may only be drawn to the showy flowers of large tree species on your site. Another advantage to using a sampling technique which ensures random and unbiased results, is to be able to compare results before and after enhancement projects. If you are able to estimate the diversity on your site prior to enhancement, you will be able to more clearly see your successes when projects are in place.

1. Line Transect

The line transect method is conducted by placing lines randomly across your study site. Identify and record the species that your lines intercept. The transect length, distance between transects, and number of transects per acre are arbitrary. To ensure accurate results, though, keep these three variables constant for all acres sampled.

2. Sample Plots

The sample plot method consists of designating circular, square, or rectangular sample areas with tape or line and identifying and recording all the species within each plot. Plots can be randomly or systematically placed. The number of plots you choose to sample is up to you and the time you have available. The more sample plots you study the more accurate your inventory will be.

B. Identification

Think about your site in terms of ecosystems and habitats. In an ecosystem, there are numerous intricate relationships occurring, not just individual species existing independently. Proper identification of a particular ecosystem can provide valuable information on the types of plants and animals which may exist on site. For example, if you identify an ecosystem (e.g. river, flood plain, prairie, northern hardwood forest) you will know what species to expect in the area. You will also be able to determine species which should be present but are not. This information may give you clues as to how you can enhance your site's habitats and increase your site's diversity.

Before you set out to do your sampling and identification, familiarize yourself with your field guides, so that you can easily refer to them once you are in the field. Use a sampling technique to get an accurate record of the vegetation on site. Take note of any species you see along the way to improve your identification skills. Dead or dying trees, known as snags, are important habitat components. Record any snags on your site. In addition, record fallen logs on site, as they provide cover and moist microclimatic conditions for wildlife.

While you are identifying the vegetation on site, look for signs of animal and insect wildlife. Note partially eaten vegetation, holes in the ground and trees, bird or squirrel nests, scratches or other marks on trees, tracks, droppings, and any other indications of use by wildlife.

Take note of plants as large as trees and as small as lichens. In between these two extremes are forbs, grasses, shrubs, and more. The following identification tips may be helpful to you:

1. **Trees and Shrubs:** Identify by looking at leaves, flowers, fruits (pine cones, acorns, berries, etc.), bark, buds, and shape.

2. **Wildflowers/Forbs:** Wildflowers or forbs are flowering herbaceous plants that are native to specific regions and able to grow and reproduce in nature without human assistance. Identify by color, size, and structure. Structure includes how flowers are clustered, number of petals or petal-like parts, and shape of flowers and leaves.

3. **Grasses, Rushes, Sedges:** These plants are often difficult to distinguish from each other. A grass is a plant with long, narrow leaves that wrap a hollow jointed stem. A rush is a grasslike plant with solid round stems. A sedge is a plant with triangular stems and clustered flowerhead, usually found growing in a wetland.

4. **Ferns:** A fern is a leafy delicate plant with divide leaves. Identify by structure, shape, and habitat.

5. **Mosses, Liverworts, Hornworts:** These plants are usually less than an inch tall and often grow in clusters or mats.

6. **Lichens:** Small moss-like plants growing on rocks, trees, soil, and numerous other surfaces. Lichens are remarkably adaptable and are able to live where many other plants cannot. Identify by color, structure, and habitat.

III. Animals and Other Wildlife

A. Birds

Bird walks are popular outings among people of all ages. The best time to look for birds is from dawn to mid-morning, since most avian species are active during that time. Regardless of other equipment you choose to bring, binoculars and a field guide are essential. Regularly scheduled bird walks on your site may have the following benefits:

- improve identification skills of your wildlife team,
- stimulate interest in wildlife and wildlife programs among employees and in the community, and

- increase your inventory of birds.

When identifying birds, it is often helpful to determine the general type of bird it is, and then use your guide to narrow down the species. Familiarize yourself with the set-up of your field guide. This will allow you to quickly refer to the appropriate section when you see a bird. For example, most field guides have sections on waterfowl, birds of prey, woodpeckers, etc.

Descriptive elements that are helpful in identification are:

- coloration and patterns on tail, eyes, back, and wings;
- bird size (can be relative, e.g. smaller than a pigeon, bigger than a wren);
- body, wing, tail, and bill shapes;
- behavior (perching, darting, wagging tail, climbing, etc.);
- flight pattern (soaring, dipping, etc.); and
- song.

B. Mammals

Habitat, range, and behavior will help you identify mammals. Mice, shrews, voles, and other small mammals may be caught in live capture traps which allow you to identify species and release them unharmed. In order to minimize the time the animal is captured, check the traps at least twice daily. Setting traps in the evening and checking in the morning is a good strategy, since many small mammals are nocturnal. Animal tracks and scat can help you identify mammals. Conducting a survey after a rain or snow will increase your chances of sighting and identifying animal tracks. Note that handling animal scat can be dangerous, as it may contain parasites and diseases which are harmful to humans.

Overtaken rocks and stumps, marks on trees, and other visual disruptions may be signs of medium and large mammals. Bears and raccoons will turn over rocks and stumps looking for grubs and other food. Deer will browse in woodlands and along field-woodland edges, leaving marks on the lower branches of trees. Bucks will rub their antlers on young trees, leaving marks. Black bears mark trees by clawing them at the highest point they can reach.

C. Reptiles

Snakes, lizards, turtles, alligators, and crocodiles are all reptiles. Often people are apprehensive about reptiles. In fact, once you familiarize yourself with the many different species of reptiles and improve your identification skills, you will become fascinated by them. Reptiles are ectotherms (cold-blooded); their body temperatures fluctuate with environmental temperatures. Because of this characteristic, reptiles are often seen on exposed rocks or blacktop sunning themselves, absorbing heat from the environment. Therefore, the best time to look for reptiles on most sites is in the middle of the day. Identify snakes and lizards by coloration, patterns, size, and behavior. Identify turtles by shell shape, size, coloration, habitat, and behavior. Usually, land tortoises have domed shells, hard undersides, and are able to pull their heads inside their shells. Water turtle cannot retreat inside their shells. Identify alligators and crocodiles by a pointed or rounded snout, color, size, and location.

Like all wild animals, reptiles do not like to be surprised or handled by humans. Although many snakes and lizards are poisonous, some snakes and lizards, and many turtles are safe to handle and examine. Before approaching a reptile, though, make sure you know what it is and that it is safe to handle. If you are unsure of the exact species you have found, it is usually best to view the species from a safe distance and retreat slowly. Most reptiles lay leathery eggs on land; if you see any eggs on your site, do not disturb them but do try to identify them by size, number, and location.

D. Amphibians

Salamanders, toads, and frogs are all amphibians. Amphibians differ from reptiles in that amphibians spend the first part of their lives in aquatic habitats equipped with gills to breath. Eventually the young grow legs, develops lungs, and breaths air. A difference which may help you distinguish between amphibians and reptiles is that amphibians have moist skin, whereas most reptiles have dry, scaly skin.

Many salamanders and frogs live in or near ponds, marshes, and lakes. By quietly approaching such habitats and looking carefully at the water's surface, you may spot individuals emerging. Toads, treefrogs, and some salamanders live in upland areas. By

looking under logs in a woodland, you may discover them, but be sure to carefully replace logs as they were found. Identify species by color, size, and habitat. It is very important to note that amphibians have sensitive, moist, glandular skin that is easily damaged by human hands. To avoid harming species, **make sure your hands are relatively clean and wet** before touching amphibians.

Another way to enjoy and identify amphibians is through a night walk on your site. Chorus frogs, such as the spring peeper, are famous for their night sounds, and the more familiar bullfrog is well-known for its bass notes that say "jug-o'-rum." Children are particularly fascinated by salamanders, toads, and frogs. If possible, include children in your search for amphibians on site.

E. Fish and Mollusks

A good way to inventory the fish on your site is to go fishing! This can be done with a pole, fly rod, or net. Be sure to abide by fishing regulations and release what you catch. Identify by body and head shape, fins, coloration, patterns, size, and habitat. Mollusks include univalves (e.g. conch), bivalves (e.g. clam), and species without shells such as squid and octopus. Look along the water's edge for living mollusks or just their shells. Identify by shape, size, color, and habitat. Note that many birds that feed on shellfish will drop mollusk shells quite a distance from where they found the mollusks.

F. Insects

Insects are an important part of any ecosystem. Most flowers rely on insects for pollination, and many bird species feed solely on insects. There are at least 100,000 insect species in North America. Subsequently, identifying the exact species of an insect is difficult. Determining to which group an insect belongs is often adequate and enough of a challenge. Examples of such groups are: ladybug beetles, milkweed butterflies, swallowtails, honeybees, and dragonflies. Insects' bodies are made up of three parts: the head, the thorax, and the abdomen. Identify insects by the color size, and shape of these three parts, as well as wings, eyes, and habitat. Keep in mind that caterpillars are young insects. Identify by size, coloration, and habitat.

An ongoing inventory of the wildlife on your site is a fun and exciting way to record the effects of your habitat enhancement programs. Not only will your identification skills improve immensely, but, hopefully, the species diversity on your site will increase continuously. Inventory outings are wonderful opportunities to attract employees to your wildlife projects and to get the word out on the projects going on at your site, thereby improving community relations. At first, the information in this pamphlet may seem overwhelming and time consuming, but with experience, your team will be able to identify the flora and fauna on your site with ease, improve enhancement projects, and, ultimately, increase the biodiversity on your site.

3.3 WRITE THE SITE WILDLIFE HABITAT MANAGEMENT AND BIODIVERSITY PROTECTION PLAN

The probability of success for any habitat enhancement program is largely dependent on the formation of a comprehensive strategy; as such, the development of a wildlife habitat management and biodiversity protection plan (in conjunction with the site inventory) should be the most fundamental task of the Limerick Generating Station Wildlife Team. The wildlife habitat management plan outlines the goals of the wildlife habitat program, describes projects to achieve these goals, makes provisions for monitoring projects, and presents implementation and review schedules. WHC recommends that the wildlife habitat management and biodiversity protection plan be holistic in scope by encompassing the entirety of the site. Although the primary goal of the wildlife habitat program is to enhance wildlife habitat, WHC further recommends that additional goals, such as the implementation of an education component or achieving WHC certification, as well as all projects associated with each goal, be included in the wildlife habitat management and biodiversity protection plan.

WHC recommends that the Wildlife Team begin by identifying site habitat and biodiversity program objectives and setting target dates for achievements. In addition, the team should outline how program success will be measured and how performance will be assessed. Habitat projects should be prioritized and clearly defined before beginning projects. In addition, Limerick Generating Station employees should work to involve community

volunteers and knowledgeable professionals in the habitat management and biodiversity plan development and implementation phases. A sample management plan can also be accessed under the “Technical Reference Documents” menu of the Report CD.

3.4 IMPLEMENT THE FIRST TEAM PROJECT

Implementing the first team project is especially important for building a solid volunteer program. Simple projects with high visibility that will yield measurable results in habitat improvement are ideal first projects for the Limerick Generating Station Wildlife Team. The first year of the program at the Limerick facility should be geared toward projects that provide learning experiences for Wildlife Team members, generate additional enthusiasm and volunteerism, and demonstrate to the community and non-participant employees that Exelon Corporation is committed to enhancing wildlife habitat at its facility. WHC recommends undertaking more complex and intensive habitat management projects after the team gains experience and greater support from the site management and community.

4. RECOMMENDED WILDLIFE HABITAT ENHANCEMENT PROJECTS

The individual habitat enhancement projects recommended in this section are provided as a resource for developing the wildlife management plan and were chosen based upon ease of implementation, high visibility, and relative likelihood of success. The Wildlife Team may choose to implement some or all of these projects and is furthermore encouraged to explore additional habitat enhancement opportunities. Projects suggested for the Limerick Generating Station Wildlife Team members to consider in the future include:

- Identifying and managing any invasive, exotic species on site;
- Use Best Management Practices of Right-of-Ways that cross the site,
- Enhancing riparian habitats for wildlife,
- Partnering with neighboring land managers to enhance early successional, grassland habitats for local wildlife species including birds, mammals and pollinators,
- Considering the creation of a nest box monitoring program for cavity nesting species including songbirds, raptors and bats,
- Planning and initiation of habitat enhancement projects to benefit native amphibian and reptile species.

As the wildlife program develops and interest among employees – participant and non-participant alike - increases, WHC recommends that the Limerick Generating Station pursue additional projects to maintain momentum and continue expanding the program, thereby producing additional opportunities for wildlife habitat enhancement on the site facility, which in turn will further generate exposure and attention to the program. WHC encourages employee and managers associated with the Limerick Generating Station to give these initiatives careful consideration as they arise.

In addition to unforeseen opportunities for employees to contribute positively to wildlife conservation within wildlife management areas, WHC recommends exploring additional areas of the site that can be restored or enhanced to provide habitat. Please contact WHC

for additional information concerning individual habitat enhancement project recommendations.

5. RAISING ENVIRONMENTAL AWARENESS AMONG EMPLOYEES AND MEMBERS OF THE LOCAL COMMUNITY

An important aspect of a wildlife program is the benefit it provides, through active participation and environmental education, to employees, their families, and to members of the local community. As such, a wildlife program initially based on employee participation that is expanded to engage community organizations for assistance in program implementation holds great potential for the inclusion of public outreach and environmental education components. WHC recommends the following activities for consideration when developing and fostering relationships with the local community and using site enhancement projects as a tool for furthering environmental and conservation education, awareness, and outreach efforts.

- Create a nature trail to highlight habitat areas and wildlife viewing places.
- Establish a *Corporate Lands for Learning* program.
- Hold an employee and program volunteer wildlife photography contest.
- Create a Wildlife Team newsletter to inform employee and the community about the program.
- Work with local scouting and school groups as much as possible when planning, designing and implementing enhancement projects.

Please contact WHC for additional information concerning individual environmental education and community outreach project recommendations.

6. WHC'S CORPORATE HABITAT CERTIFICATION/INTERNATIONAL ACCREDITATION PROGRAM

WHC's *Corporate Wildlife Habitat Certification/International Accreditation Program* recognizes meaningful wildlife habitat management programs, providing third-party credibility and an objective evaluation of enhancement projects to applicants. WHC-habitat certified programs demonstrate a long-term commitment to managing quality habitat for wildlife. As a reward for individual program efforts, and following approval from site representatives, descriptions of certified programs are published on WHC's website, and then distributed to local and national news contacts identified by the site, as well as to area government representatives. Sites achieving WHC Habitat Program Certification and Recertification also receive an award plaque and are honored through a multi-media presentation and informational displays at WHC's Annual Symposium.

The Limerick Generating Station will be eligible to apply for Habitat Program Certification once habitat enhancement project shave been implemented and monitored of one year. Habitat enhancement projects must be documented, monitored, and maintained for at least one year in order to be eligible for Habitat Program Certification. Overall, representatives from Exelon must demonstrate that the Limerick Generating Station has instituted a program based on a sound commitment to environmental stewardship. A team of wildlife biologists will review the application materials in order to determine if the program meets the certification criteria.

Criteria for Habitat Program Certification are as follows:

- ★ Demonstration of a progressive environmental stewardship policy through the implementation of appropriate habitat management projects.
- ★ Participation in a site visit with a WHC Wildlife Biologist.

- ★ Compilation of individual project information demonstrating the existence and active monitoring of at least **one habitat enhancement project, which has been in place for a minimum of one year.**

If all the above criteria are satisfied, the site is eligible for Habitat Program Certification. As outlined on the certification application form, which can be accessed by clicking on the “Applications for Recognition” button under the “About the Wildlife Habitat Council” menu of the Report CD, the following items should be included with all submittals:

- ★ The completed Site Overview Questionnaire
- ★ A site map with project locations identified
- ★ A wildlife habitat management plan
- ★ A species inventory
- ★ Project status summaries
- ★ Completed Reference Interview Questionnaires (3 total)
- ★ Photo documentation of site activities
- ★ Color slides or digital photos for use at WHC’s Annual Symposium
- ★ Media contact information (listing those contacts that should receive press releases concerning program certification)

The on-time deadline for submittal of Habitat Certification Program applications is July 31 annually. There is a late deadline of August 31 that has a \$100 late fee associated with it. Following submission of the application, WHC biologists review the materials to determine if the program meets the standards of Habitat Program Certification. Site representatives are notified of the outcome of the certification review process prior to the end of October. WHC biologists evaluate wildlife habitat enhancement programs based on the materials included with the required application forms. Each of the following items are assessed by WHC’s Wildlife Biologists during the review of the certification applications and required materials:

- ★ Improvements Made to Habitat: The habitat projects identified in the application and all accompanying materials demonstrate an overall understanding of the interrelationship of various target species’ living requirements. Documentation confirms that the habitat preservation and enhancement measures are designed to improve and protect biodiversity. Special attention is paid to the use of, or maintenance of, native species.
- ★ Scope of Habitat Enhancement Projects: Relative to the size and number of habitat types present, volunteers addressed (or mention future plans to address) each available habitat area. Also, efforts to raise environmental education and awareness have been planned and/or developed.

- ★ Level of Demonstrated Commitment: Documentation of voluntary efforts supports that monitoring and maintenance activities are conducted regularly, and that wildlife habitat management plans are routinely expanded upon and goals are re-evaluated as necessary.
- ★ Evaluation of Habitat Management Plan: The Habitat Management Plan included with the required application materials presents active and planned projects aimed at enhancing and conserving local, regional, and/or global biodiversity. Special attention is paid to the management of both native species and invasive species.
- ★ Education and Outreach: The program includes opportunities for scientific research and study - at any educational level- when possible. In addition, site inventories and investigations regarding habitat quality and availability are utilized to evaluate the overall success of the Wildlife Habitat Management Plan.
- ★ Outside Group Involvement: The program is accessible to the local community, conservation organizations, and regulatory agencies when possible. Site representatives have invited others to participate when possible.
- ★ Credibility: As an environmental professional, each reviewer must rate the program based on the overall program credibility and benefit to biodiversity, as interpreted from the application materials.

Following two application reviews, which are conducted by WHC biologists using the aforementioned assessment methods, the outcome of each application is determined.

Possible Outcomes of each Habitat Program Certification application are as follows:

- ★ Good Start- The “Good Start” designation is typically given to programs that have not had an active program in place for at least one year. Receiving the “Good Start” designation following the application process simply means that reviewers have recognized that there is a program in place at the site; however, documentation provided is either inadequate, or confirms the program has been in place for less than one year. In either case, after direct follow up with site contacts, the site will be required to submit additional program documentation in the following certification year. The site is not required to re-pay the application fee the following year, only to provide required documentation in order to achieve status as a fully certified program.
- ★ Certified- The “Certified” designation is given to all programs that meet the standards and requirements of the certification program. Initial “Certified” status is only valid for two years, following which; WHC requires the submission of

project progress reports, termed "Recertification." Meaning that following the two-year period of program Certification, each program is required to apply for Recertification in order to maintain "Certified" status. Following Recertification the program will be placed into either a two-year or a three-year Recertification rotation, based upon program success. The recertification process also allows WHC to review the site's efforts, provide recommendations for continued habitat enhancement projects planned on site, and provide recognition for newly instituted projects.

In order to assist the Limerick Generating Station in attaining WHC Habitat Program Certification in the future, WHC provides the following recommendations. Additional information about the certification process and associated awards such as the Rookie of the Year Award, the Community Partner of the Year Award, the Pollinator Friendly Practices Registration, and the Wild Turkey Management Award can be accessed by clicking on the "Applications for Recognition" button under the "About the Wildlife Habitat Council" menu of the Report CD.

6.1.1 THE COMPLETED SITE OVERVIEW QUESTIONNAIRE

The site overview questionnaire is provided to each site interested in Habitat Program Certification as pages four and five of the "Habitat Program Certification Workbook." These questions were added to the list of items required for Habitat Program Certification in 2003 in order to provide a concise format for obtaining general site information, and will be required in order to attain program certification. This form includes ten short-answer questions, ranging from requests for the descriptions of natural communities on site to providing a space to list community partners. There are no "right" or "wrong" answers to these questions, even negative responses would not necessarily jeopardize the program's achievement of certification. These questions may be answered in the spaces provided on the form, either by typing in responses or handwriting them. If the answers to these questions are provided in other application materials, simply make a reference to that information in answer to the question. An example of the Site Overview Questionnaire is provided in **Figure 20**.

Figure 20. Example Site Overview Questionnaire

Site Overview Questionnaire
Please answer all questions and return with required application materials.

1. When did your company acquire the property?
2. What are the major land uses of the site? (past and present)
3. Describe the area surrounding your property. (i.e. rural, urban, residential etc.)
4. What are the main vegetative communities of the site? (i.e. grassland, forest, wetland etc.)
5. Are there any bodies of water on-site, or running through the site? If yes, please list and describe them.

YES NO

Briefly describe any land use practices that may impact water quality.
6. Is the site in compliance with all rules, regulations and permits required by law? If no, briefly explain how the site is addressing issues of compliance.
7. Are habitat enhancement projects separate from areas with regulatory issues?

YES NO
8. Were any of the habitat projects done in relation to a mitigation project or similar project required by a regulatory agency?

YES NO

If answered yes to question above, did the scope of the project exceed the regulatory requirements?

YES NO
9. Please list any other certifications or awards that apply to the site:
10. Please list any community partners/partnering organizations that have provided assistance with habitat management projects:

6.1.2 SITE MAP

The site map is also required and should be submitted with other Habitat Program Certification materials. If possible, the site map should include an indication of where on the site enhancement projects have been implemented. For example, an enhancement map submitted by the Limerick Generating Station would ideally identify, on a map or aerial photo, the location of the habitat areas and identify the general locations of enhancement projects. Realizing that this type of mapping technology is time consuming, an overall map accompanied with a narrative describing project locations, or a site map with project locations penciled in, is also acceptable. If there is no map available to depict the general layout of the site, site representatives may draw their own map, or submit documentation explaining the absence of the map, in order to qualify for Habitat Program Certification.

6.1.3 Wildlife Habitat Management Plan

The wildlife habitat management plan should outline the goals of the wildlife habitat enhancement and management program, describe projects to achieve identified goals, make provisions for monitoring projects, and present implementation and review schedules. The wildlife habitat management plan should also include information outlining the strategy behind the implemented and planned enhancement programs. For example, if the overall goal of the Limerick Generating Station habitat enhancement program is to conserve overall site biodiversity, the plan should describe the current conditions of the site's biodiversity, and the specific projects that have been and will be designed to increase this measure. The plan should include provisions for monitoring this remote location, perhaps through the assistance of local colleges, universities, or volunteer organizations.

Furthermore, while the wildlife habitat management plan may identify target species that projects will focus on, such as pollinators, shrubland nesting birds, grassland nesting birds and small mammals, the overall management plan should demonstrate an understanding not only of the habitat conditions required for the target species, but should also identify non-target species that will benefit from enhancement programs, for instance additional species such as small mammals and invertebrates may benefit from the placement of nest boxes for

avian species. The wildlife habitat management plan may be constructed in whatever manner site representatives see fit.

6.1.4 Species Inventory

The species inventory is an important component of the certification application and overall habitat enhancement and management program instituted at the Limerick Generating Station because it reflects the wildlife species and habitat types found on site, logging the progression of biodiversity overtime. This inventory will also help to gauge the success of projects over time, as future inventories can be compared to the initial or past inventory.

Without a baseline inventory, it is difficult to measure overall successes in achieving greater biodiversity through an active habitat enhancement program. Initial projects can certainly result in visual changes, but the comparative inventories will lend credibility to the functionality of the habitat or ecosystem created. It is recommended that representatives and/or volunteers associated with the Limerick Generating Station use past surveys and planting lists, in addition to the lists provided in this report, to compile the initial species inventory. In addition, casual observances made by employees and volunteers could also supplement the inventory. WHC recommends that the inventory also provide scientific names of species, as common names can vary from region to region. The species inventory must be submitted with other required application materials.

6.1.5 Project Status Summaries

Project status summaries should provide more detailed information about the individual projects implemented within the Limerick Generation Station property. It is not required that this detailed project information be submitted in a separate section; this information may be presented in the body of the habitat management plan, or in a detailed project chronology that lists specific project activities and associated dates. Information to be included in each project summary is outlined on pages six and seven of the Habitat Program Certification Workbook. Information WHC would like covered about each project identified in the certification application includes a description of the type of project initiated or planned, information related to the project planning process, and the date the project was

initiated. In addition, include an estimate of the number and type of personnel involved with planning and carrying out each project.

In addition to this detailed project information, be sure to explicitly indicate the ways in which the site is providing habitat for wildlife. Examples may include indicating the success of nest box monitoring programs, documenting increases in the number and diversity of wildlife species noted on site, adhering to individual goals set forth in the CWCS, and/or the number of partners participating in various educational and wildlife habitat enhancement-oriented activities.

In addition to the project information and identification of how the site is benefiting wildlife, WHC requires that the site provide documentation of monitoring and maintenance activities. Acceptable forms of monitoring and maintenance information may be presented through before and after project photos, updated species inventories, and a chronological listing of program activities. In addition, any records of activities such as a native seed purchase order or letter from a program participant would also be acceptable. Detailed information for each project reported in the Habitat Program Certification application must be submitted with all other required materials.

6.1.6 Completed Reference Interview Questionnaires

The reference interview questionnaire, which is provided with the Habitat Program Certification Workbook, is also required to attain certification. WHC asks that the site representatives provide this questionnaire to three people who can serve as references for the wildlife habitat enhancement program created at the Limerick Generating Station. The questions that the references are asked to answer are as follows:

- Question 1) How are you involved with the site's enhancement program?
- Question 2) Is the program benefiting local wildlife? If so, how? If not, why?
- Question 3) Is the program benefiting the local community? If so, how? If not, why?
- Question 4) Do you have any recommendations for improving the program?
- Question 5) Is there anything else you would like to share with WHC about the program?

Completed Reference Interview Questionnaires, as well as completed application materials can be mailed, faxed or emailed to WHC using the following contact information:

The Wildlife Habitat Council
Attn: Emily Powell
Certification Coordinator
8737 Colesville Road, Suite 800
Silver Spring, MD 20910
Fax: 301-588-4629
Email: epowell@wildlifehc.org

At least one program reference must be submitted on behalf of the site by the application deadline.

6.1.7 Photo Documentation

Photo documentation should depict before and after photos of site habitats, and include wildlife species whenever possible. Photos may also document site information such as general project locations or provide a depiction of volunteers carrying out wildlife habitat enhancement activities. Photos may be submitted in hard copy, on CD, or on floppy disk. Photos must be submitted with other required application materials.

6.1.8 Color Slides/Digital Photos

Slides or digital photos submitted on behalf of the program will be used during WHC's Annual Symposium, provided the site submits all required information and meets the criteria of certification. Slides and/or digital photos should depict habitats, species of interest, or enhancement activities. The slides and/or digital photos will be kept by WHC for possible use in future presentations and publications. Digital photos and/or slides submitted to WHC for use in the Annual Symposium may also serve to satisfy the photo documentation requirements described previously (and visa-versa). Photos must be submitted with other required application materials.

6.1.9 Media Contact Information

If the Limerick Generating Station wildlife habitat program achieves certification, WHC will write a short description of the successful enhancement of wildlife habitat, and release it to the media contacts that are specified by site representatives. Once the application has been reviewed and the outcome of the process has been determined, a WHC representative will write the article and submit it to the appropriate company representative for review, edit, and approval. Once the article is finalized, WHC will send it to the specified media contacts. In this section of the application, please provide the following information:

- ★ The name and appropriate company Public Relations contact
- ★ That persons phone number
- ★ That persons fax number
- ★ That persons email address
- ★ That persons mailing address

For the Media Contacts, please provide mailing labels with the names and addresses of the contacts site representatives would like press releases sent to, or simply list this information and the appropriate email address, if known. Media contact information, including internal Public Relations contacts and local media contacts must be submitted with other required application materials.

7. ADDITIONAL OPPORTUNITIES FOR PROGRAM DEVELOPMENT

The success of the Limerick Generation Station's *Wildlife at Work* program depends in large part upon the levels of expertise, labor, and funding available for projects. Thus the potential for success of the site's *Wildlife at Work* program will be significantly increased through the formation of partnerships with an assortment of specialized organizations that may assist in the provision of such factors. Collaborations with local, regional, and national organizations, including non-profits, community groups, schools, youth groups, private landowners, and government agencies, may prove beneficial for the realization of program implementation.

Effective programs for the Wildlife Team to meet conservation and environmental education objectives through partnerships include:

- The North American Bird Conservation Initiative (NABCI)
- The North American Pollinator Protection Campaign
- Work with the National Wild Turkey Federation
- WHC's *Corporate Lands for Learning (CLL) Program*
- The U.S. Fish and Wildlife Service's Joint Ventures Program
- The U.S. Fish and Wildlife Service's Corporate Partnerships Program
- The Five-Star Restoration Program
- The Backyard Conservation Program

7.1 PARTNERSHIP DEVELOPMENT

The survival of many species, in particular those with extended ranges or that exhibit migratory behavior, depends on coordinated conservation efforts among a number of stakeholder entities. As a result, functional collaboration among various groups is becoming increasingly common as a way of dealing with environmental issues. Such stakeholder affiliations address pressing conservation issues on a landscape scale while allowing

individual partner groups to continue working at the local level. As such, individual site programs such as that instituted at the Limerick Generating Station are generally more effective when partnered with organizations working for conservation at broader scales.

7.2 THE NORTH AMERICAN BIRD CONSERVATION INITIATIVE

Many migratory bird species of North America must cross international political boundaries during their bi-annual journey. As such, countries with incongruent environmental, biological, and conservation legislation and practices must therefore formulate a standard medium with which to facilitate cooperation for attaining the common goal of bird conservation in order to overcome such disparities in national conservation regulations and programs.

The North American Bird Conservation Initiative (NABCI) was formed to facilitate coordination and cooperation among Canada, the United States, and Mexico in order to address the conservation of migratory bird species that span the continent. Formally,

“...NABCI is a statement of principles and approaches shared by individuals, organizations, agencies, and programs working for the conservation of birds and their habitats in Canada, the United States, and Mexico.”

- NABCI website.

NABCI is not a regulatory instrument, but rather acts as a forum designed to facilitate the flow of ideas and information among concerned organizations and to provide a mechanism for the dissemination of information to a non-specialized audience.

7.3 NORTH AMERICAN POLLINATOR PROTECTION CAMPAIGN

According to the eighty partners working together in the North American Pollinator Protection Campaign (NAPPC), pollinating species such as native and managed bees, beetles, butterflies, moths, bats and birds ensure productive harvests and seed set for many important food, oil and fiber crops throughout the world. In the U.S. alone, the USDA

estimates that pollinators are responsible for providing reproduction services to \$40 billion worth of agricultural products each year.

Pollinators are also essential for maintaining healthy, natural ecosystems by pollinating native plants important to many species of insects, wildlife and fish. For example, approximately 25 percent of all songbirds include fruit or seeds as a major part of their diet, while other animals eat the leaves, roots, nuts, pollen and/or nectar of pollinated plants. Additionally, many species of birds, mammals and fish rely on the adult or larval forms of pollinators as an important source of protein.

Unfortunately, pollinator populations are rapidly declining worldwide. The USDA Council on Sustainable Development and other agencies recognize that the continuing decline of pollinator populations is becoming "...a significant conservation and sustainability issue", and the National Academy of Sciences has recently begun a study, spearheaded by NAPPC, to determine the status of pollinators in North America.

According to NAPPC, the major threat to most pollinators is the destruction and fragmentation of habitat, in addition to the misuse of pesticides and several detrimental introduced diseases. In many places pollinator habitat has been degraded to small, isolated patches that are often times dominated by invasive plants and turf grasses that offer little ecological value. This has led to a loss of wildflowers required for nectar and pollen, in addition to a lack of nesting sites and host plants so important for ensuring the reproduction of pollinating species. The extensive use and misuse of pesticides also severely impacts pollinators and their habitats, decimating many beneficial insects and contaminating soil and water for wildlife and humans. With so much at stake, WHC calls its corporate partners to action to help conserve this diverse and valuable group of species known as pollinators.

The NAPPC partners, including WHC, The Xerces Society for Invertebrate Conservation and the Coevolution Institute, developed the Pollinator Friendly Practices (PFP) guidelines in 2002. Adopted by the NAPPC, PFPs are used in support of existing land management practices in schools, private industries, public spaces, agricultural plots, forests and home landscapes. The guidelines augment existing land use incentives and are to be used by

organizations in promoting pollinator-friendly land use practices. WHC is the first organization to promote the PFPs, offering an opportunity for formal recognition, through the "NAPPC WHC Pollinator Protection Award," for institutions implementing pollinator-friendly activities. The award is granted annually to the one certified WHC site that best implements PFP guidelines through specific land management practices that both promote pollinator populations and habitats, and provide outreach education to surrounding communities.

The NAPPC Pollinator Friendly Practices guidelines consider six different areas of land use management: Foraging Habitat, Reproduction, Shelter, Invasive/Exotic Species, Chemical Use, and Monitoring. For each topic, there is a central question to be addressed, followed by a detailed approach to the subject. The complete guidelines, as well as a program registration form, can be accessed by clicking on the "Applications for Recognition" button under the "About the Wildlife Habitat Council" menu of the Report CD. For more information, please contact Marcia Maslonek, WHC Director of Biodiversity and Technical Programs, at (412) 777-2464.

7.4 WORK WITH THE NATIONAL WILD TURKEY FEDERATION

In addition to the Pollinator Friendly Practices Award and program, WHC encourages sites with appropriate habitat resources to partner with the National Wild Turkey Federation (NWTF) to manage habitats and potentially compete for the annually presented Wild Turkey Management Award.

The Wild Turkey Management Award was added to the list of awards generated from the pool of Habitat Certification Program applicants in 2001 as a result of partnership between WHC and the NWTF. In order to qualify for the Wild Turkey Management Award, WHC suggests that Limerick Generating Station employees actively document habitat enhancement projects on site that benefit turkeys, as well as any turkey sightings. WHC encourages site managers to work with the National Wild Turkey Federation in the development of a site wildlife habitat management plan. Contact information for the

National Wild Turkey Federation is provided in **Appendix III**, and the Wild Turkey Management Award application can be accessed by clicking on the “Applications for Recognition” button under the “About the Wildlife Habitat Council” menu of the Report CD.

7.5 CORPORATE LANDS FOR LEARNING (CLL)

The Wildlife Habitat Council and the National Environmental Education and Training Foundation (NEETF) co-developed the *Corporate Lands for Learning (CLL)* program to facilitate the coordination of corporate resources with local schools to form functional partnerships based on the foundation of environmental education and outreach. The goal of the program is to maximize the use of human and natural resources of the corporate site to benefit the educational needs of the local schools. An environmental education program would allow students from the local community to use available portions of the Limerick Generating Station as an outdoor classroom for practical and applied experience related to current environmental issues. *CLL* offers the opportunity to create a nationally recognized environmental education partnership between corporations and the communities in which they exist.

The first steps in initiating an environmental education program are to evaluate the needs of the local community and the resources available at the site. Site representatives then meet with representative individuals from local schools and environmental education groups in the community to identify constraints and opportunities. Following these two steps, WHC will provide the site with a report that outlines the types of activities possible, recommendations for implementation, an overview of state mandates, and a suggested curriculum that can be accomplished on the site to meet these mandates. WHC can then develop and deliver a two-day training workshop designed to teach and train employees, educators, and others how to build partnerships and use the provided educational programs and curriculum.

The Limerick Generating Station can apply for WHC *Corporate Lands for Learning* Certification in addition to *Corporate Habitat Certification* following the addition of an environmental education component to the wildlife management program. To be eligible for *CLL* certification, the site must provide:

- A detailed education program description and curriculum.
- Evidence demonstrating that the site hosted a minimum of ten hours of active learning activities throughout the year.
- Three letters of reference from teachers or community members.

For more information regarding WHC's *Corporate Lands for Learning* program and *CLL* certification, contact Thelma Redick, WHC Education and Outreach Program Manager, at (724) 695-8844 (thelma.redick@verizon.net).

7.6 U.S. FISH AND WILDLIFE SERVICE'S JOINT VENTURES

U.S. Fish and Wildlife Service's Joint Ventures are non-regulatory, voluntary public/private partnerships "...composed of individuals; corporations; conservation organizations; and local, state, and provincial agencies drawn together by common conservation objectives." (U.S. Fish and Wildlife Service). The FWS is involved with NABCI and is incorporating international conservation ideas into their Joint Ventures programs. These regional partnerships are part of a larger Bird Conservation Initiative, components of which include the North American Waterfowl Management Plan, Partners in Flight, the Western Hemispheric Shorebird Reserve Network, and others. Joint Ventures implement the goals of the North American Waterfowl Plan by developing and funding hands-on conservation projects for the benefit of obligate and facultative wetland species.

Many regional Joint Ventures have broadened their efforts to include more than just wetland creation, restoration, and conservation and waterfowl that breed in or migrate through wetland habitats. Joint Venture projects may consider maintaining or enhancing the quality of wetland vegetation, other wetland wildlife (including invertebrates, migratory songbirds, amphibians, and mammals), and associated upland habitats and wildlife species. These

projects not only improve wildlife habitat but also enhance natural resource quality, such as reducing soil erosion and flood potential and filtering pollutants in ground water.

7.6.1 Additional Information and Assistance

More information about the Corporate Campaign for Migratory Birds, regional Joint Ventures, Management Boards, projects, goals, and corporate benefits can be found on-line at www.wildlifehc.org/managementtools/waterfowl.cfm.

7.7 FIVE-STAR RESTORATION PROGRAM

The Limerick Generating Station can further demonstrate its commitment to watershed protection by participating in the Five-Star Restoration Program. The Five-Star challenge grant program – a partnership between WHC, the U.S. EPA, the National Fish and Wildlife Federation (NFWF), the National Association of Counties, and the National Oceanic and Atmospheric Administration (NOAA) – focuses on community-based watershed restoration projects. Each year, approximately \$500,000 is given in grant awards to 70 projects, which are typically matched five-fold by the partners in each project. Since the program's inception in 1998, 70 miles of stream buffers have been planted, 7,000 acres of wetlands have been restored and over 10,000 volunteers have participated. Five-Star is a unique opportunity that allows corporations to reach out to their communities and involve local governments, non-profit organizations, small businesses and a wide range of citizen groups. Each organization contributes cash or services and becomes a “partner” who makes a permanent commitment to maintain the restored or enhanced waterway.

WHC is pleased to promote corporate participation in Five-Star, and we spotlight their work on the WHC web site, in our quarterly newsletters, and at our annual Symposium. Thus far, more than 30 of WHC's corporate members have been involved with Five-Star by organizing projects at their own facilities or making in-kind and cash donations to support projects in their neighborhoods. Further information about the Five-Star Restoration Matching Grants Program can be found online at <http://www.wildlifehc.org/fivestar>.

7.8 THE BACKYARD CONSERVATION PROGRAM

The Backyard Conservation program, a collaborative effort of WHC, the National Association of Conservation Districts (NACD), and the Natural Resources Conservation Service (NRCS), was formed to provide educational assistance in developing and implementing conservation practices on nonagricultural private property. Backyard Conservation focuses on conservation activities adapted from farms and ranches that can be applied to available residential and corporate lands. Simple, inexpensive habitat enhancements put forth on corporate lands have the potential to influence and demonstrate to surrounding land owners how small, low-cost conservation measures can benefit native wildlife populations. Furthermore, such projects can aid in natural ecosystem processes to improve soil, air, and water quality. These conservation practices include:

- Planting trees;
- Enhancing habitat to provide food, water, and shelter for wildlife;
- Installing ponds;
- Creating wetlands;
- Composting wastes;
- Applying mulch;
- Managing nutrients;
- Building terraces;
- Conserving water; and
- Managing pests.

Implementing these practices will not only provide a healthy environment for the immediate locale, but may influence corporate and residential neighbors to initiate projects as well. WHC encourages those who participate to promote conservation practices outside of their site's borders in order to expand the scope of their projects to involve neighboring property owners, as well as encourage community involvement. Schools and other organizations may be interested in the planning or implementation of certain projects and using them as an environmental education resource. In addition, public officials should be encouraged to practice conservation measures on parks and other public property. For more information regarding the Backyard Conservation program, contact WHC or refer to the Backyard Conservation website at <http://www.wildlifehc.org/managementtools/backyard.cfm>.

*SITE ASSESSMENT AND WILDLIFE MANAGEMENT OPPORTUNITIES FOR EXELON CORPORATION'S
LIMERICK GENERATING STATION*

8. SUMMARY AND CONCLUSIONS

WHC has developed the information and recommendations in this report to best describe and supplement existing habitat types in correlation with Exelon Corporation goals: habitat enhancement, employee and community involvement, and public recognition of environmental commitment.

There are several important factors to keep in mind during the development of the wildlife program. First, employee involvement is crucial and can lead to increased morale, productivity, and improved environmental performance. Positive changes to the natural setting where employees work often leads to an improvement in worker morale. Most importantly, by implementing productive habitat enhancement projects at the facility, the Limerick Generating Station will help protect biodiversity: Increasing site biodiversity should be the overall goal of the wildlife programs initiated at the two facilities. With this in mind, WHC has recommended several enhancement projects for various areas of the site, including:

- Identifying and managing any invasive, exotic species on site;
- Use Best Management Practices of Right-of-Ways that cross the site,
- Enhancing riparian habitats for wildlife,
- Partnering with neighboring land managers to enhance early successional, grassland habitats for local wildlife species including birds, mammals and pollinators,
- Considering the creation of a nest box monitoring program for cavity nesting species including songbirds, raptors and bats,
- Planning and initiation of habitat enhancement projects to benefit native amphibian and reptile species.

WHC can provide technical assistance regarding project implementation, maintenance, and recommendations for future projects throughout the formulation and development stages of

the Limerick Generating Station's wildlife habitat enhancement programs. WHC staff is also available to participate in team meetings, species inventories, special events, and strategic planning of the program.

WHC is pleased to have been given the opportunity to assist employees at the Limerick Generating Station in the development and implementation of a long-term wildlife habitat management program and encourages Exelon Corporation to continue its leadership in this pursuit.

APPENDIX I INFORMATION SOURCES

These resources provide additional information about the habitat enhancement projects discussed in this report. Information can also be obtained from the Natural Resources Conservation Service (NRCS), your state Department of Environmental Quality (DEQ). General resources are listed first, followed by a selection of recommended field guides.

Internet Resources

USDA, NRCS. 2004. The PLANTS Database, Version 3.5 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, Louisiana.

NatureServe. 2004. NatureServe Explorer: An online encyclopedia of life. Version 4.0 (<http://www.natureserve.org/explorer>). NatureServe, Arlington, Virginia.

General Habitat Enhancement Resources

Adams, George. 1994. *Birdscaping Your Garden: A Practical Guide to Backyard Birds and the Plants That Attract Them*. Rodale Press, Emmaus, Pennsylvania. 208pp.

Bailey, Robert G. 1995. Description of the ecoregions of the United States. 2d. ed. Rev. and expanded (1st ed. 1980). Misc. Publ. No. 1391 (rev.), Washington D.C. USDA Forest Service. 108 p.

Benyus, Janine, M. 1989. *The Field Guide to Wildlife Habitats of the Western United States*. Simon & Schuster Inc. New York, New York. 336 pp.

Biebighauser, Thomas R. 2003. *A Guide to Creating Vernal Ponds*. USDA Forest Service. 33pp.

Bookhout, Theodore A., ed. 1994. *Research and Management Techniques for Wildlife and Habitat*. 5th ed. Wildlife Society, Bethesda, Maryland. 740pp.

Cowardin, Lewis M., Virginia Carter, Francis Golet and Edward LaRoe. 1979. *Classification of Wetland and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service FWS-OBS-79/31. 103pp.

Decker, Daniel J. and John W. Kelly. 1988. *Enhancement of Wildlife Habitat on Private Lands*.

Dennis, John V. 1988. *The Wildlife Gardener*. Alfred A. Knopf, New York, New York. 293pp.

Ehrlich, Paul R., David S. Dobkin and Darryl Wheye. 1988. *The Birder's Handbook: A Field Guide to the Natural History of North American Birds*. Simon & Schuster Inc. New York, New York. 784pp.

- Ellefson, Connie, Tom Stephens and Doug Welsh. 1992. *Xeriscape Gardening: Water Conservation for the American Landscape*. Macmillan Publishing Company, New York, New York. 323pp.
- Ellis, Barbara W. and Fern Marshall Bradley, eds. 1992. *The Organic Gardener's Handbook of Natural Insect and Disease Control*. Rodale Press, Emmaus, Pennsylvania. 534pp.
- Flink, Charles A., Peter Lagerwey, Diana Balmori and Robert M. Searns. 1993. *Trails for the Twenty-First Century: Planning, Design, and Management Manual for Multi-use Trails*. Edited by Karen-Lee Ryan. Island Press, Washington, D.C. 213pp.
- Grimm, William Carey. 1993. *The Illustrated Book of Wildflowers and Shrubs*. Stackpole Books, Harrisburg, Pennsylvania. 637pp.
- Hammer, Donald A. 1992. *Creating Freshwater Wetlands*. Lewis Publishers, Inc., Chelsea, Michigan. 298pp.
- Harker, Donald, Gary Libby, Kay Harker, Sherri Evans and Marc Evans. 1999. *Landscape Restoration Handbook*. 2nd ed. Lewis Publishers, Ann Arbor, Michigan. 145pp.
- Henderson, Carrol L. 1987. *Landscaping for Wildlife*. Minnesota Dept. of Natural Resources, St. Paul, Minnesota. 110pp.
- Henderson, Carrol L. 1992. *Woodworking for Wildlife: Homes for Birds and Mammals*. 2nd ed. Minnesota Department of Natural Resources, St. Paul, Minnesota. 111pp.
- Henry, Peggy. 1995. *Gardening to Attract Birds and Butterflies*. Avon Books, New York, New York. 79pp.
- Hotchkiss, Neil. 1972. *Common Marsh, Underwater and Floating-leaved Plants of the United States and Canada*. General Publishing Co., Ltd. Toronto, Ontario. 124pp.
- Hygnstrom, Scott, Robert Timm and Gary Larson. 1994. *Prevention and Control of Wildlife Damage*. Vol. 1-2, Texas.
- Jones, Samuel B. and Leonard E. Foote. 1990. *Gardening with Native Wildflowers*. Timber Press, Portland, Oregon. 195pp.
- Kusler, Jon A. and Mary E. Kentula, eds. 1990. *Wetland Creation and Restoration*. Island Press, Washington D.C. 594pp.
- Lee, David S., Carter S. Gilbert, Charles H. Hocutt, Robert E. Jenkins, Don E. McAllister and Jay R. Stauffer, Jr. 1980. *Atlas of North American Freshwater Fishes*. North Carolina State Museum of Natural History., North Carolina. 867pp.
- Lincoln, Roger, Geoff Boxshall and Paul Clark. 1998. *A Dictionary of Ecology, Evolution and Systematics*, 2nd ed. Cambridge University Press, Cambridge, UK. 361pp.

- Magee, Dennis W. 1981. *Freshwater Wetlands: A Guide to Common Indicator Plants of the Northeast*. The University of Massachusetts Press, Amherst, Massachusetts. 245 pp.
- Martin, Laura C. 1986. *The Wildflower Meadow Book: A Gardener's Guide*. East Woods Press, Charlotte, North Carolina. 303 pp.
- McComas, Steve. 1993. *Lake Smarts: The First Lake Maintenance Handbook*. Edited by Rachel Reeder. Terrene Institute, Alexandria, Virginia. 215pp.
- Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA NRCS. 1995. *Northeast wetland flora: Field office guide to plant species*. Northeast National Technical Center, Chester, PA.
- Packard, Stephen and Cornella F. Mutel. 1997. *The Tallgrass Restoration Handbook for Prairies, Savannas, and Woodlands*. Island Press, Washington, D.C. 463pp.
- Parrow, Martin R. and Anthony J. Davy, eds. 2002. *Handbook of Ecological Restoration, Volume 1: Principles of Restoration*. Cambridge University Press, Cambridge, UK. 444pp.
- Parrow, Martin R. and Anthony J. Davy, eds. 2002. *Handbook of Ecological Restoration, Volume 2: Restoration in Practice*. Cambridge University Press, Cambridge, UK. 599pp.
- Payne, Neil F. 1992. *Techniques for Wildlife Habitat Management of Wetlands*. McGraw-Hill, Inc., New York, New York. 549pp.
- Payne, Neil F. and Fred C. Bryant. 1994. *Techniques for Wildlife Habitat Management of Uplands*. McGraw-Hill, Inc., New York, New York. 840pp.
- Proudman, Robert D. and Reuben Rajala. 1981. *Trail Building and Maintenance*. 2nd ed. Appalachian Mountain Club. 300pp.
- Randall, John M. and Janet Marinelli, eds. 1996. *Invasive Plants: Weeds of the Global Garden*. Brooklyn Botanic Garden, Inc., Brooklyn, New York. 111pp.
- Rodiek, Jon E. and E.G. Bolen., eds. 1991. *Wildlife and Habitats in Managed Landscapes*. Island Press, Washington, DC. 201pp.
- Rosenzweig, Michael, 2003. *Win-Win Ecology: How the Earth's Species can Survive in the Midst of Human Enterprise*. Oxford University Press.
- Russo, Monica and Robert Dewire. 1976. *The Complete Book of Birdhouses and Feeders*. Drake Publishers, New York, New York.
- Schenk, Marcus. 1990. *Butterflies, How to Identify and Attract Them to Your Garden*. Rodale Press, Inc., U.S.A. 160pp.
- Sibley, David Allen. 2001. *The Sibley Guide to Bird Life and Behavior*. Alfred A. Knopf, New York, New York. 607pp.

- Sibley, David Allen. 2000. *The Sibley Guide to Birds*. Alfred A. Knopf, New York, New York. 544pp.
- Stokes, Donald and Lilian. 1990. *The Complete Birdhouse Book: The Easy Guide to Attracting Nesting Birds*. Little, Brown and Company, New York, New York. 95pp.
- Stokes, Donald and Lilian. 1989. *The Hummingbird Book: The Complete Guide to Attracting, Identifying, and Enjoying Hummingbirds*. Little, Brown and Company, Boston, Massachusetts. 87pp.
- Tacha, Thomas C. and Clait E. Braun, eds. 1994. *Migratory Shore and Upland Game Bird Management in North America*. Allen Press, Lawrence, Kansas. 223pp.
- Terres, John K. 1956. *The Audubon Society Encyclopedia of North American Birds*. Wings Books, Avenel, New Jersey. 1109pp.
- Treepeople, Andy and Katie Lipkis. 1990. *The Simple Act of Planting a Tree*. Jeremy P. Tarcher, Inc., Los Angeles, California. 236pp.
- U.S.D.A. Forest Service. 1984. *Standard Specification for Construction of Trails*. EM-7720-102. U.S.D.A., Forest Service, Washington, DC. 105pp.
- USDA, NRCS. 2005. *The PLANTS Database, Version 3.5* (<http://plants.usda.gov>). Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
- Whitson, Tom D., ed., Larry C. Burrill, Steven A. Dewey, David W. Cudney, B.E. Nelson, Richard D. Lee and Robert Parker. 1996. *Weeds of the West*. 5th ed. Pioneer of Jackson Hole, Jackson, Wyoming. 630pp.
- Xerces Society, The. 1990. *Butterfly Gardening: Creating Summer Magic in your Garden*. Sierra Club Books, San Francisco, California. 192pp.

Recommended Field Guides

- Boyd, Howard P. 1991. *A Field Guide to the Pine Barrens of New Jersey*. Plexus Publishing, Inc., Bedford, New Jersey. 423pp.
- Bull, John. 2000. *The Audubon Society Field Guide to North American Birds: Eastern Region*. Revised ed. Alfred A. Knopf, New York, New York. 800pp.
- Burr, Brooks M., Lawrence M. Page, and Tory Peterson. 1998. *A Field Guide to Freshwater Fishes: North America North of Mexico* (Peterson Field Guides). Houghton Mifflin Company, Boston, Massachusetts. 541pp.

- Burt, William H. 1998. *A Peterson Field Guide to the Mammals of North America North of Mexico*. Houghton Mifflin Company, Boston, Massachusetts. 367pp.
- Capula, Massimo. 1989. *Simon & Schuster's Guide to Reptiles and Amphibians of the World*. Edited by John L. Behler. Simon & Schuster Inc., New York, New York. 256pp.
- Clark, William S. and Brian K. Wheeler. 2001. *A Peterson Field Guide to Hawks of North America*. 2nd ed. Houghton Mifflin Company, Boston, Massachusetts. 328pp.
- Conant, Roger and Joseph Collins. 1998. *A Field Guide to Reptiles and Amphibians of Eastern and Central North America*. 4th ed. Houghton Mifflin Company, Boston, Massachusetts. 634pp.
- Covell, Charles V., Jr. 1984. *A Peterson Field Guide to Moths of Eastern North America*. Edited by Roger Tory Peterson. Houghton Mifflin Company, Boston, Massachusetts. 496pp.
- Harrison, Hal H. 1998. *A Peterson Field Guide to the Birds' Nests: The United States East of the Mississippi River*. Houghton Mifflin Company, Boston, Massachusetts. 288pp.
- Kricher, John C. 1998. *A Peterson Field Guide to Eastern Forests*. Houghton Mifflin Company, Boston, Massachusetts. 506pp.
- Little, Elbert L. Jr. 1980. *The Audubon Society Field Guide to North American Trees: Eastern Region*. Chanticleer Press, New York, New York. 716pp.
- McKenney, Margaret, and Roger Tory Peterson. 1998. *A Peterson Field Guide to Wildflowers: Northeastern and Northcentral North America*. Houghton Mifflin Company, Boston, Massachusetts. 448pp.
- Murie, Olaus J. 1998. *A Peterson Field Guide to Animal Tracks*. Houghton Mifflin Company, Boston, Massachusetts. 400pp.
- Newcomb, Lawrence. 1989. *Newcomb's Wildflower Guide*. Little, Brown and Company, Boston, Massachusetts. 490 pp.
- Opler, Paul A. and Vichai Malikul. 1998. *A Peterson Field Guide to Eastern Butterflies*. Houghton Mifflin Company, Boston, Massachusetts. 503pp.
- Peterson, Roger Tory. 2002. *A Peterson Field Guide to the Birds of Eastern and Central North America*. 5th ed. Houghton Mifflin Company, Boston, Massachusetts. 450pp.
- Petrides, George A. 1998. *A Field Guide to Eastern Trees*. 2nd ed. Houghton Mifflin Company, New York, New York. 441pp.
- Redington, Charles B. 1994. *Redington Field Guides: Plants in Wetlands*. Kendall/Hunt Publishing Co., Dubuque, Iowa. 394pp.

Silberhorn, Gene M. 1999. *Common Plants of the Mid-Atlantic Coast: A Field Guide*. Revised ed. The Johns Hopkins University Press, Baltimore, Maryland. 295pp.

Theiret, John W., William A. Neiring, and Nancy C. Olmstead. 2001. *National Audubon Society Field Guide to North American Wildflowers: Eastern Region*. Alfred A Knopf, Inc., New York, New York. 896pp.

White, Richard E., and Donald J. Borror. 1998. *A Peterson Field Guide to Insects: America North of Mexico*. Houghton Mifflin Company, Boston, Massachusetts. 448pp.

Williamson, Sheri L. 2002. *A Peterson Field Guide to the Hummingbirds of North America*. Houghton Mifflin Company, Boston, Massachusetts. 275pp.

APPENDIX II

The term 'ecoregion' may be loosely defined as a unit of land or water, usually relatively large in extent, which exhibits a distinguishing assemblage of distinct and often discrete natural communities and species. The list of species contained in this table is offered to provide the site Wildlife Team with a representation of plant and animal species indicative of the ecoregion that is prevalent for the site location, and therefore to provide a sampling of species that may be encountered when compiling the site species inventory. Please note that this list is not meant to be definitive.

APPENDIX III
CONTACT INFORMATION

E2-36: Enclosure 2: Terrestrial Ecology, item I.a

In relation to reference WHC (2006), please provide the following for the indicated Wildlife at Work Projects:

Bird and bat project summary sheets, including location maps, data sheets, and notes.

Exelon Response

The requested document is provided.

WILDLIFE AT WORK
Project Summary Sheet
(FORM PSS)



Bird and Bat Project Summary Sheet

1. What is the name of the project?

Project Name: Erecting Artificial Avian and Raptor Nesting Structures

2. What is the location of project?

Project Location: Perimeter area of Limerick Generating Station

3. Indicate the date (month/year) the project was started.

Project Start Date: August 2007

4. Please provide a brief list/ timeline of completed activities as well as the current status of the project. Attach additional timelines at the end of the PSS.

- A biodiversity assessment and wildlife habitat management plan was developed in June 2006 to identify the strength and weaknesses of the Limerick Generating Station property to support wildlife.
- In June 2007 the artificial bird structure were installed to support Blue Bird, Purple Martin, bat, owl, and raptor species populations.
- Monitoring of habitat structures continues.

5. If applicable, what is the size of the project?

- The station is located on approximately 600 acres in southern Montgomery County, Pennsylvania. The targeted habitat area for this project encompasses approximately one half the site and includes both semi-developed and undeveloped space.

6. Describe the project and why you are doing it.

Reasoning Behind Project: Throughout the nation and locally avian species have experienced significant declines. In Pennsylvania, the largest issue responsible for the decline of bird populations is extensive habitat loss and fragmentation. Limerick Generating Station property provides both grassland and forestland to support and encourage an increased number of resident songbirds and raptors.

Brief Description of Project: The project involves the installation of artificial nesting structures for both song bird and raptor species. The song bird structures are installed at the northern side of the station which also serves as the main entrance. The structures are optimally located for avian use as well as visually observable by both the employees and public. Raptor structures were installed in remote areas conducive to habitation/use.

7. How does this project fit in with your other habitat enhancement projects?

This is the first project of the site Environmental Council and as such its success with other habitat projects can not be assessed as of this time. In June 2010 a toad fence was installed along a heavily traveled on-site road to prevent road-kills from vehicles. Both project aim to increase population and improve habitat needs of local species.

8. Please describe the precise steps used to implement the project. All steps, even if they have not been completed, should be listed. (These are your objectives and prescriptions). You may use additional space/pages.

- A biodiversity assessment and wildlife habitat management plan was developed in June 2006
- Targeted avian species were identified for improved nesting structure
- The station property was assessed to determine optimal locations for ensured success of the nesting structures
- A subsurface assessment of the identified locations was performed to ensure there were no artificial obstructions
- In June 2007 six Blue Bird, one Purple Martin, two owl, and two bat artificial habitat structures were installed in addition to one raptor perch.

9. In order for wildlife species to thrive, the essential habitat components of food, water, cover, and space must be readily available. To be considered for *Wildlife at Work* certification, at least one project or several projects linked together must address all habitat components. Please indicate how this project addresses the listed habitat requirements.

- Food: The structures are located to support the natural food requirements of the species. Bird houses are adjacent to a semi-developed grass field. The field provides the habitat for various insects desired by birds. The bat, owl, and raptor structures are located in remote and forested areas to provide optimal food supplies as well.
- Water: The area surrounding the station is more than adequately supplied with fresh water. Adjacent to the site is the Possum Hollow Creed as well as the Schuylkill River.
- Cover: The Blue Bird structures are located in a grassy paralleling a tree line. The entrance hole faces east to face away from prevailing winds. The support pole includes a predator shield to protect from unwanted guests. The Purple Martin structure is mounted atop a fifteen foot pole that includes a predator shield. It is located 30-40 feet from any tree line. The owl structures are atop a fifteen foot pole and are located down an embankment adjacent to the Possum Hollow Creek and face north. The bat structures are atop two fifteen foot poles each and are located in a wooded area on the eastern side of the station. The structures are placed to receive the maximum amount of morning sunlight and face southeast. The raptor perch is located on the north-east section of the property on a hill. The perch is placed such that the cross pieces are oriented east-west. This provides maximum visibility for the birds during early morning and late afternoon sunlight.
- Space: Each of the structure locations as described above are located to optimally achieve the space necessary to encourage both short and long term use by the various species.

10. Please describe the Wildlife Team's future plans for the project.

The team plans to continue monitoring of the structures to determine use and overall condition. During a recent monitoring period it was determined that several of the structures require internal cleaning of nesting materials. This event will be planned in the near future.

11. Please indicate the number of employees and volunteers involved in the project.

A total of five Limerick employees participated in the installation of the various artificial habitat structures. Since that time additional personnel have participated in the monitoring of the structures.

12. Please list the organizations, agencies, or community groups involved in the project and describe their involvement. Please label each as a future, present, and/or past partner.

As this project was undertaken by on-site volunteer employees no outside agencies or groups were involved with the installation of monitoring of the structures.

13. Are native plantings being used in this project? Please provide a list of species planted, including scientific names. Websites including www.itis.gov, www.wildflower.org/explore, and www.plants.usda.gov will help provide this information.

This project scope included identification of species in need for habitat structures, installation of the structures, and monitoring of the structures. No plantings were incorporated at this time.

- 14. Are invasive species being controlled in this project? Please provide a list of species controlled and the control method that is utilized, including scientific names. Websites including www.itis.gov, www.invasive.org, and www.plants.usda.gov will help provide this information.**

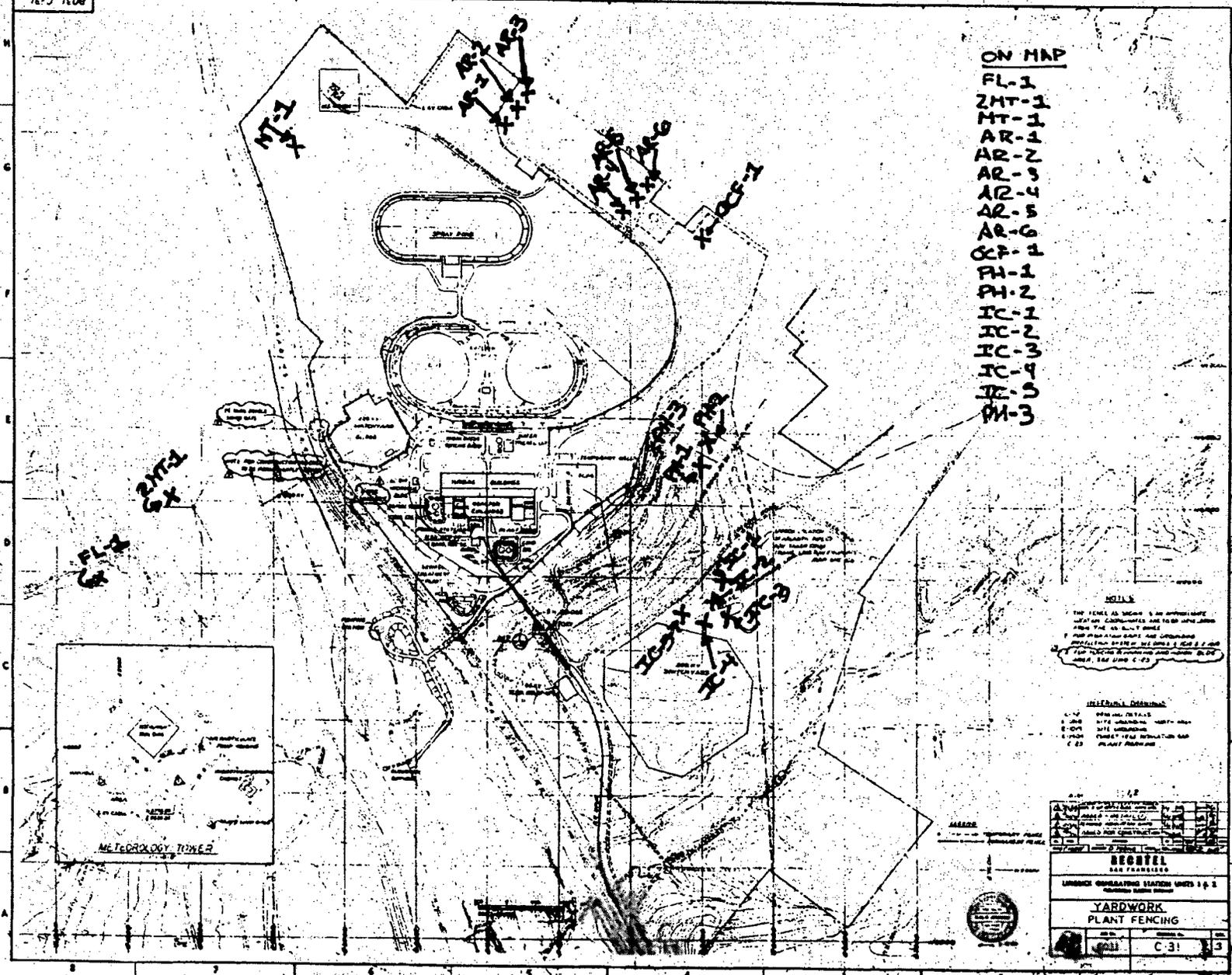
No invasive species are being controlled as part of this project.

- 15. Provide required monitoring and maintenance documentation and descriptions.**

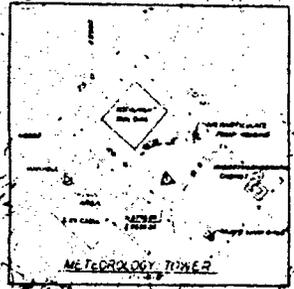
As provided in attached documents.

03/12/11 LKB

16-C 1508



- ON MAP**
- FL-1
 - ZHT-1
 - MT-1
 - AR-1
 - AR-2
 - AR-3
 - AR-4
 - AR-5
 - AR-6
 - OCF-1
 - PH-1
 - PH-2
 - IC-1
 - IC-2
 - IC-3
 - IC-4
 - JE-1
 - PH-3



NOTES

THE FENCE AS SHOWN IS AN APPROXIMATE
 LAYOUT. CONDITIONS ARE TO BE VERIFIED
 FROM THE AS-BUILT DRAWING
 FOR THE FENCE LINE AND UTILITIES
 UTILITIES ARE TO BE SHOWN IN THE AS-BUILT DRAWING
 FOR THE FENCE LINE AND UTILITIES

SYMBOLS

- 1-10 OFFICE BUILDING
- 1-11 SITE CHANGING
- 1-12 SITE CHANGING
- 1-13 FENCE LINE
- 1-14 FENCE LINE
- 1-15 FENCE LINE

DATE	12
BY	...
CHECKED	...
APPROVED	...

BECHTEL		
SAN FRANCISCO		
LANDMARK OPERATING STATION UNIT 1 & 2		
YARDWORK		
PLANT FENCING		
NO. 0031	C-31	3

30X

...

Birdhouses

Area	Box #	Date	Time	Weather	Species	# of adults	# eggs # hatchlings # fledglings	Type of Nesting Structure	GPS Location	Box Intact	Guard Intact	Notes
Old Cement Factory	OCF-1	03/18/11	0900 - 1200					Purple Martin				
Old Cement Factory	OCF-2	03/18/11	0900 - 1200					Bird Box				
Old Cement Factory	OCF-3	03/18/11	0900 - 1200					Bird Box				
Old Cement Factory	OCF-4	03/18/11	0900 - 1200					Bird Box				
Access Road	AR-1	03/18/11	0900 - 1200					Blue Bird Box				
Access Road	AR-2	03/18/11	0900 - 1200					Blue Bird Box				
Access Road	AR-3	03/18/11	0900 - 1200					Blue Bird Box				
Access Road	AR-4	03/18/11	0900 - 1200					Blue Bird Box				
Access Road	AR-5	03/18/11	0900 - 1200					Blue Bird Box				
Access Road	AR-6	03/18/11	0900 - 1200					Blue Bird Box				
Access Road	AR-7	03/18/11	0900 - 1200					Bird Box				
Access Road	AR-8	03/18/11	0900 - 1200					Bird Box				
Access Road	AR-9	03/18/11	0900 - 1200					Bird Box				
Access Road	AR-10	03/18/11	0900 - 1200					Bird Box				
MET Tower	MT-1	03/18/11	0900 - 1200					Raptor Perch				
MET Tower	MT-2	03/18/11	0900 - 1200					Bird Box				
MET Tower	MT-3	03/18/11	0900 - 1200					Bird Box				
MET Tower	MT-4	03/18/11	0900 - 1200					Bird Box				
Possum Hollow	PH-1	03/18/11	0900 - 1200					Owl Boxes				
Possum Hollow	PH-2	03/18/11	0900 - 1200					Owl Boxes				
Possum Hollow	PH-3	03/18/11	0900 - 1200					Bird Box				
Possum Hollow	PH-4	03/18/11	0900 - 1200					Bird Box				
Possum Hollow	PH-5	03/18/11	0900 - 1200					Bird Box				
Possum Hollow	PH-6	03/18/11	0900 - 1200					Bird Box				
Possum Hollow	PH-7	03/18/11	0900 - 1200					Bird Box				
Possum Hollow	PH-8	03/18/11	0900 - 1200					Bird Box				
Old Training Building	OTB-1	03/18/11	0900 - 1200					Bird Box				
Old Training Building	OTB-2	03/18/11	0900 - 1200					Bird Box				
Old Training Building	OTB-3	03/18/11	0900 - 1200					Bird Box				
Old Training Building	OTB-4	03/18/11	0900 - 1200					Bird Box				
Old Training Building	OTB-5	03/18/11	0900 - 1200					Bird Box				
Info Center	IC-1	03/18/11	0900 - 1200					Bird Box				
Info Center	IC-2	03/18/11	0900 - 1200					Bird Box				
Info Center	IC-3	03/18/11	0900 - 1200					Bird Box				
Info Center	IC-4	03/18/11	0900 - 1200					Bird Box				
Info Center	IC-5	03/18/11	0900 - 1200					Bird Box				
Info Center	IC-6	03/18/11	0900 - 1200					Bird Box				
Info Center	IC-7	03/18/11	0900 - 1200					Bird Box				
Info Center	IC-8	03/18/11	0900 - 1200					Bird Box				
2 MET Tower	2MT-1	03/18/11	0900 - 1200					Bat Box				
2 MET Tower	2MT-2	03/18/11	0900 - 1200					Bat Box				
2 MET Tower	2MT-3	03/18/11	0900 - 1200					Bird Box				
2 MET Tower	2MT-4	03/18/11	0900 - 1200					Bird Box				
Frick's Locke	FL-1	03/18/11	0900 - 1200					Bird Box				
Frick's Locke	FL-2	03/18/11	0900 - 1200					Bird Box				

Birdhouses

Area	Box #	Date	Time	Weather	Species	# of adults	# eggs # hatchlings # fledglings	Type of Nesting Structure	GPS Location	Box Intact	Guard Intact	Notes
Frick's Locke	FL-3	03/18/11	0900 - 1200					Bird Box				
Frick's Locke	FL-4	03/18/11	0900 - 1200					Bird Box				
Frick's Locke	FL-5	03/18/11	0900 - 1200					Bird Box				
Frick's Locke	FL-6	03/18/11	0900 - 1200					Bird Box				
Frick's Locke	FL-7	03/18/11	0900 - 1200					Bird Box				
Frick's Locke	FL-8	03/18/11	0900 - 1200					Bird Box				
Frick's Locke	FL-9	03/18/11	0900 - 1200					Bird Box				
Frick's Locke	FL-10	03/18/11	0900 - 1200					Bird Box				

03.18.11 LOG

Area	Box #	Date	Time	Weather	Species	# of adults	# eggs # hatchlings # fledglings	Type of Nesting Structure	GPS Location	Box Intact	Guard Intact	Notes
Old Cement Factory	OCF-1	03/18/11	0900 - 1200	Sunny	0	0	0	Purple Martin	On Map under Box #	N	N	Box and guard missing, need to be replaced.
Access Road	AR-1	03/18/11	0900 - 1200	Sunny	0	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-2	03/18/11	0900 - 1200	Sunny	0	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-3	03/18/11	0900 - 1200	Sunny	0	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-4	03/18/11	0900 - 1200	Sunny	0	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-5	03/18/11	0900 - 1200	Sunny	1 - sparrow	1	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-6	03/18/11	0900 - 1200	Sunny	0	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
MET Tower	MT-1	03/18/11	0900 - 1200	Sunny	0	0	0	Raptor Perch	On Map under Box #	N	N/R	Perch needs to be repaired/replaced.
Possum Hollow	PH-1	02/24/11	0900 - 1200	Sunny	0	0	0	Owl Boxes	On Map under Box #	Y	N/R	Did not required cleaning.
Possum Hollow	PH-2	02/24/11	0900 - 1200	Sunny	0	0	0	Owl Boxes	On Map under Box #	Y	N/R	Did not required cleaning.
Info Center	IC-1	03/18/11	0900 - 1200	Sunny	0	0	0	Bird Box	On Map under Box #	Y	N	Needs a guard, cleaned out.
Info Center	IC-2	03/18/11	0900 - 1200	Sunny	1 - tree swallow	1	0	Bird Box	On Map under Box #	Y	N	Needs a guard, did not require cleaning.
Info Center	IC-3	03/18/11	0900 - 1200	Sunny	1 - tree swallow	1	0	Bird Box	On Map under Box #	Y	N	Needs a guard, did not require cleaning.
Info Center	IC-4	03/18/11	0900 - 1200	Sunny	0	0	0	Bird Box	On Map under Box #	Y	N	Needs a guard, did not require cleaning.
Info Center	IC-5	03/18/11	0900 - 1200	Sunny	0	0	0	Bird Box	On Map under Box #	Y	N	Needs a guard, did not require cleaning.
2 MET Tower	2MT-1	03/18/11	0900 - 1200	Sunny	0	0	0	Baf Box	On Map under Box #	Y	N/R	Structurally sound, no rust.
Frick's Locke	FL-1	03/18/11	0900 - 1200	Sunny	0	0	0	Bird Box	On Map under Box #	N	N	Needs to be removed/replaced, not usable.

06.03.11 LOG

Area	Box #	Date	Time	Weather	Species	# of adults	# eggs # hatchlings # fledglings	Type of Nesting Structure	GPS Location	Box Intact	Guard Intact	Notes
Old Cement Factory	OCF-1	06/03/11	8:15 AM	Overcast	0	0	0	Purple Martin	On Map under Box #	N	N	Box and guard missing, need to be replaced.
Access Road	AR-1	06/03/11	8:30 AM	Overcast	Sparrow Nest	1	6 eggs	Blue Bird Box	On Map under Box #	Y	Y	Nest Left Alone.
Access Road	AR-2	06/03/11	8:30 AM	Overcast	Sparrow Nest	1	4 hatch	Blue Bird Box	On Map under Box #	Y	Y	Nest Left Alone.
Access Road	AR-3	06/03/11	8:30 AM	Overcast	Swallow Nest	1	0	Blue Bird Box	On Map under Box #	Y	Y	Dead Adult Tree Swallow - Removed.
Access Road	AR-4	06/03/11	8:30 AM	Overcast	Sparrow Nest	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-5	06/03/11	8:30 AM	Overcast	Sparrow Nest	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-6	06/03/11	8:30 AM	Overcast	Sparrow Nest	2	5 eggs	Blue Bird Box	On Map under Box #	Y	Y	Nest Left Alone, adult male & female seen.
MET Tower	MT-1	06/03/11	10:30 AM	Sunny	0	0	0	Raptor Perch	On Map under Box #	N	N/R	Perch needs to be repaired/replaced.
Possum Hollow	PH-1	06/03/11	10:00 AM	Sunny	Wren Nest	0	4 hatch	Owl Boxes	On Map under Box #	Y	N/R	Nest Left Alone.
Possum Hollow	PH-2	06/03/11	10:00 AM	Sunny	Chickadee Nest	1	1 hatch	Owl Boxes	On Map under Box #	Y	N/R	Hole in bottom of box, will need to be replaced at some time. Black-Capped Chickadee.
Possum Hollow	PH-3	06/03/11	9:45 AM	Sunny	Brown Bats	2	0	Bat Box	On Map under Box #	Y	N/R	Box needs to be repaired or replaced soon. Little Brown Bats.
Info Center	IC-1	06/03/11	9:15 AM	Sunny	Swallow Nest	2	5 hatch	Bird Box	On Map under Box #	Y	N	Needs a guard, on order. No issues w/ Tree Swallows.
Info Center	IC-2	06/03/11	9:15 AM	Sunny	Wren Nest	0	3 eggs	Bird Box	On Map under Box #	Y	N	Needs a guard, on order. Wide hole in box by woodpecker.
Info Center	IC-3	06/03/11	9:15 AM	Sunny	Swallow Nest	2	5 hatch	Bird Box	On Map under Box #	Y	N	Needs a guard, on order. No issues w/ Tree Swallows.
Info Center	IC-4	06/03/11	9:15 AM	Sunny	Blue Bird Nest	2	3 fled	Bird Box	On Map under Box #	Y	N	Needs a guard, on order. No issues w/ Eastern Bluebird.
Info Center	IC-5	06/03/11	9:15 AM	Sunny	Wren Nest	0	0	Bird Box	On Map under Box #	Y	N	Needs a guard, on order. No issues.
2 MET Tower	2MT-1	06/03/11	8:55 AM	Overcast	Brown Bats	2	0	Bat Box	On Map under Box #	Y	N/R	Nest Left Alone. Little Brown Bats
Frick's Locke	FL-1	06/03/11	9:00 AM	Overcast	0	0	0	Bird Feeder	On Map under Box #	N	N	Needs to be removed/replaced, not usable.

Follow Up Items:

- Next inspection need screwdriver, keys to frick's locke, and 6 small screws.
- Review if sparrows nests can be removed with babies or eggs in the nest.
- Look at what type of sparrows and wrens were identified.

10.26.11 LOG

Area	Box #	Date	Time	Weather	Species	# of adults	# eggs # hatchlings # fledglings	Type of Nesting Structure	GPS Location	Box Intact	Guard Intact	Notes
Old Cement Factory	OCF-1	10/26/11	1200 - 1400	Sunny	0	0	0	Purple Martin	On Map under Box #	N	N	Box and guard missing, need to be replaced.
Access Road	AR-1	10/26/11	1200 - 1400	Sunny	Sparrow Nest	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-2	10/26/11	1200 - 1400	Sunny	Sparrow Nest	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-3	10/26/11	1200 - 1400	Sunny	Swallow Nest	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-4	10/26/11	1200 - 1400	Sunny	Sparrow Nest	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-5	10/26/11	1200 - 1400	Sunny	Sparrow Nest	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
Access Road	AR-6	10/26/11	1200 - 1400	Sunny	Sparrow Nest	0	0	Blue Bird Box	On Map under Box #	Y	Y	Cleaned out.
MET Tower	MT-1	10/26/11	1200 - 1400	Sunny	0	0	0	Raptor Perch	On Map under Box #	N	N/R	Perch needs to be repaired/replaced.
Possum Hollow	PH-1	10/26/11	1200 - 1400	Sunny	Wren Nest	0	0	Owl Boxes	On Map under Box #	Y	N/R	Cleaned out.
Possum Hollow	PH-2	10/26/11	1200 - 1400	Sunny	Chickade Nest	0	0	Owl Boxes	On Map under Box #	Y	N/R	Hole in bottom of box, will need to be replaced at some time. Cleaned out.
Possum Hollow	PH-3	10/26/11	1200 - 1400	Sunny	Brown Bats	1	0	Bat Box	On Map under Box #	Y	N/R	Box needs to be repaired or replaced soon. Little Brown Bats.
Info Center	IC-1	10/26/11	1200 - 1400	Sunny	Swallow Nest	0	0	Bird Box	On Map under Box #	Y	N	Needs a guard added. Cleaned out.
Info Center	IC-2	10/26/11	1200 - 1400	Sunny	Wren Nest	0	0	Bird Box	On Map under Box #	Y	N	Needs a guard added. Cleaned out.
Info Center	IC-3	10/26/11	1200 - 1400	Sunny	Swallow Nest	1	0	Bird Box	On Map under Box #	Y	N	Needs a guard added. Cleaned out.
Info Center	IC-4	10/26/11	1200 - 1400	Sunny	Blue Bird Nest	1	0	Bird Box	On Map under Box #	Y	N	Needs a guard added. Cleaned out.
Info Center	IC-5	10/26/11	1200 - 1400	Sunny	Wren Nest	0	0	Bird Box	On Map under Box #	Y	N	Needs a guard added. Cleaned out.
2 MET Tower	2MT-1	10/26/11	1200 - 1400	Sunny	Brown Bats	2	0	Bat Box	On Map under Box #	Y	N/R	Cleaned out. Little Brown Bats
Frick's Locke	FL-1	10/26/11	1200 - 1400	Sunny	0	0	0	Bird Feeder	On Map under Box #	N	N	Needs to be removed/replaced, not usable.

Follow Up Items:

- This is the 3rd qtr walkdown, missed doing it at end of September.
- Forgot camera, add to log to bring.
- Need to install guards in 4th qtr walkdown.

E2-37: Enclosure 2: Terrestrial Ecology, item I.b.

In relation to reference WHC (2006), please provide the following for the indicated Wildlife at Work Projects:

Frog project summary sheet.

Exelon Response

The requested document is provided.

WILDLIFE AT WORK
Project Summary Sheet
(FORM PSS)



Frog Project Summary Sheet

1. What is the name of the project?

Frog Fencing

2. What is the location of project?

The project location was an approximate 500 ft stretch of land along the lower southeastern portion of the plant perimeter.

3. Indicate the date (month/year) the project was started.

June 18, 2010

4. Please provide a brief list/ timeline of completed activities as well as the current status of the project. Attach additional timelines at the end of the PSS.

The area was assessed during a walkdown of Possum Hollow. The walkdown included a one-day informal assessment of wildlife and wildlife habitats that included measuring out a portion of the southeastern perimeter for the installation of a barrier (frog fence) to prevent native frogs and toads from entering the road way and adjacent parking lot. The purpose of the frog fencing is to eliminate or reduce the number of amphibian losses caused by pedestrians and vehicles.

5. If applicable, what is the size of the project?

The project was comprised of an approximate 500 ft stretch of land along the lower southeastern portion of the plant perimeter.

6. Describe the project and why you are doing it.

As part of Limerick's continued environmental biodiversity, members of the Environmental Stewardship Committee (ESC) conducted a walk down of Possum Hollow. The area's wildlife was evaluated and the eastern portion of the lower parking area was measured for a seasonal barrier to reduce the number of amphibians (frogs and toad) that attempt to cross the parking lot.

A 300 foot fencing barrier along the southeastern portion of the lower parking area was installed. The purpose of the fencing is to reduce the number of amphibians that cross the parking lot during the spring. The frogs and toads attempt to cross the roadway during springtime mainly because it is mating season. Unfortunately, springtime is also outage time at Limerick and with the number of vehicles, many of the frogs and toads are unsuccessful in crossing the parking lot.

7. How does this project fit in with your other habitat enhancement projects?

This project is one of many the ESC is working on in 2010. Other projects that will be taking place this year are installation of wood duck boxes, and training on handling of injured wildlife. Each of these projects aid in sustaining the natural habit and wildlife native to the surrounding area.

8. Please describe the precise steps used to implement the project. All steps, even if they have not been completed, should be listed. (These are your objectives and prescriptions). You may use additional space/pages.

- The ESC lead requested volunteers to conduct an assessment of Possum Hollow
- Volunteers performed the assessment of Possum Hollow and provided the ESC and station management with the assessment summary that included a discussion of the frog fencing.
- The proposed area for the fencing was walked down and measurements were taken.
- ESC volunteers researched the various types of fencing and suggested installation and the cost was provided to management for approval.
- Upon management approval, the fencing and materials were purchased.
- All policies, procedures, and requests were completed by the ESC lead prior to start of the project.
- Volunteers were solicited for installation of the fencing and any necessary safety training was conducted.
- The proposed area was cleared of any weeds or trees that obstructed the installation path.
- The fencing was installed on June 18, 2010.

9. In order for wildlife species to thrive, the essential habitat components of food, water, cover, and space must be readily available. To be considered for *Wildlife at Work* certification, at least one project or several projects linked together must address all habitat components. Please indicate how this project addresses the listed habitat requirements.

This project was not specifically selected based on the listed habitat requirements. Instead, the project was selected based on ways to increase the survival rate and protect a specific species.

• Food:

• Water:

• Cover:

• Space:

10. Please describe the Wildlife Team's future plans for the project.

Future plans for this project includes:

- Periodic inspection of the fencing integrity;
- Assessment of the projects success; and
- Maintenance of the fencing as needed.

11. Please indicate the number of employees and volunteers involved in the project.

A total of four employees/volunteers, including a supervisor, were involved in this project.

12. Please list the organizations, agencies, or community groups involved in the project and describe their involvement. Please label each as a future, present, and/or past partner.

Due to resisted access to Limerick Generating Station, no external organizations, agencies or community groups were involved with this project.

13. Are native plantings being used in this project? Please provide a list of species planted, including scientific names. Websites including www.itis.gov, www.wildflower.org/explore, and www.plants.usda.gov will help provide this information.

Native plantings were not used in this project.

14. Are invasive species being controlled in this project? Please provide a list of species controlled and the control method that is utilized, including scientific names. Websites including www.itis.gov, www.invasive.org, and www.plants.usda.gov will help provide this information.

The control of invasive species was not needed as part of this project.

15. Provide required monitoring and maintenance documentation and descriptions.

This Project Summary description is being prepared and submitted as part of the initial certification process. Ongoing activities and activity logs will be maintained by the ESC lead.

E2-38: Enclosure 2: Terrestrial Ecology, item I.c.

In relation to reference WHC (2006), please provide the following for the indicated Wildlife at Work Projects:

Documented Environmental Evaluation Walkdown/Assessment (for frog fence replacement)
(Report AR 01183399)

Exelon Response

The requested document is provided.

[Go Back](#)[Print](#) | [New Search](#) | [Home](#)**AR 01183399 Report**

Aff Fac:	Limerick	AR Type:	CR	Status:	COMPLETE
Aff Unit:	NA	Owed To:	A5232CAP	Due Date:	04/03/2011
Aff System:	--			Event Date:	03/04/2011
CR Level/Class:	4/D			Disc Date:	03/04/2011
How Discovered:	H02A			Orig Date:	03/04/2011
WR/PIMS AR:		Component #:	-		

Action Request Details

Subject: DOCUMENTED ENVIRONMENTAL WALKDOWN/ASSESSMENT

Description:

Originator: EDWARD N KRINER Supv Contacted: Birkmire, L.

Condition Description:

The Environmental Stewardship Committee performed a field assessment of the amphibian fencing installed in Fall 2010.

The as-found condition of the amphibian (silt) fencing showed it has been breached by winter weather. Since installation of the original fencing in 2010, an improved barrier has now been installed which offers a wider range of protection and is substantially more durable. The new barrier runs parallel to the original fence and is 25 feet west of the original fence line, but much longer.

Since the amphibian fencing has degraded due to winter weather and the new barrier is providing better protection, the original amphibian barrier (silt fence) was removed from the tree line.

The attending team also took time to pick up trash and debris and two signs which have blown into the tree line during the winter.

Immediate actions taken:

Torn and damaged sections of original fence was removed from the tree line, bundled and will be recycled.

Recommended Actions:

Close to track and trend.
No additional actions required.

Since the new barrier is considerably more durable than the original silt fence, follow-up assessments will be scheduled and performed only if required.

What activities, processes, or procedures were involved?

Routine environmental walkdown of amphibian barrier.
Continued support of Environmental Stewardship committee.
HU-AA-1211 briefing.
SA-AA-116 Appropriate Hand protection and practices.

Why did the condition happen?

Good Environmental Stewardship.

What are the consequences?

More amphibians live long and prosper at our site.

Were any procedural requirements impacted?

No

Were there any adverse physical conditions?

Original Fencing found damaged. Replacement barrier confirmed to be in

place and suitable.

List of knowledgeable individuals:

Leanne Birkmire
 Lisa MacDonald
 Joe Carlile
 Chris Conroy
 Ed Kriner

Repeat or similar condition?

N/A

Operable Basis:

Not TS/TRM/ODCM related issue.

Reportable Basis:

Does not meet any reportability threshold.

Reviewed by: ROBERT D MANDIK 03/04/2011 14:02:33 CST

Reviewer Comments:

Reviewed by Operations for Operability, Reportability and Environmental concerns. This issue has no impact on the ability to safely operate the plant, to achieve or maintain the plant in a safe shutdown condition, or to mitigate the effect of any accident condition. This issue does not identify an equipment deficiency that affects operability or functionality of any SSC. There are no Operability, Reportability, or Environmental concerns.

SOC Reviewed by: MARK W CRIM 03/08/2011 09:36:25 CST

SOC Comments:

track and trend

Trend Codes

TC1	TC2	TC3	Proc	Org	Rank
EOR309	*	*	EN	CH	

Assignments

Assign #:	<u>01</u>	Assigned To:		Status:	COMPLETE
Aff Fac:	Limerick	Prim Grp:	ACAPALL	Due Date:	03/09/2011
Assign Type:	TRKG	Sec Grp:		Orig Due Date:	
Priority:					
Schedule Ref:					
Unit Condition:					
Subject/Description:	DOCUMENTED ENVIRONMENTAL WALKDOWN/ASSESSMENT				

E2-39, TE-1: Enclosure 2: Terrestrial Ecology, item J

Submit for docketing the text responses to site audit information needs TE-1, TE-2, TE-3, TE-4, TE-5, TE-6, TE-7, TE-8, and TE-9. These information needs can be found in NRC's Environmental Audit Needs List dated November 4, 2011 (ML11286A330).

Exelon Response

The text response to site audit information needs TE-1 is provided.

Limerick Environmental Audit – Audit Needs Question

Question #: TE-1

Category: Terrestrial Ecology

Statement of Question:

The ER reiterates the expected outcomes of potential impacts described in the Final Environmental Statement (FES)-Construction Permit and FES-Operating License. Briefly describe what specific records or information Exelon Generation reviewed to determine that no new and significant information exists for each of the following:

- Avian collisions with cooling towers
- Cooling tower salt drift deposition effects on native and ornamental vegetation
- Avian collisions with transmission lines and electrocutions
- Transmission line and water pipeline corridor maintenance effects on nesting birds and non-target biota
- Spray pond operation, maintenance, and routine testing effects on wildlife, particularly avian species (e.g., waterfowl) that may be inclined to nest there.

Response:

In general, the new and significant assessment that Exelon Generation conducted during preparation of this license renewal application included:

- (1) Interviews with Exelon Generation and contractor subject matter experts on the validity of the conclusions in the GEIS as they relate to LGS;
- (2) An extensive review of documents related to environmental issues at LGS;
- (3) A review of correspondence with state and federal agencies to determine if the agencies had concerns relevant to their resource areas that had not been addressed in the GEIS;
- (4) A review of the results of LGS environmental monitoring and reporting, as required by regulations and oversight of plant facilities and operations by state and federal regulatory agencies (i.e., the results of ongoing routine activities that could bring significant issues to Exelon Generation's attention);
- (5) A review for issues relevant to the LGS application of certain license renewal applications that have previously been submitted to the NRC by the operators of other nuclear plants; and
- (6) Desktop search for new information.

The above process was applied to the Terrestrial Resources area and resulted in part in the preparation of Sections 2.4.2 (Current Information), 3.1.1.3 (Spray Pond), and 3.1.3.1/2/3 (Transmission System vegetation and avian management processes/programs) of the Environmental Report. After commencement of operations at LGS in 1984, annual, non-radiological environmental monitoring and reporting to the U.S. Nuclear Regulatory Commission (NRC) was performed in accordance with the Environmental Protection Plan (Non-Radiological), which was Appendix B to each unit's Facility Operating License. However, no terrestrial monitoring was required as part of the Environmental Protection Plan; therefore, available information since the pre-operational time period was limited in extent. Efforts since 2005 associated with the World Habitat Council, Wildlife Management Plan, and LGS Environmental Stewardship Committee were undertaken at Exelon Generation's own initiative.

The Exelon Generation investigative team identified knowledgeable Exelon Generation and contractor staff to be interviewed regarding plant environmental issues, generally, as well as specifically applicable NRC non-categorized issues, Category 1 issues, and Category 2 issues. The Exelon Generation New and Significant investigative team interviewed staff primarily at the Learning Center located at the Limerick site, with some supplemental interviews conducted via teleconferencing. For each applicable issue, one or more individuals familiar with the issue(s) were interviewed. Interviewees were provided the GEIS discussion of the issue prior to the interview. Interviewees included persons responsible for maintaining contacts with regulatory agencies, staying abreast of emerging regulatory and technical issues, and implementing the LGS environmental protection program.

During the interview, interviewers explained the purpose of the interview, the issue(s) of interest, including refurbishment activities, the NRC definitions of significance (SMALL, MODERATE and LARGE), and NRC findings described in the GEIS. For Category 1 issues, interviewers then solicited information about (1) whether the issue was or had been, of concern at LGS; (2) whether or not the interviewee agreed with the NRC findings, and if not, why not; and (3) whether the interviewee was aware of any similar offsite activities that could contribute to cumulative impacts. For Category 2 issues, the interviewee was asked if the issue was or had been a concern at LGS and whether the interviewee was aware of any similar offsite activities that could contribute to cumulative impacts. Finally, the interviewer recorded information about the interviewees' credentials and experience relative to the issue(s) for which they were interviewed.

All interviewees agreed with NRC findings that environmental impacts from Category 1 issues applicable to LGS are SMALL and have not been of particular concern. Interviewees identified no activities that would be cumulative to the Category 2 impacts of LGS.

The Terrestrial Resources issues applicable to LGS, for which interviews were conducted as described above, are all Category 1 and include:

- Issue 41 (Cooling tower impacts on crops and ornamental vegetation);
- Issue 42 (Cooling tower impacts on native plants);
- Issue 43 (Bird collisions with cooling towers);
- Issue 45 (Power line right-of-way management);
- Issue 46 (Bird collisions with transmission lines); and
- Issue 48 (Floodplains and wetlands on power line right-of-way).

Water pipelines associated with LGS were buried along existing utility (electric, gas line) corridors for which those property owners maintain responsibility for corridor maintenance.

List Attachments Provided: None.

E2-39, TE-2: Enclosure 2: Terrestrial Ecology, item J

Submit for docketing the text responses to site audit information needs TE-1, TE-2, TE-3, TE-4, TE-5, TE-6, TE-7, TE-8, and TE-9. These information needs can be found in NRC's Environmental Audit Needs List dated November 4, 2011 (ML11286A330).

Exelon Response

The text response to site audit information needs TE-2 is provided.

Please note that the document listed as an attachment to site audit information needs TE-2 is not provided here, but is provided within this package in response to another information request item, as follows:

1. Environmental Working Committee – Biodiversity Evaluation of Possom Hollow is provided in response to Enclosure 2, Terrestrial Ecology, Item A (Index Tab # E2-28).

Limerick Environmental Audit – Audit Needs Question

Question #: TE-2

Category: Terrestrial Ecology

Statement of Question:

Clarify if the "recent field reconnaissance" mentioned on page 2-39, paragraph 3, refers to the 2006 Site Assessment and Wildlife Management Opportunities (NRC) prepared by WHC. If not, please provide a description of this field reconnaissance plus any associated reports or documentation. Similarly, clarify if the "surveying of biodiversity of Possum Hollow Run" on page 2-39, paragraph 7, also refers to the same 2006 assessment by WHC. If not, please provide any survey reports or documentation related to this effort.

Response:

Paragraph 3 on page 2-39 of the LGS License Renewal Environmental discusses the preparation of a Wildlife Management Plan (WMP) for use at the plant site, how the WMP describes the current terrestrial habitats on the LGS plant site, and how the WMP lists plants and animals that have been observed at Exelon Generation-owned properties associated with the LGS plant site and makeup water supply system based on historic data and recent field reconnaissance. The term "recent field reconnaissance" refers to reconnaissance performed by visiting WHC biologists and LGS staff personnel to support preparation of the WHC 2006 report.

The "surveying of biodiversity of Possum Hollow Run" on page 2-39, paragraph 7 does not refer to the same 2006 assessment by WHC. It refers to a separate recent assessment that is described in the attached "Biodiversity Evaluation of Possum Hollow."¹

List Attachments Provided:

1. Environmental Working Committee - Biodiversity Evaluation of Possum Hollow.

¹ Personal Communication between Nancy Ranek, License Renewal Environmental Lead, and Leanne Birkmire, LGS Supervisor RW / Environmental. October 2011.

E2-39, TE-3: Enclosure 2: Terrestrial Ecology, item J

Submit for docketing the text responses to site audit information needs TE-1, TE-2, TE-3, TE-4, TE-5, TE-6, TE-7, TE-8, and TE-9. These information needs can be found in NRC's Environmental Audit Needs List dated November 4, 2011 (ML11286A330).

Exelon Response

The text response to site audit information needs TE-3 is provided.

Please note that the documents listed as attachments to site audit information needs TE-3 are not provided here, but are provided within this package in other responses to information requests, as follows:

1. Relative Abundance of Bird Species During Migration, Robert W. Blye, 1973 is provided in response to Enclosure 2, Terrestrial Ecology, Item B (Index Tab # E2-29).
2. Non-Radiological Environmental Monitoring for Limerick Generating Station, 1979 – 1983, Sections 7.0 and 8.0 is provided in response to Enclosure 2, Terrestrial Ecology, Item C (Index Tab # Index E2-30).
3. Non-Radiological Environmental Monitoring for Limerick Generating Station, 1984, Sections 7.0 and 8.0 is provided in response to Enclosure 2, Terrestrial Ecology, Item D (Index Tab # Index E2-31).
4. Non-Radiological Environmental Monitoring for Limerick Generating Station, 1985, Sections 7.0 and 8.0 is provided in response to Enclosure 2, Terrestrial Ecology, Item E (Index Tab # Index E2-32).
5. Non-Radiological Environmental Monitoring for Limerick Generating Station, 1986, Sections 7.0 and 8.0 is provided in response to Enclosure 2, Terrestrial Ecology, Item F (Index Tab # Index E2-33)

Limerick Environmental Audit – Audit Needs Question

Question #: TE-3 **Category:** Terrestrial Ecology

Statement of Question:

Provide copies of the bird surveys conducted from 1972 – 1985 mentioned on page 2-39, paragraph 4, of the Environmental Report.

Response:

The documents listed below are being provided.

List Attachments Provided:

1. Relative Abundance of Bird Species During Migration, Robert W. Blye, 1973.
2. Non-Radiological Environmental Monitoring for Limerick Generating Station, 1979 – 1983, Sections 7.0 and 8.0.
3. Non-Radiological Environmental Monitoring for Limerick Generating Station, 1984, Sections 7.0 and 8.0.
4. Non-Radiological Environmental Monitoring for Limerick Generating Station, 1985, Sections 7.0 and 8.0.
5. Non-Radiological Environmental Monitoring for Limerick Generating Station, 1986, Sections 7.0 and 8.0.

E2-39, TE-4: Enclosure 2: Terrestrial Ecology, item J

Submit for docketing the text responses to site audit information needs TE-1, TE-2, TE-3, TE-4, TE-5, TE-6, TE-7, TE-8, and TE-9. These information needs can be found in NRC's Environmental Audit Needs List dated November 4, 2011 (ML11286A330).

Exelon Response

The text response to site audit information needs TE-4 is provided.

Please note that the documents listed as attachments to site audit information needs TE-4 are not provided here, but are provided within this package in response to other information request items, as follows:

1. WHC: Wildlife at Work Project Summary Sheet: Bird and Bat Project Summary Sheet is provided in response to Enclosure 2, Terrestrial Ecology, Item I.a (Index E2-36).
2. Bird and Bat Box Location Map with Notes is provided in response to Enclosure 2, Terrestrial Ecology, Item I.a (Index E2-36).
3. WHC: Wildlife at Work Project Summary Sheet: Frog Project Summary Sheet is provided in response to Enclosure 2, Terrestrial Ecology, Item I.b (Index E2-37).
4. AR 01183399 Report, "Documented Environmental Evaluation Walkdown/Assessment" is provided in response to Enclosure 2, Terrestrial Ecology, Item I.c (Index E2-38).
5. Frog Fence Location Map is provided in response to Enclosure 2, Terrestrial Ecology, Item I.b (Index E2-37).

Limerick Environmental Audit – Audit Needs Question

Question #: TE-4

Category: Terrestrial Ecology

Statement of Question:

Provide any additional information or material that the NRC can reference in its EIS relating to LGC's Environmental Stewardship Committee projects mentioned on page 2-39, Paragraph 6, of the ER. Specifically, describe:

- (a) The locations of artificial avian and raptor nesting structures, the species that benefit from these structures, and any ongoing monitoring of these nest sites.
- (b) The location, purpose, and specific frog species that benefit from the 300-ft-long fence.

Response:

The documents listed below are being provided.

List Attachments Provided:

- 1. WHC: Wildlife at Work Project Summary Sheet: Bird and Bat Project Summary Sheet.
- 2. Bird and Bat Box Location Map with Notes
- 3. WHC: Wildlife at Work Project Summary Sheet: Frog Project Summary Sheet.
- 4. AR 01183399 Report, "Documented Environmental Evaluation Walkdown/Assessment
- 5. Frog Fence Location Map

E2-39, TE-5: Enclosure 2: Terrestrial Ecology, item J

Submit for docketing the text responses to site audit information needs TE-1, TE-2, TE-3, TE-4, TE-5, TE-6, TE-7, TE-8, and TE-9. These information needs can be found in NRC's Environmental Audit Needs List dated November 4, 2011 (ML11286A330).

Exelon Response

The text response to site audit information needs TE-5 is provided.

Limerick Environmental Audit – Audit Needs Question

Question #: TE-5

Category: Terrestrial Ecology

Statement of Question:

Provide a copy of LGS's WHC Corporate Wildlife Habitat Certification that is referenced on Page 2-39, Paragraph 3, of the ER.

Response:

Reference listed below.

List Attachments Provided:

1. Copy of Wildlife Habitat Council Certificate

E2-39, TE-6: Enclosure 2: Terrestrial Ecology, item J

Submit for docketing the text responses to site audit information needs TE-1, TE-2, TE-3, TE-4, TE-5, TE-6, TE-7, TE-8, and TE-9. These information needs can be found in NRC's Environmental Audit Needs List dated November 4, 2011 (ML11286A330).

Exelon Response

The text response to site audit information needs TE-6 is provided.

Please note that the document discussed in site audit information needs TE-6 is not provided here, but is provided within this package in response to another information request item, as follows:

- Exelon Generation. 2010c. Limerick Generating Station Wildlife Management Plan is provided in response to Enclosure 2, Terrestrial Ecology, Item G (Index Tab # E2-34).

Limerick Environmental Audit – Audit Needs Question

Question #: TE-6

Category: Terrestrial Ecology

Statement of Question:

Provide a copy of LGS's Wildlife Management Plan that is referenced on Page 2-39, Paragraph 3, of the ER.

Response:

The 2010 LGS Wildlife Management Plan is cited in the ER as:

- Exelon Generation. 2010c. Limerick Generating Station Wildlife Management Plan.

A copy of the requested reference is available for NRC personnel to review during the LGS License Renewal Environmental Audit. The Binder location for this document is Supplemental Report Volume #3, Binder # 6, Tab LGS-R-086.

List Attachments Provided:

See response.

E2-39, TE-7: Enclosure 2: Terrestrial Ecology, item J

Submit for docketing the text responses to site audit information needs TE-1, TE-2, TE-3, TE-4, TE-5, TE-6, TE-7, TE-8, and TE-9. These information needs can be found in NRC's Environmental Audit Needs List dated November 4, 2011 (ML11286A330).

Exelon Response

The text response to site audit information needs TE-7 is provided.

Please note that the documents discussed in site audit information needs TE-7 are not provided here, but are provided within this package in response to other information request items, as follows:

- WHC, 2006. WHC (Wildlife Habitat Council). 2006. Site Assessment and Wildlife Management Opportunities prepared for Exelon Corporation's Limerick Generating Station. 100 pp. Illustrated. August is provided in response to Enclosure 2, Terrestrial Ecology, Item H (Index Tab # E2-35).
- Exelon Generation, 2010c. Exelon Generation. 2010c. Limerick Generating Station Wildlife Management Plan is provided in response to Enclosure 2, Terrestrial Ecology, Item G (Index Tab # E2-34).

Limerick Environmental Audit – Audit Needs Question

Question #: TE-7

Category: Terrestrial Ecology

Statement of Question:

Provide the following ER references:

- WHC, 2006. WHC (Wildlife Habitat Council). 2006. Site Assessment and Wildlife Management Opportunities prepared for Exelon Corporation's Limerick Generating Station. 100 pp. Illustrated. August.
- Exelon Generation, 2010c. Exelon Generation. 2010c. Limerick Generating Station Wildlife Management Plan.

Response:

A copy of each requested reference is available for NRC personnel to review during the LGS License Renewal Environmental Audit. Binder locations for the documents are as follows:

Document	Supplemental Report Volume #	Binder #	Tab
Exelon Generation 2010c	3	6	LGS-R-086
WHC 2006	3	17	LGS-R-278

List Attachments Provided:

None

E2-39, TE-8: Enclosure 2: Terrestrial Ecology, item J

Submit for docketing the text responses to site audit information needs TE-1, TE-2, TE-3, TE-4, TE-5, TE-6, TE-7, TE-8, and TE-9. These information needs can be found in NRC's Environmental Audit Needs List dated November 4, 2011 (ML11286A330).

Exelon Response

The text response to site audit information needs TE-8 is provided.

Limerick Environmental Audit – Audit Needs Question

Question #: TE-8

Category: Terrestrial Ecology

Statement of Question:

The ER on page 2-37 states that no terrestrial monitoring was required as part of the annual, non-radiological environmental monitoring conducted from 1984 to 2004. However, the ER on page 2-43 cites the annual, non-radiological environmental monitoring reports as evidence that no State- or Federally listed threatened or endangered species had been observed on or in the vicinity of the LGS plant site. Please verify that State- or Federally listed threatened or endangered species would appear under Section 2.7, Non-Routine Reports, had any protected species been observed or harmed on the site.

Response:

LGS site records contain no indication that State- or Federally listed threatened or endangered species have been observed on the LGS plant site. Current site environmental personnel believe it is likely that if such an observation had occurred, it would have been reported under Section 2.7, Non-Routine Reports, in an Annual Non-Radiological Environmental Monitoring Report. Exelon Procedure EN-AA-103-0001, "Environmental Evaluations", provides guidance concerning environmental evaluations conducted to assess potential impact of plant configuration changes. Attachment 3, item #4, to this procedure describes review of the potential for effects on threatened or endangered species. A copy of EN-AA-103-0001 is being provided in response to NRC Audit Needs List item CR-7.

List Attachments Provided: None.

E2-39, TE-9: Enclosure 2: Terrestrial Ecology, item J

Submit for docketing the text responses to site audit information needs TE-1, TE-2, TE-3, TE-4, TE-5, TE-6, TE-7, TE-8, and TE-9. These information needs can be found in NRC's Environmental Audit Needs List dated November 4, 2011 (ML11286A330).

Exelon Response

The text response to site audit information needs TE-9 is provided.

Limerick Environmental Audit – Audit Needs Question

Question #: TE-9

Category: Terrestrial Ecology

Statement of Question:

Provide a copy of PECO's transmission line vegetative maintenance procedure(s).

Response:

The documents listed below are being provided.

List Attachments Provided:

1. VM-ED-P011, Rev. 3, "Transmission Vegetation Management Program"
2. VM-ED-P031, Rev. 0, "Vegetation Management Program Grounds Maintenance Procedures"
3. VM-ED-P041, Rev. 2, "Transmission Vegetation Management Preventative Maintenance Process"
4. VM-ED-P043, Rev. 0, "Transmission Vegetation Management Clearance Guidelines Procedure"
5. VM-ED-P044, Rev. 0, "Transmission Vegetation Management Mitigation"
6. VM-ED-P045, Rev. 3, "Transmission Vegetation Management Corrective Maintenance Process"
7. VM-ED-Y013, Rev. 0, "Vegetation Management Policy"