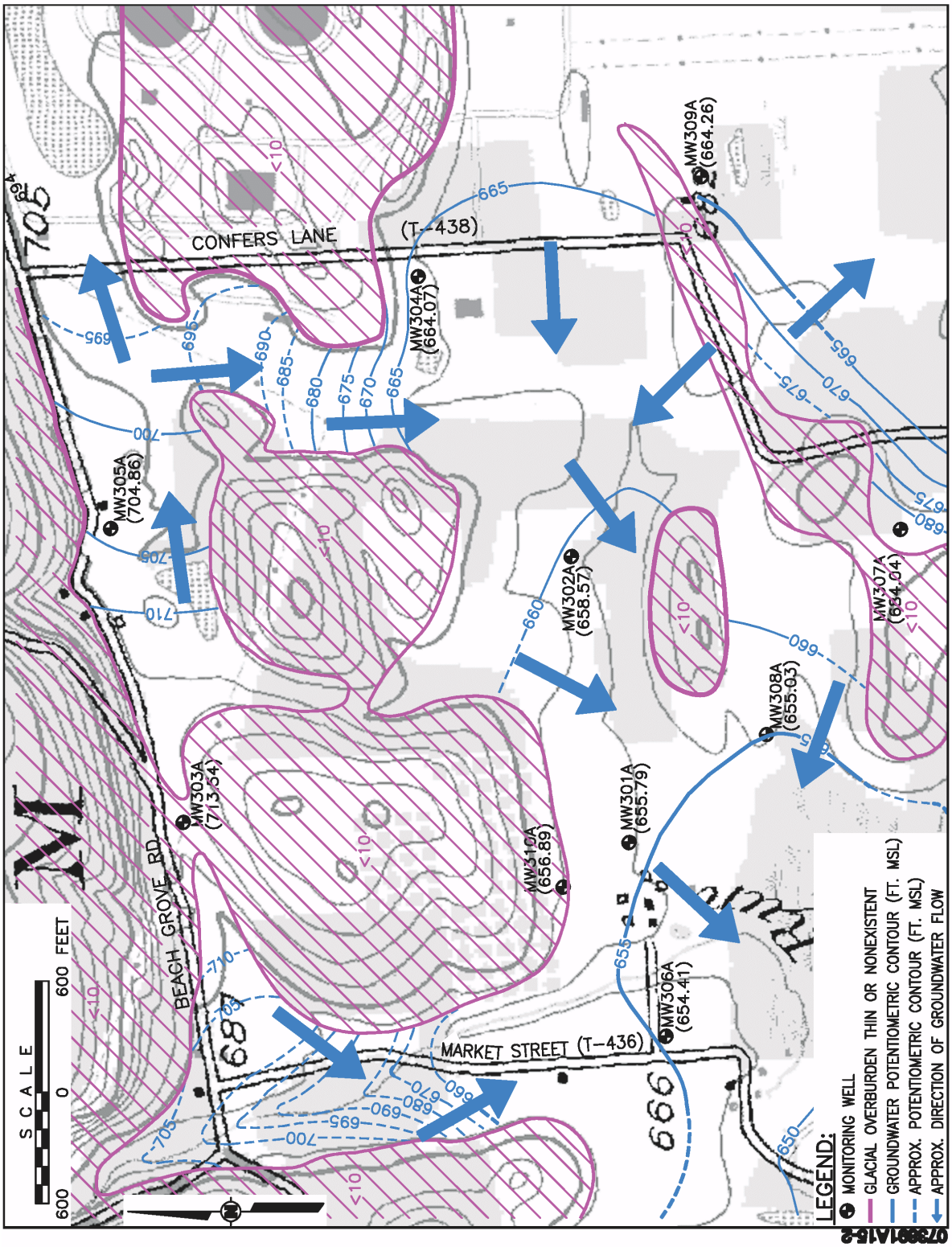


Figure 2.3-50 {Potentiometric Surface Map of Glacial Overburden Aquifer, July 2008}

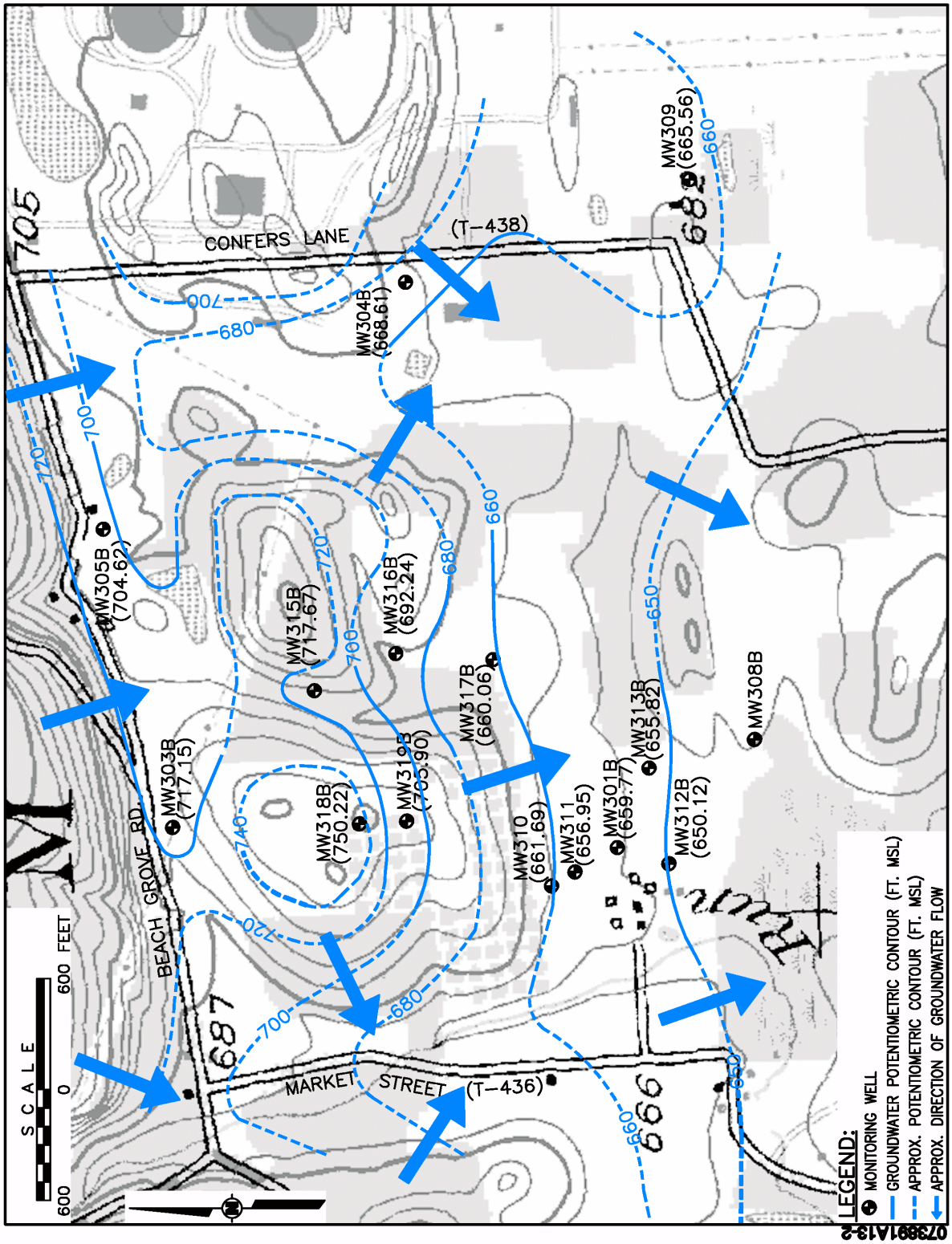
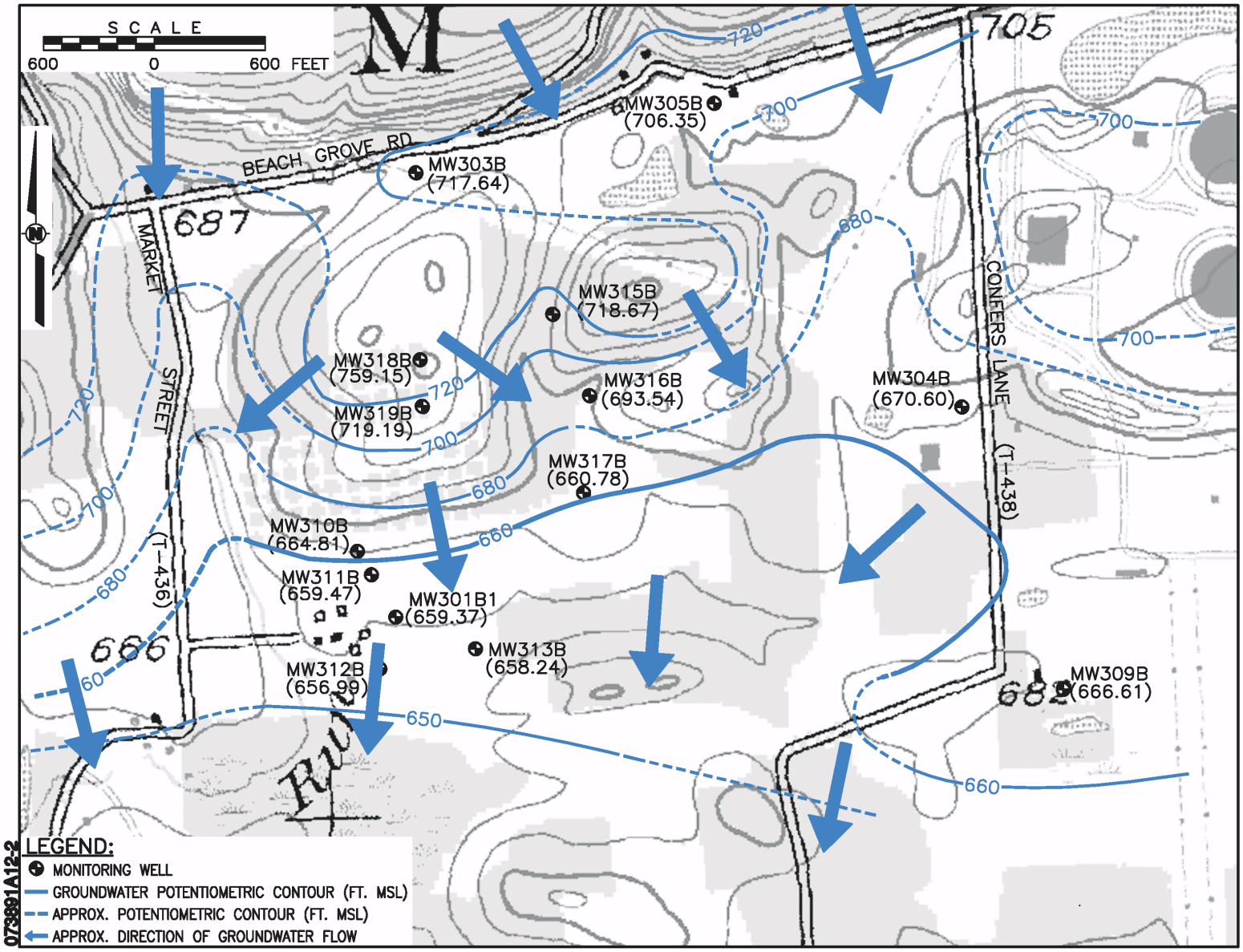


Figure 2.3-51 {Potentiometric Surface Map of Shallow Bedrock Aquifer, October 2007}

Figure 2.3-52 {Potentiometric Surface Map of Shallow Bedrock Aquifer, January 2008}



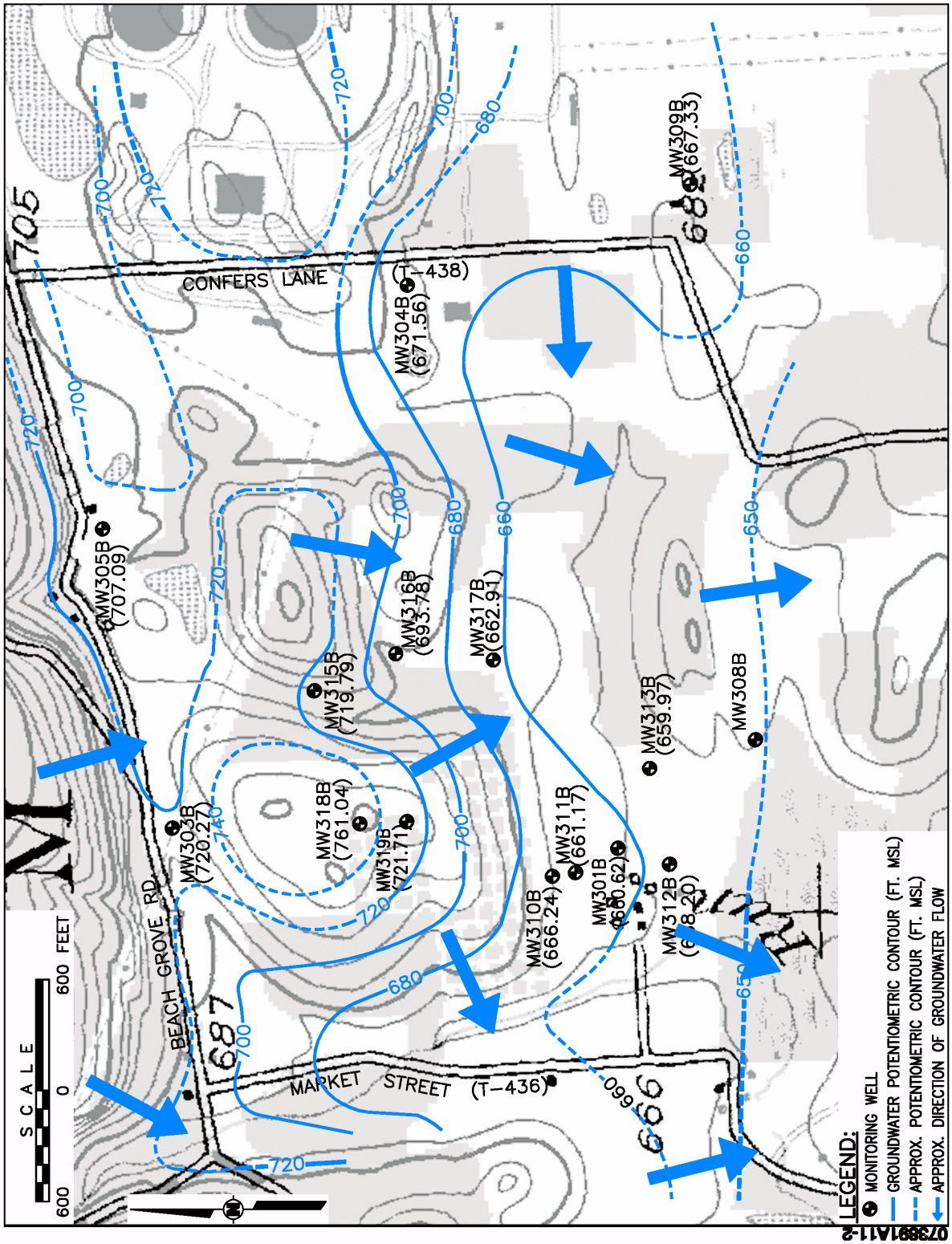


Figure 2.3-53 {Potentiometric Surface Map of Shallow Bedrock Aquifer, March 2008}

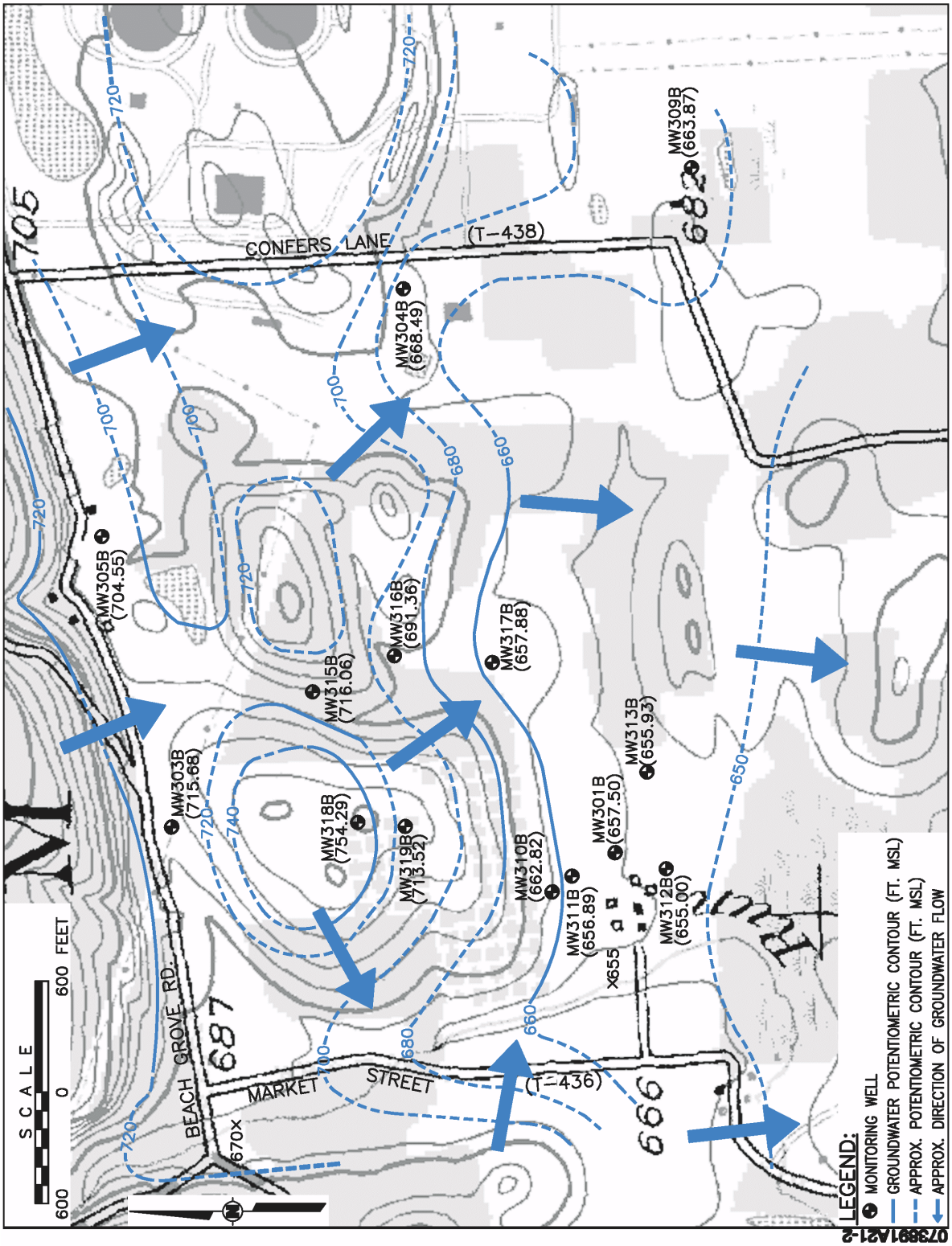


Figure 2.3-54 {Potentiometric Surface Map of Shallow Bedrock Aquifer, July 2008}

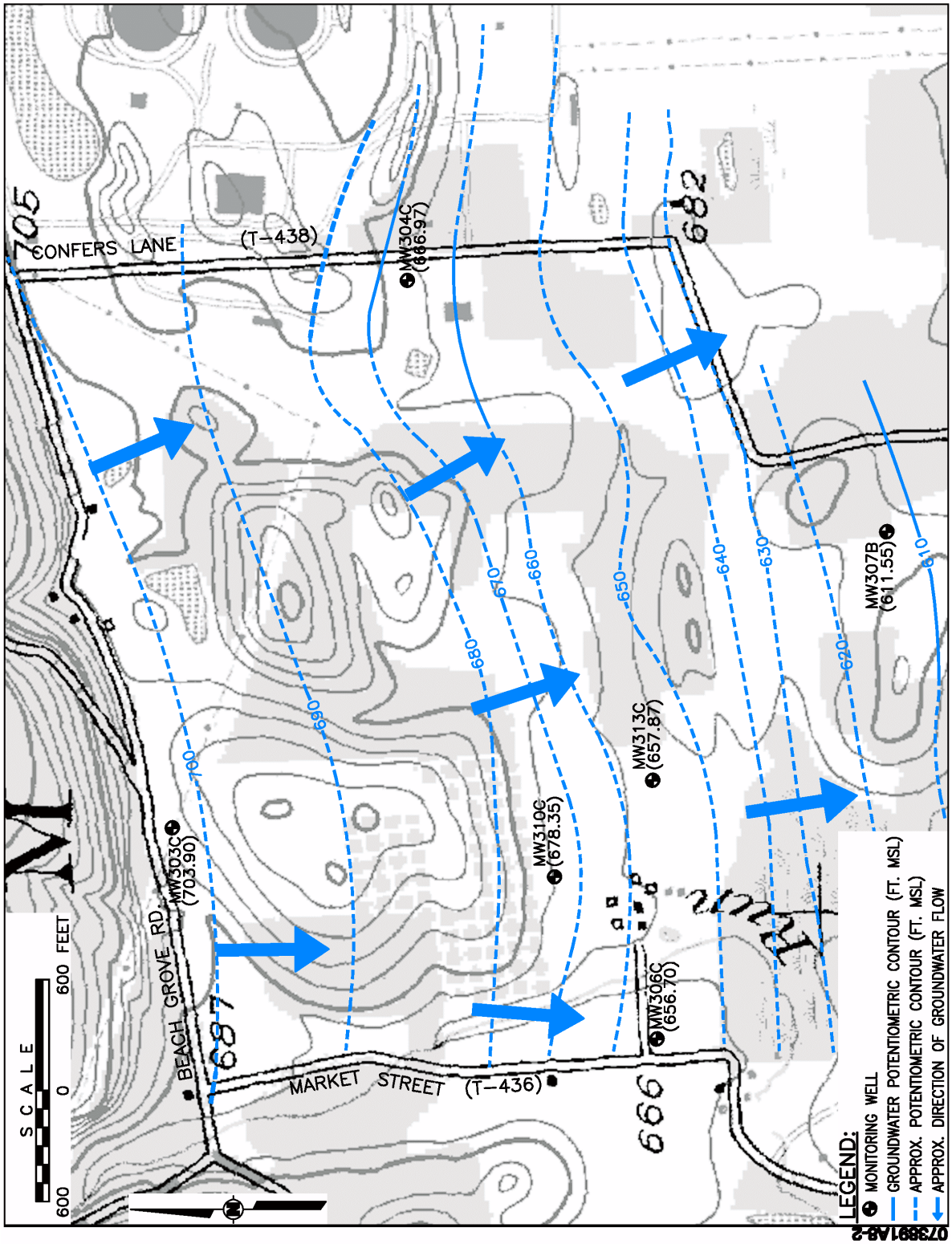


Figure 2.3-55 {Potentiometric Surface Map of Deep Bedrock Aquifer, October 2007}}

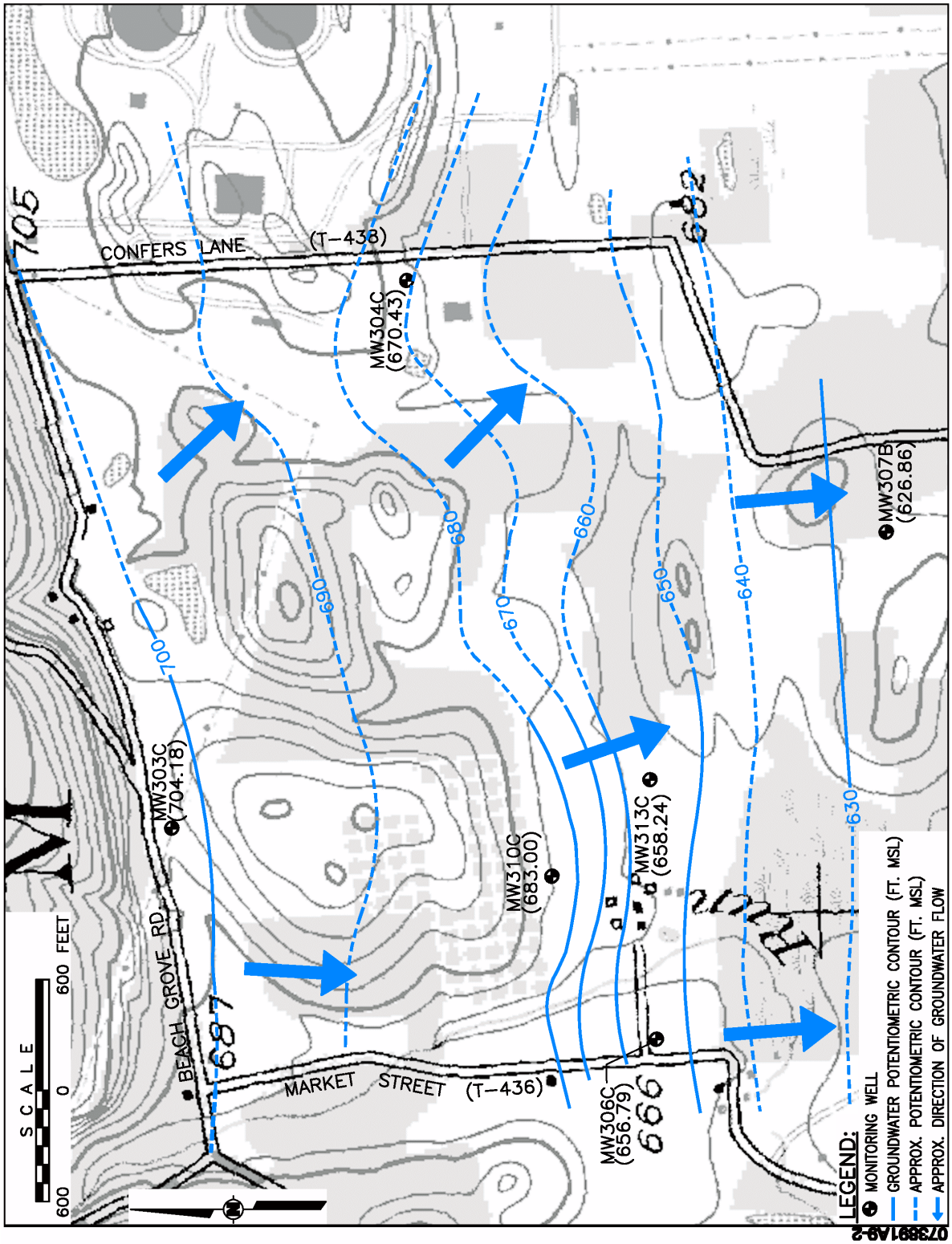


Figure 2.3-56 {Potentiometric Surface Map of Deep Bedrock Aquifer, January 2008}}

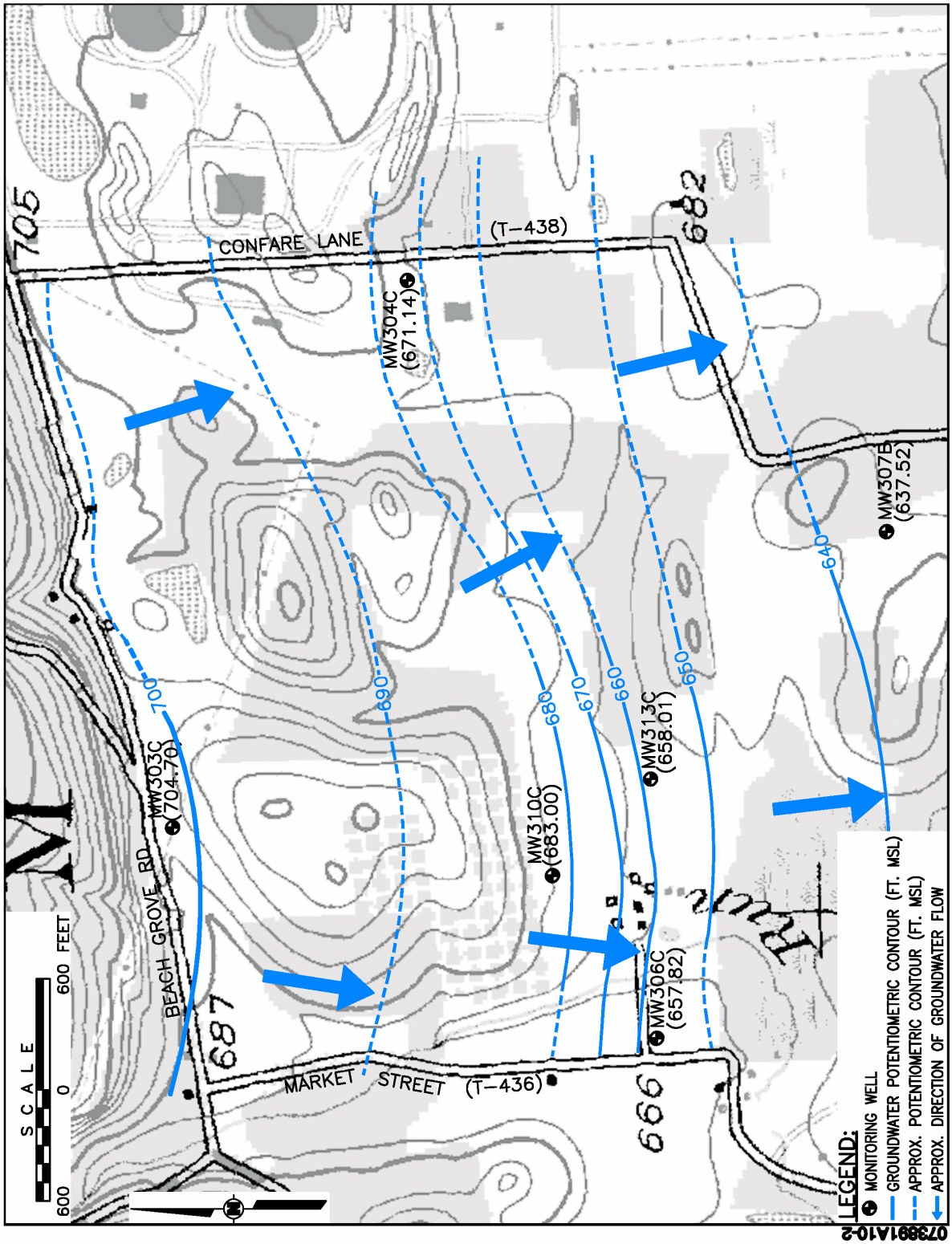


Figure 2.3-57 {Potentiometric Surface Map of Deep Bedrock Aquifer, March 2008}

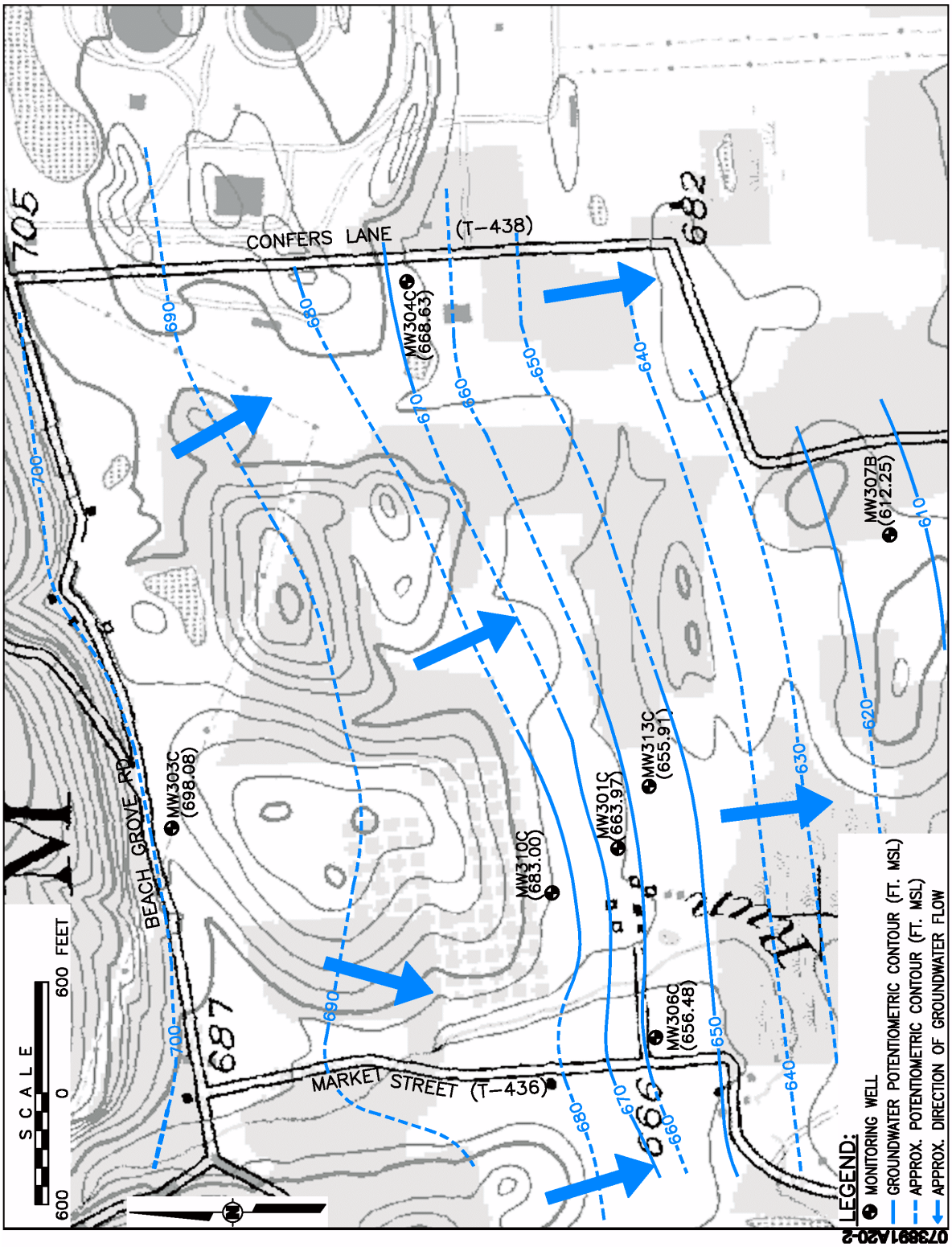
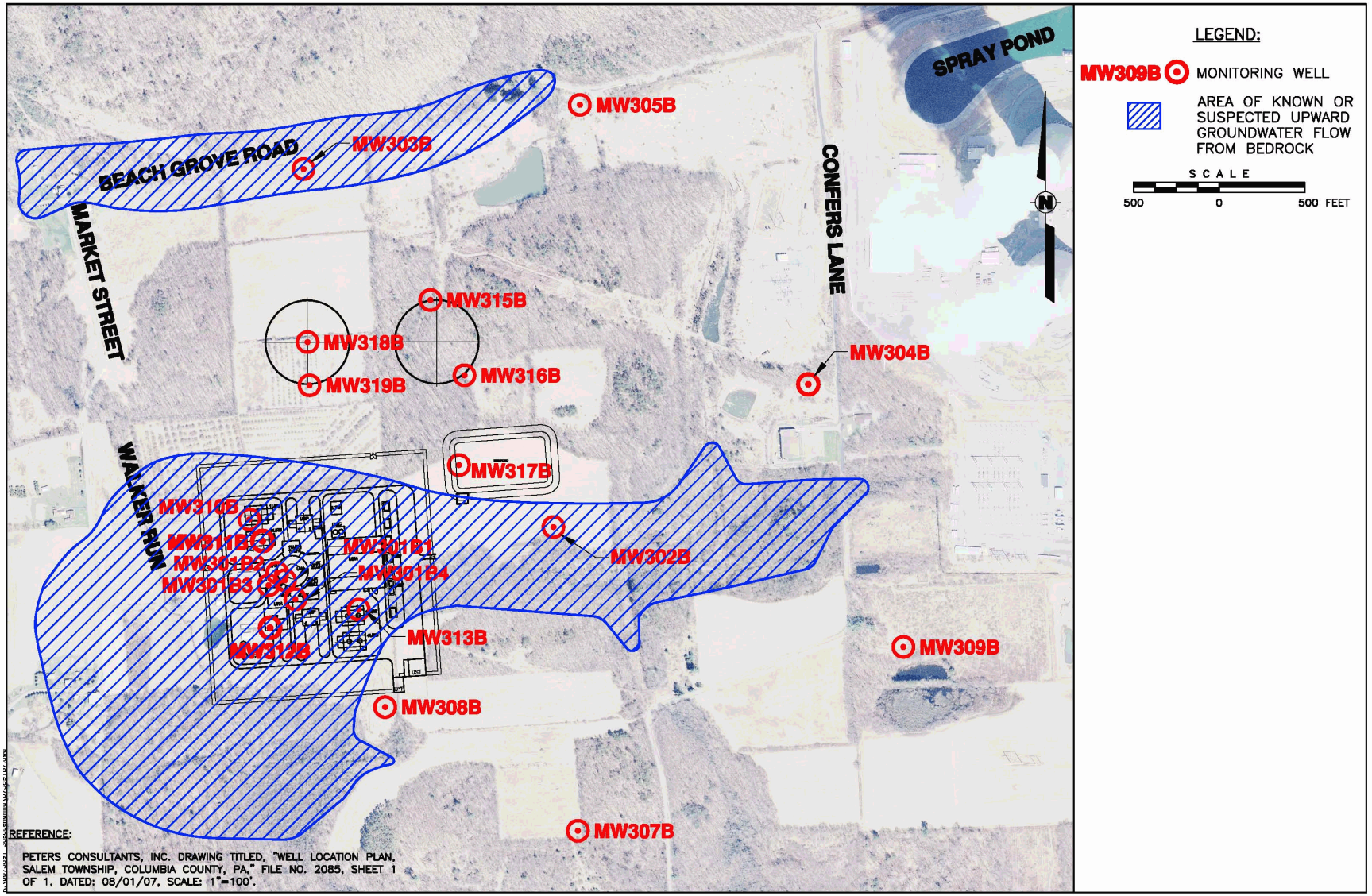


Figure 2.3-58 {Potentiometric Surface Map of Deep Bedrock Aquifer, July 2008}

Figure 2.3-59 {Areas Known or Suspected of Having Upward-Flowing Groundwater from Bedrock}



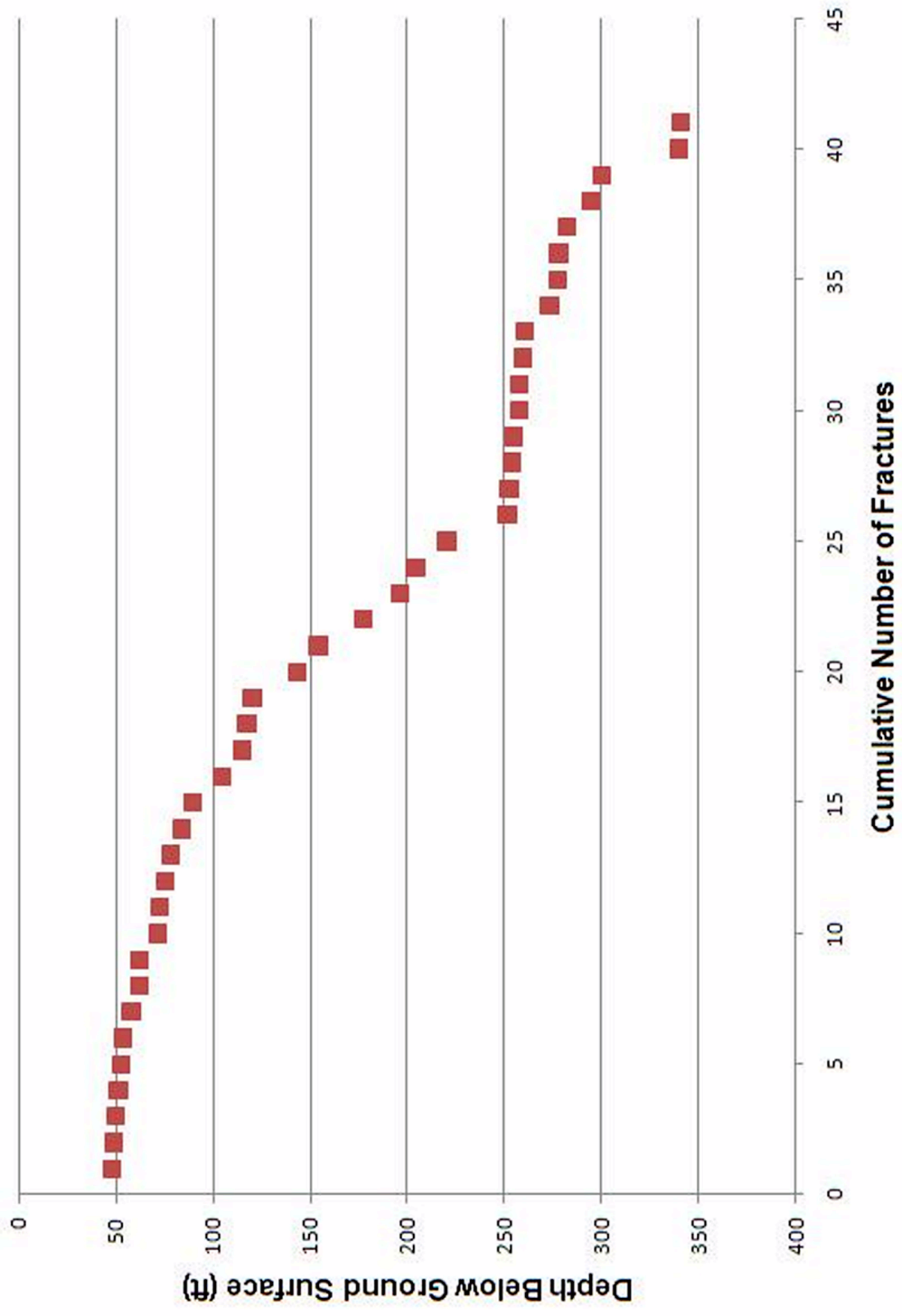


Figure 2.3-60 {Vertical Distribution of Fractures in MW301C Between 45 and 345 Feet Below Ground Surface}

Figure 2.3-61 {Distribution of Fracture Dip Directions in Monitoring Well MW301C}

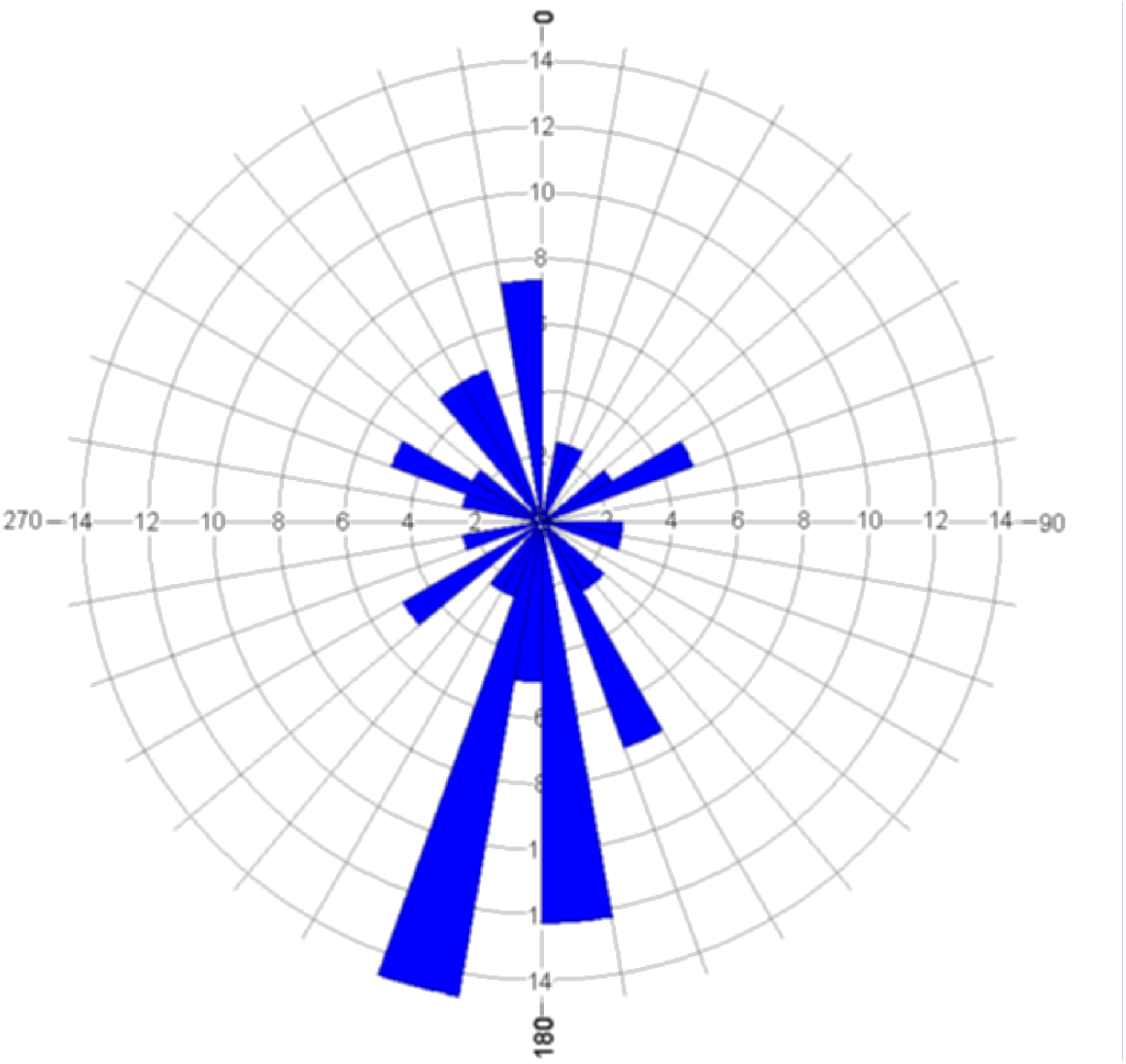
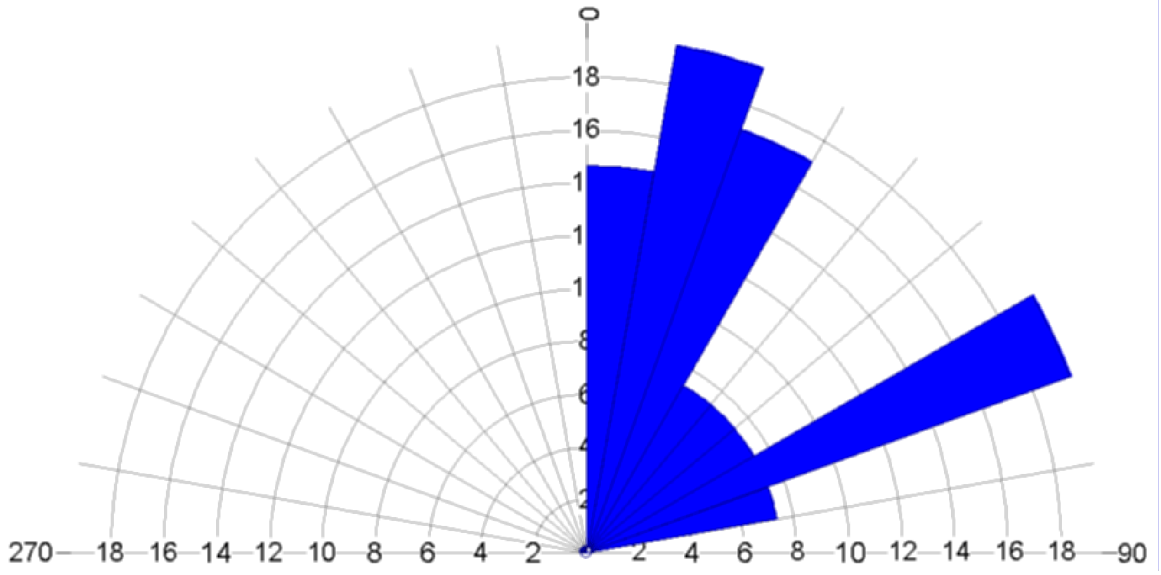


Figure 2.3-62 {Distribution of Fracture Dip Angles in Monitoring Well MW301C}



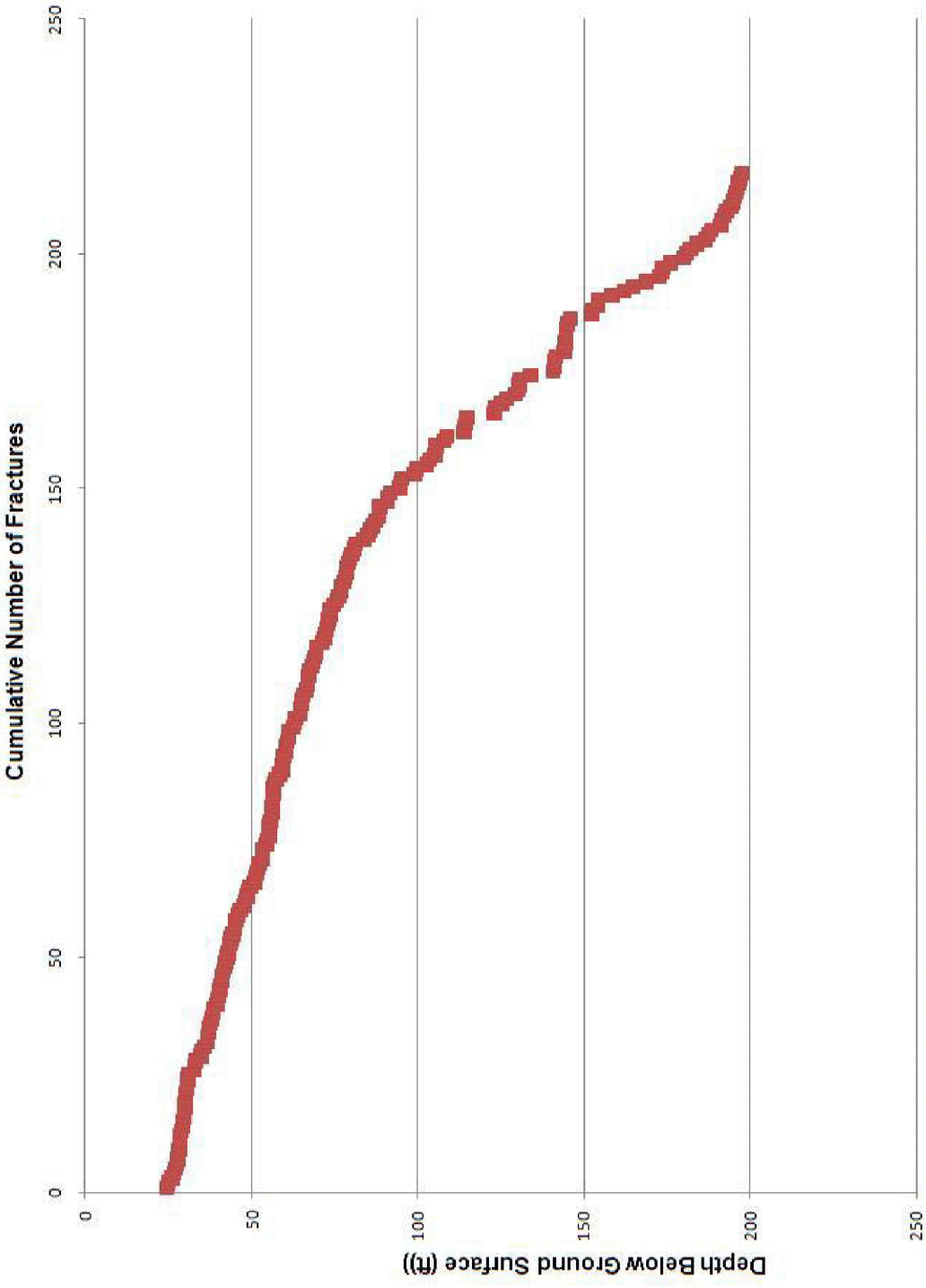


Figure 2.3-63 {Vertical Distribution of Fractures in MW310C Between 24 and 200 Feet Below Ground Surface}

Figure 2.3-64 {Distribution of Fracture Dip Directions in Monitoring Well MW310C}

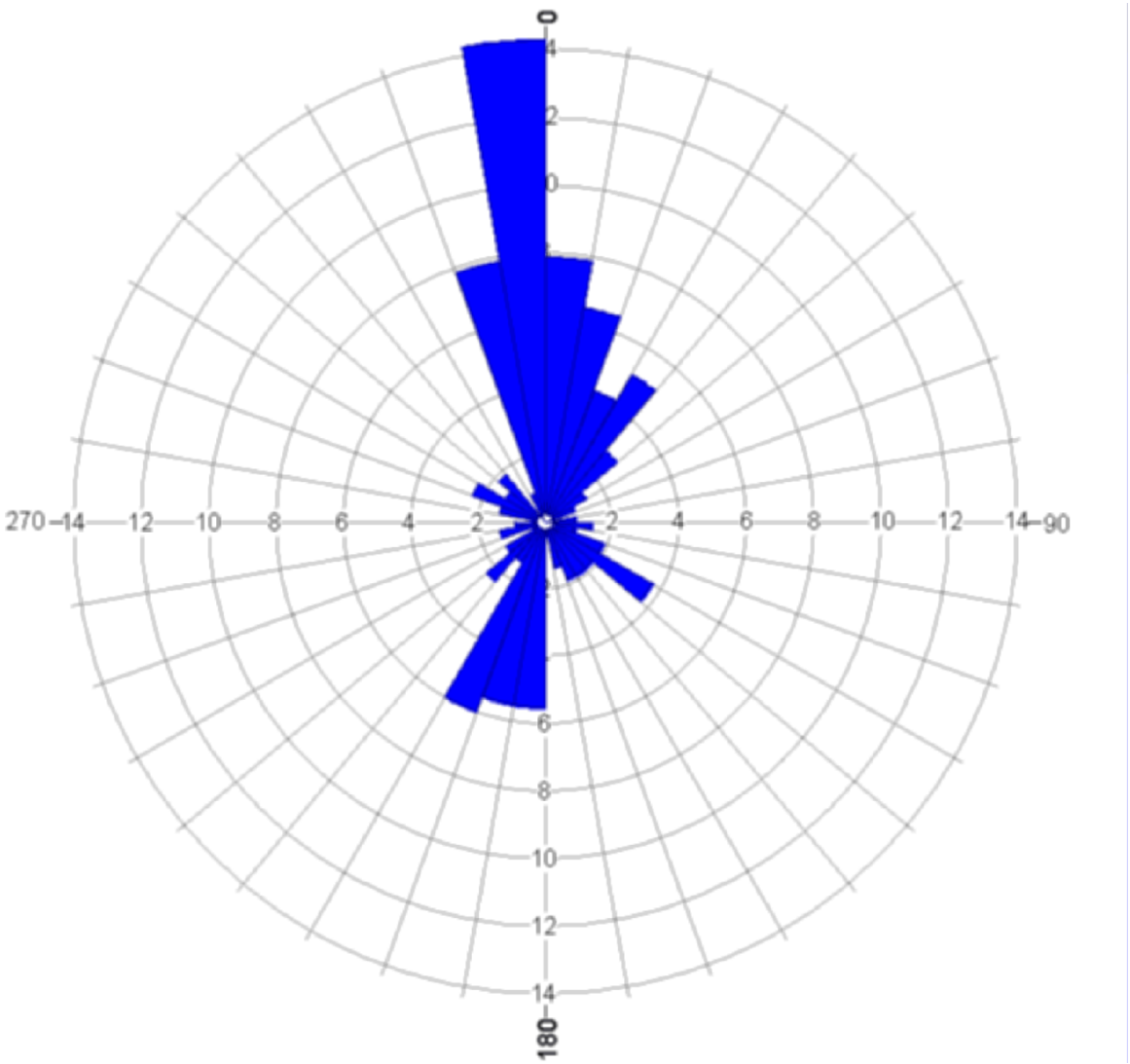


Figure 2.3-65 {Distribution of Fracture Dip Angles in Monitoring Well MW310C}

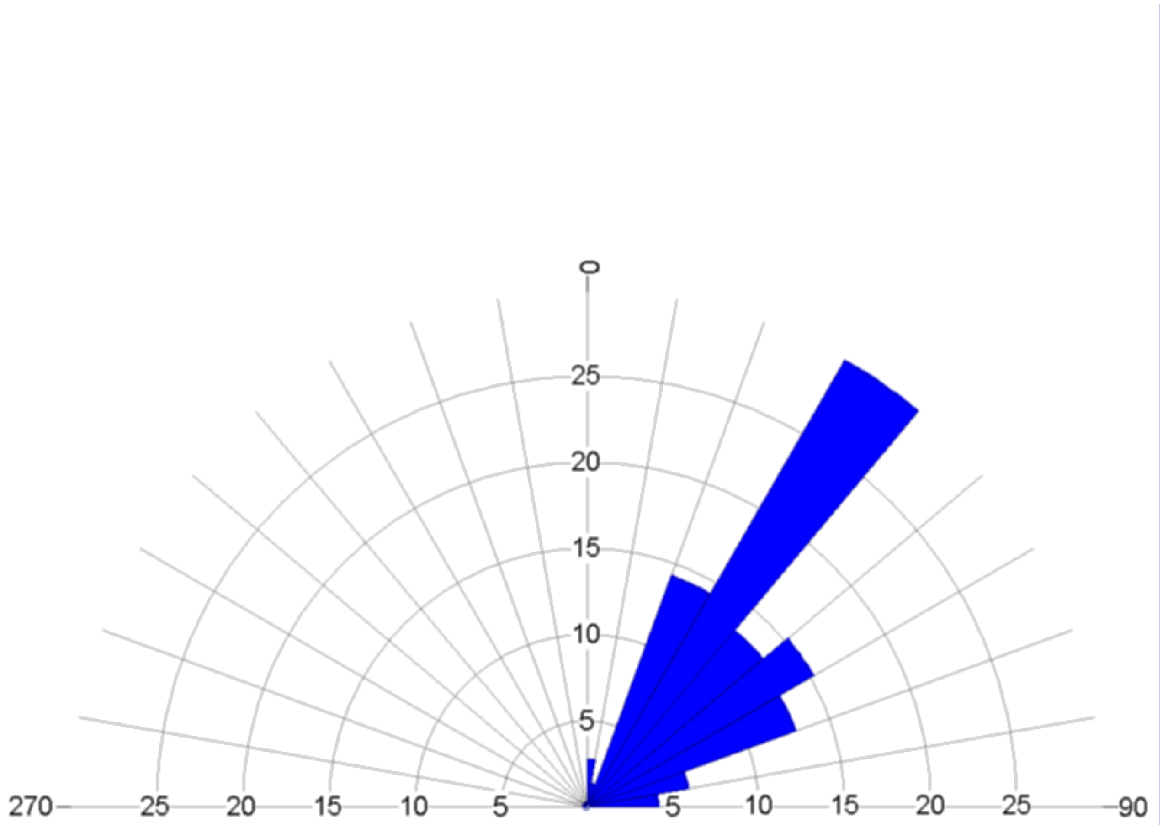
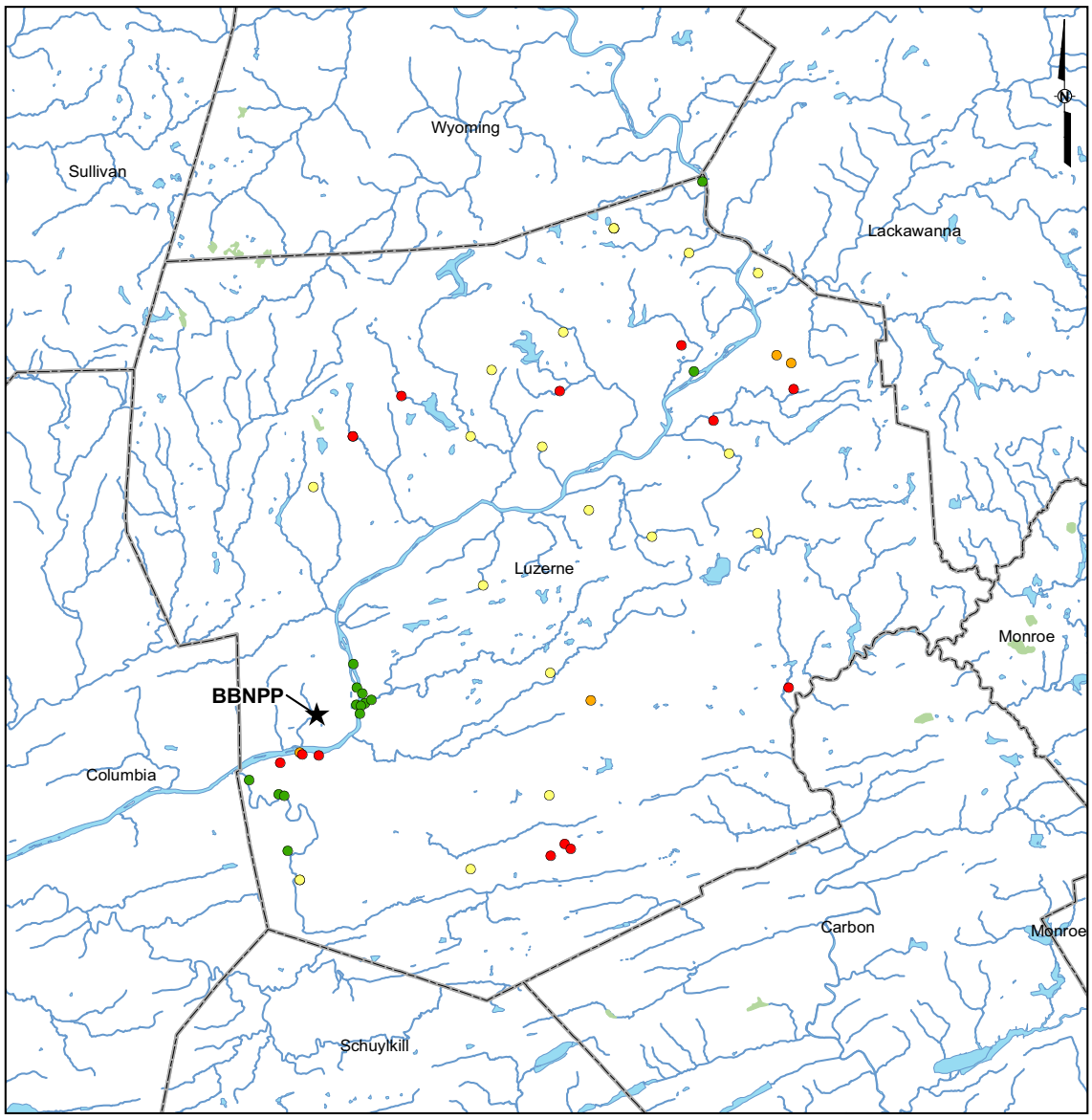


Figure 2.3-66 {Surface Water Withdrawal Within Luzerne County}



LEGEND

★ Center Point of Bell Bend NPP (BBNPP)

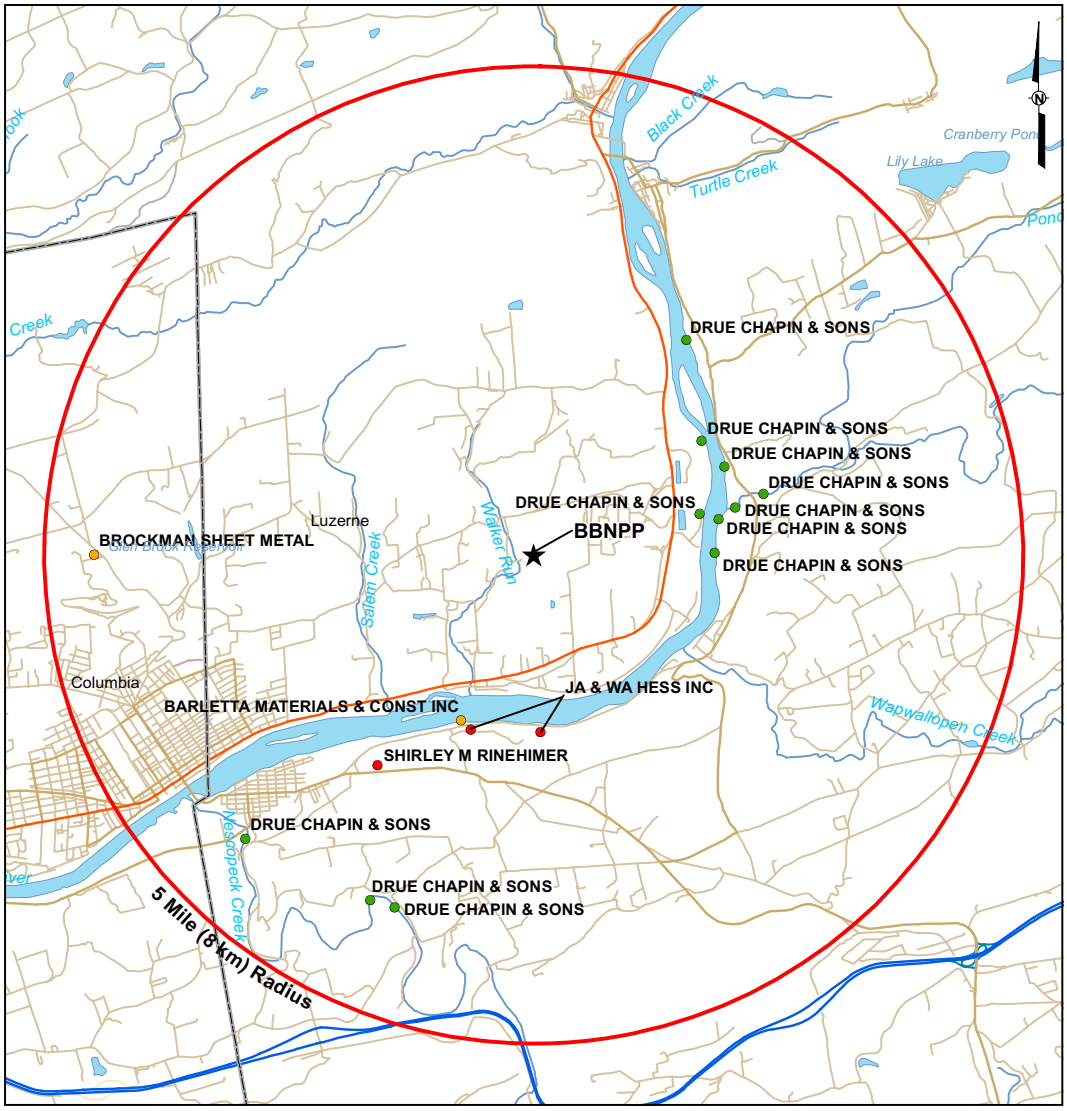
Surface Water Withdrawal (PADEP, 2008)
- Agricultural Use
- Commercial Use
- Industrial Use
- Mineral Use

County Boundary
Streams and Rivers
Waterbody

0 2 4 8 Miles
0 2 4 8 Kilometers

REFERENCES
• ESRI StreetMap Pro [CD-ROM], 2007,rivers, waterbodies, and county boundaries.
• Water Resources from PASDA, published by PADEP. http://www.pasda.psu.edu/data/dep/ Downloaded May 08, 2008.

Figure 2.3-67 {Surface Water Withdrawal Within 5 Mile (8 km) Radius}



LEGEND

- ★ Center Point of Bell Bend NPP (BBNPP)

Surface Water Withdrawal (PADEP, 2008)

- Agricultural Use
- Industrial Use
- Commercial Use
- Mineral Use

- BBNPP Reactor 5 Mile (8 km) Radius
- County Boundary
- Interstate
- Secondary State and County Highway
- Local, Neighborhood, Rural, or City Street
- Streams and Rivers
- Waterbody

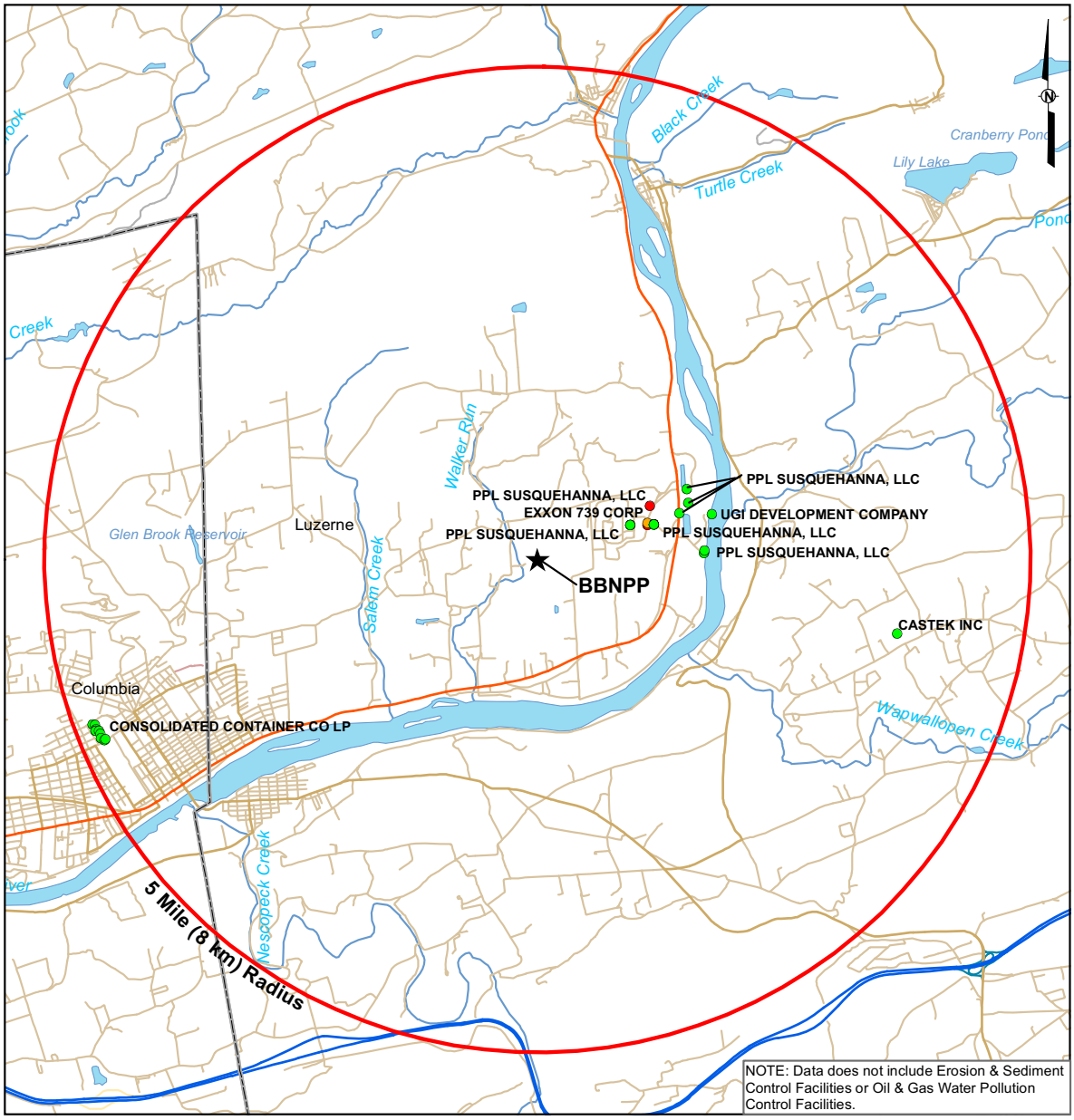
0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

REFERENCES

• ESRI StreetMap Pro [CD-ROM], 2007,rivers, waterbodies, and county boundaries.
• Water Resources from PASDA, published by PADEP. http://www.pasda.psu.edu/data/dep/ Downloaded May 08, 2008.

Figure 2.3-68 {Water Pollution Control Facility Locations Within a 5 Mile (8 km) Radius}



LEGEND

- ★ Center Point of Bell Bend NPP (BBNPP)

Water Pollution Facility (PADEP, 2008) - NPDES

- Discharge Point
- Treatment Plant
- Production Service Unit
- BBNPP Reactor 5 Mile (8 km) Radius
- County Boundary
- Interstate
- Secondary State and County Highway
- Local, Neighborhood, Rural, or City Street
- Streams and Rivers
- Waterbody

0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

REFERENCE

- ESRI StreetMap Pro [CD-ROM], 2007,rivers, waterbodies, roads, and county boundaries.
- Water Pollution Facility (NPDES) from PASDA, published by PADEP. http://www.pasda.psu.edu/data/dep/ Downloaded May 08, 2008.

Figure 2.3-69 {Water Pollution Control Facility Locations Within Luzerne County}

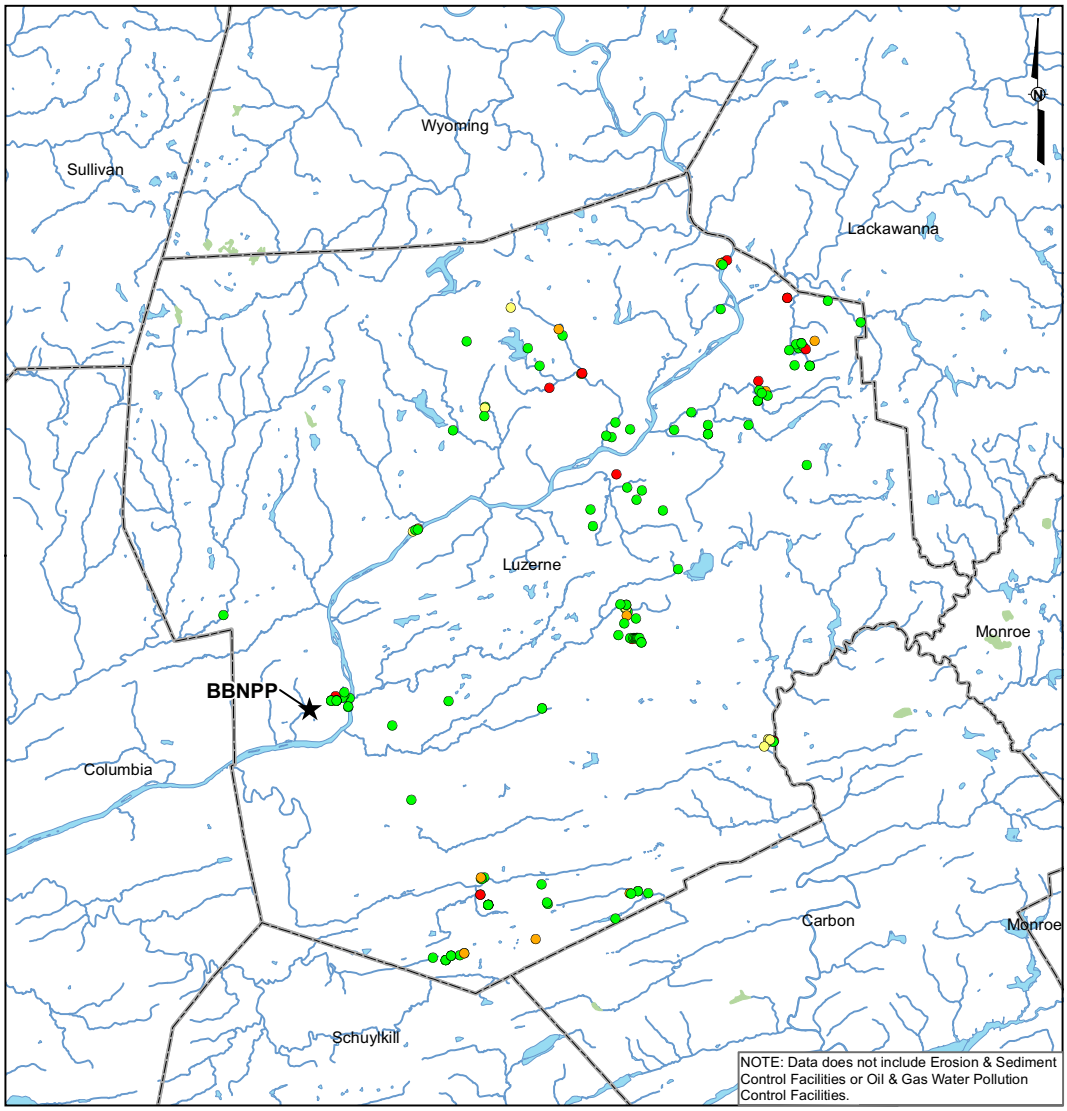
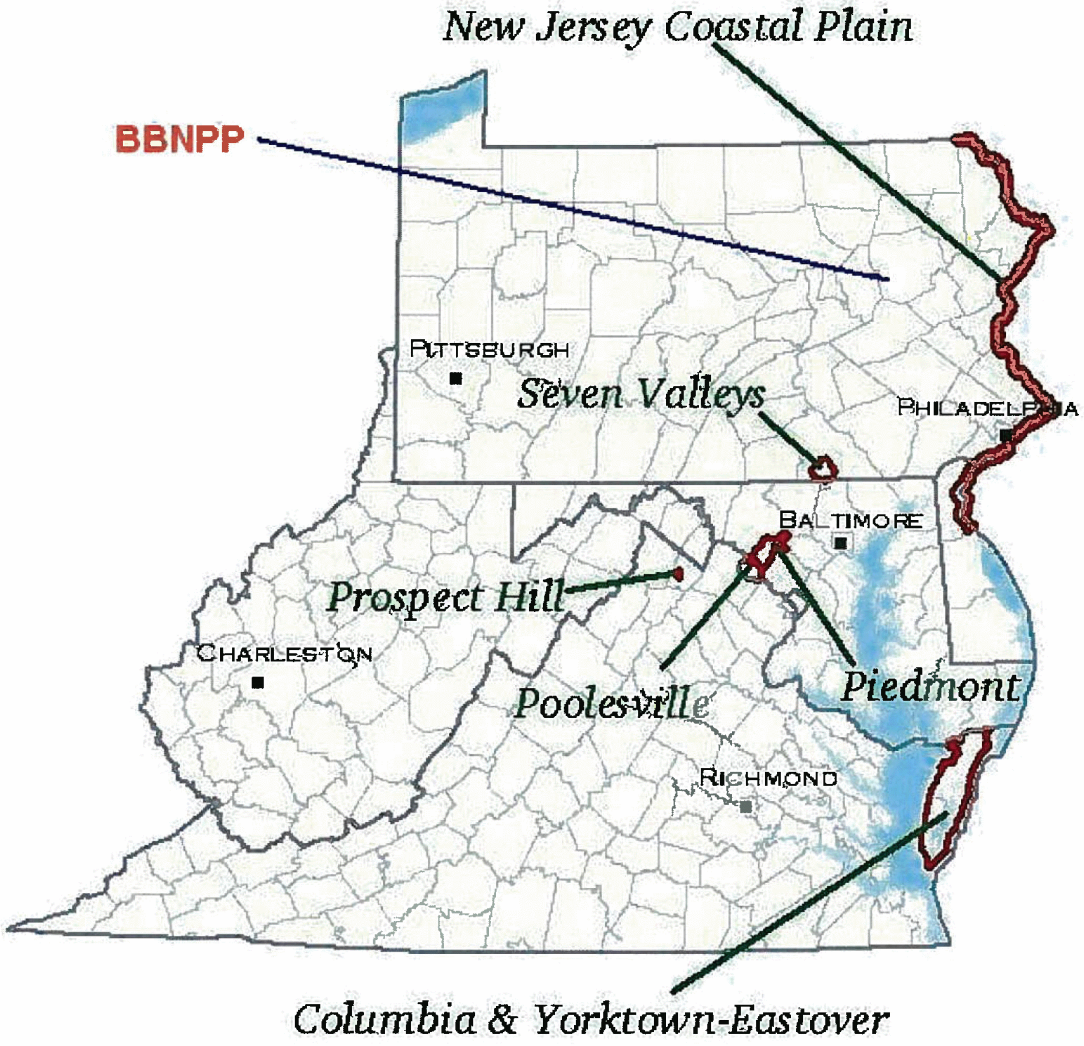
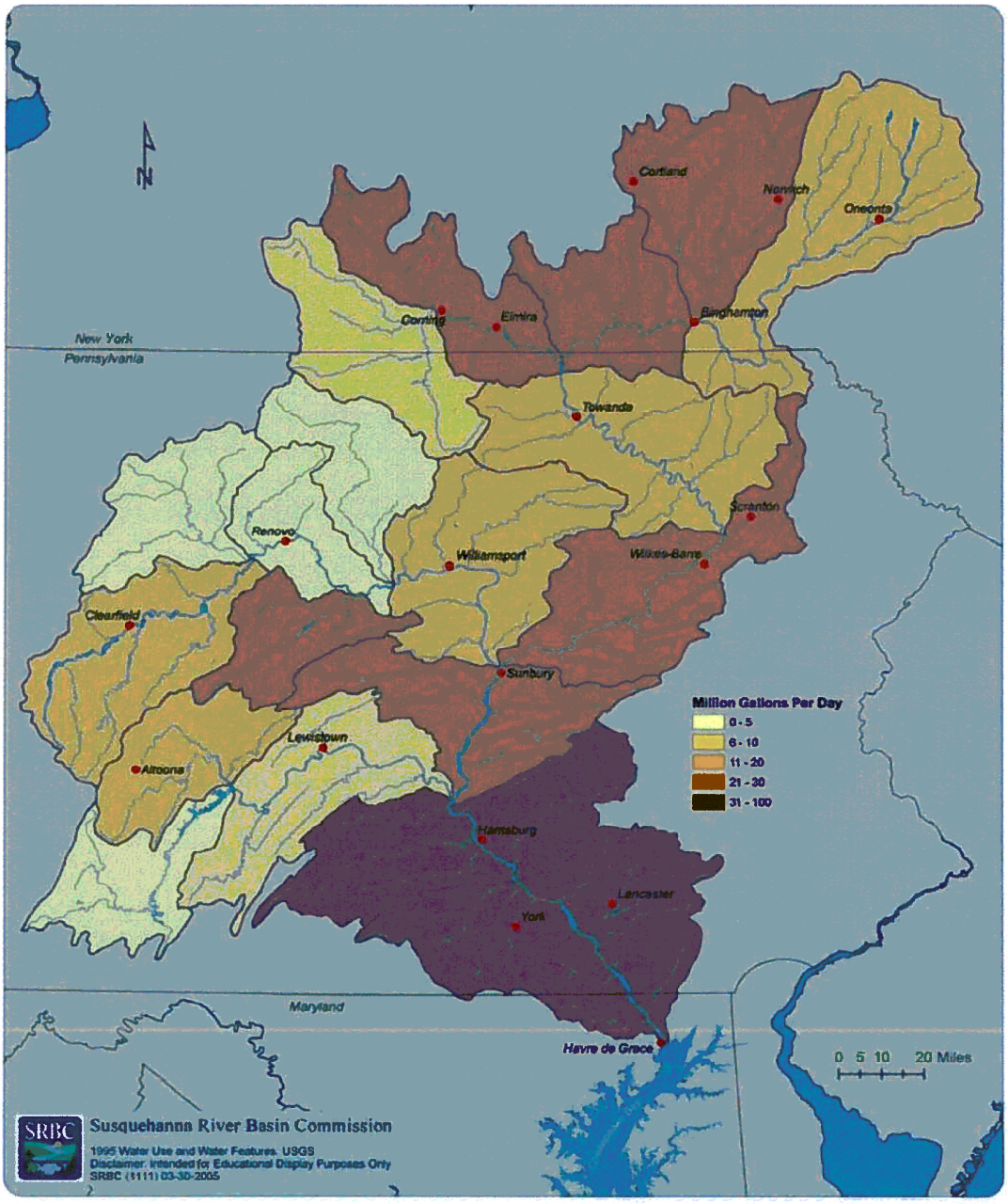


Figure 2.3-70 {Sole Source Aquifers Located in USEPA Region 3}



Reference: USEPA, 2008d

Figure 2.3-71 {Groundwater Use in the Susquehanna River Basin in 1995}



Reference: SRBC, 2005

Figure 2.3-72 {Groundwater Well Locations Within a 25-Mile (40-km) Radius}

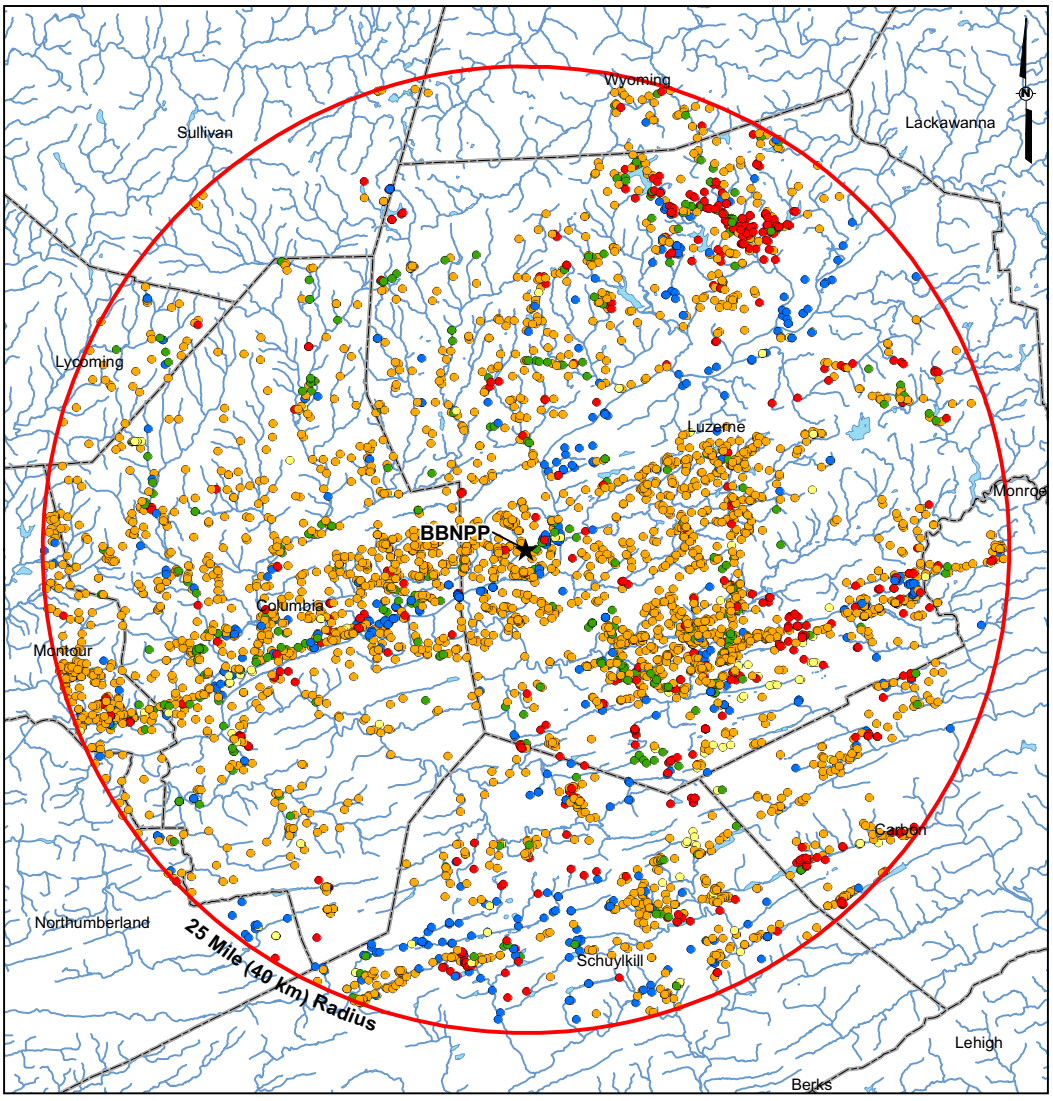
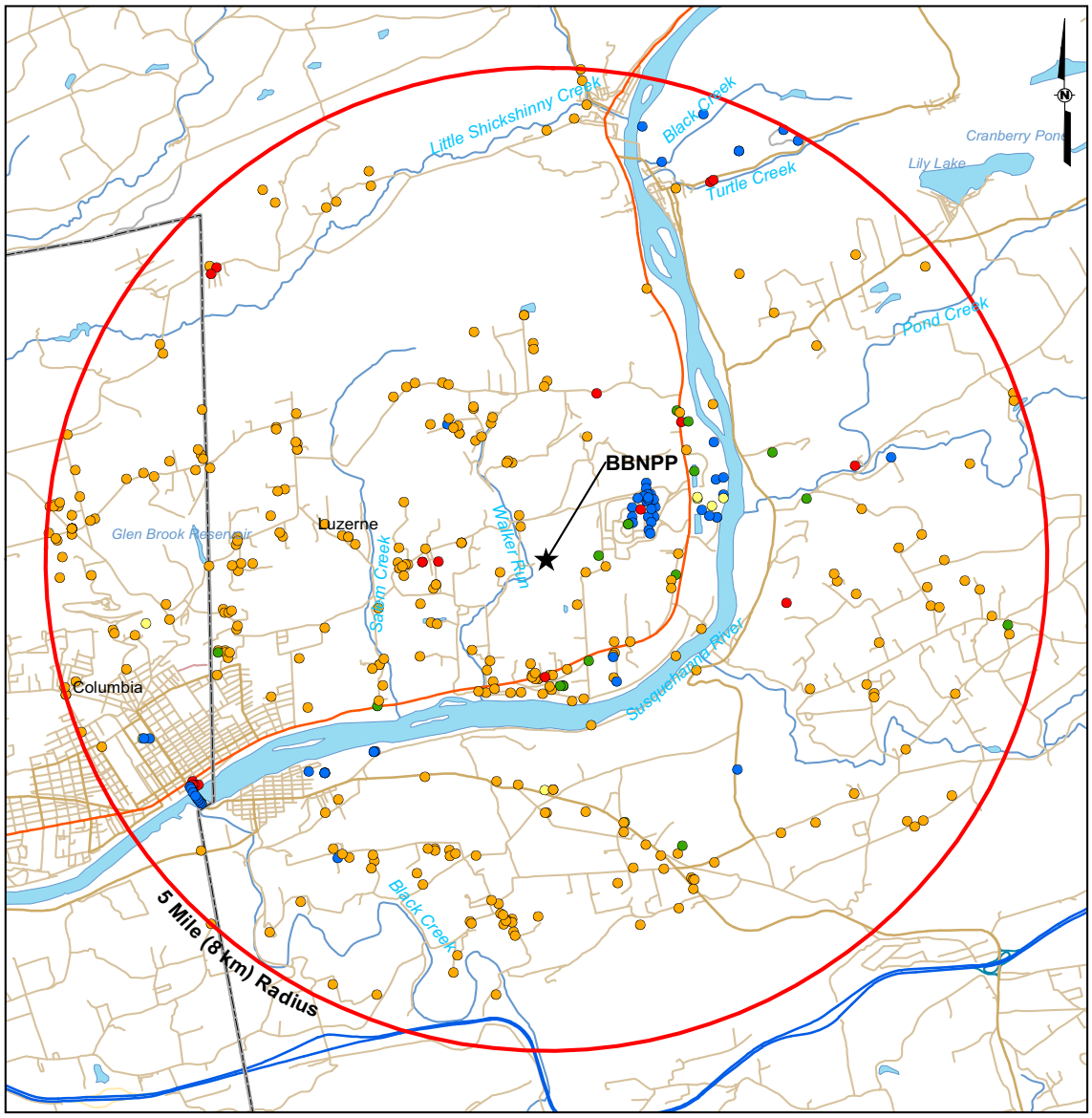


Figure 2.3-73 {Groundwater Well Locations within a 5-Mile (8-km) Radius}



LEGEND

★ Center Point of Proposed Bell Bend NPP (BBNPP)

Groundwater Well Location (PaGWIS, 2008)
- Public Supply Use
- Commercial Use
- Industrial Use
- Other Use
- Domestic Use

NPP Reactor 5 Mile (8 km) Radius
County Boundary
Interstate
Secondary State and County Highway
Local, Neighborhood, Rural, or City Street
Streams and Rivers
Waterbody

0 0.5 1 2 Miles
0 0.5 1 2 Kilometers

REFERENCE
- ESRI StreetMap Pro [CD-ROM], 2007,rivers, waterbodies, and county boundaries.
- PA Topographic & Geologic Survey, Pa Groundwater Information System (PaGWIS). http://www.dcnr.state.pa.us/topogeo/groundwater/ Database Accesses February 2008.

Figure 2.3-74 {Groundwater Withdrawal within a 25-Mile (40-km) Radius}

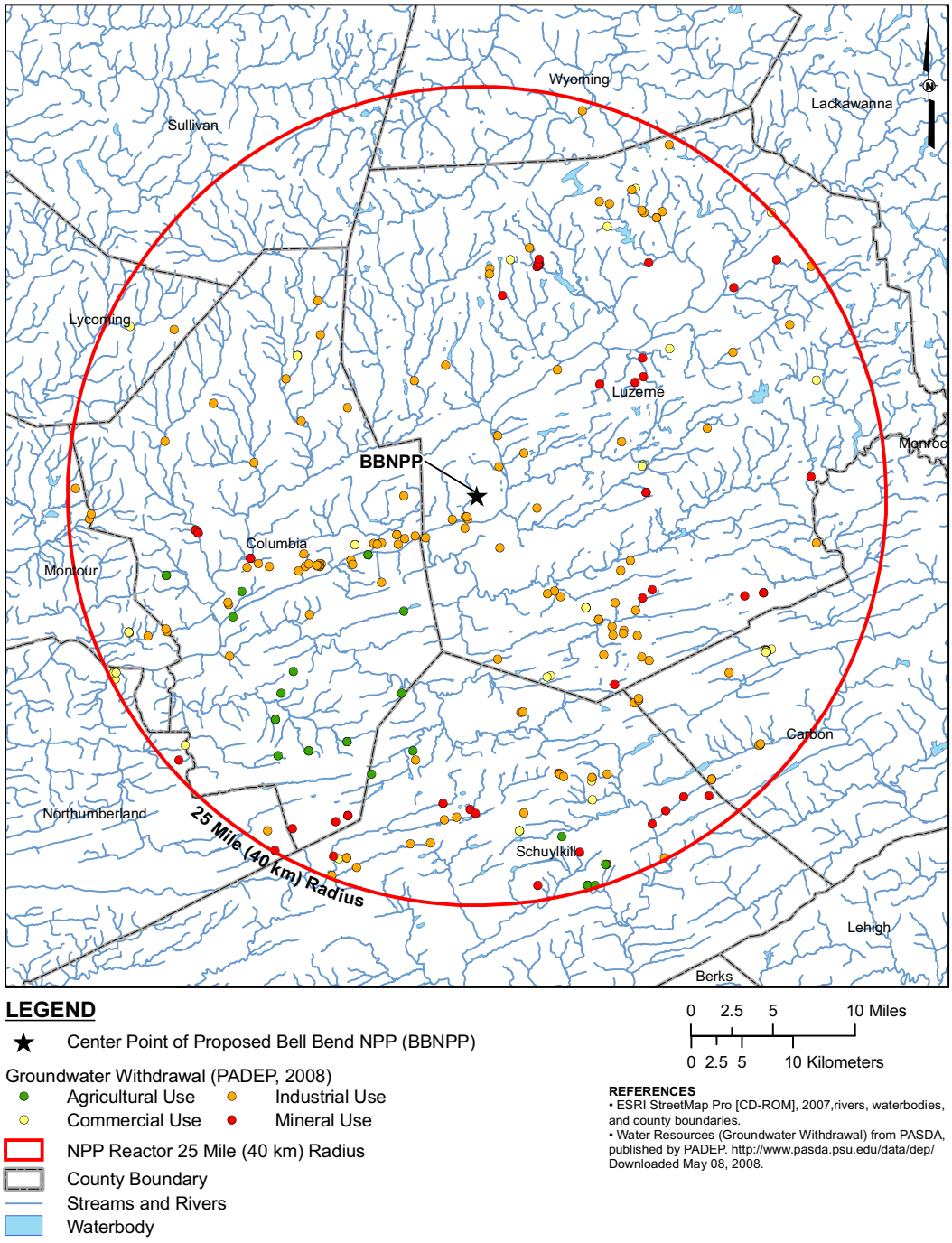
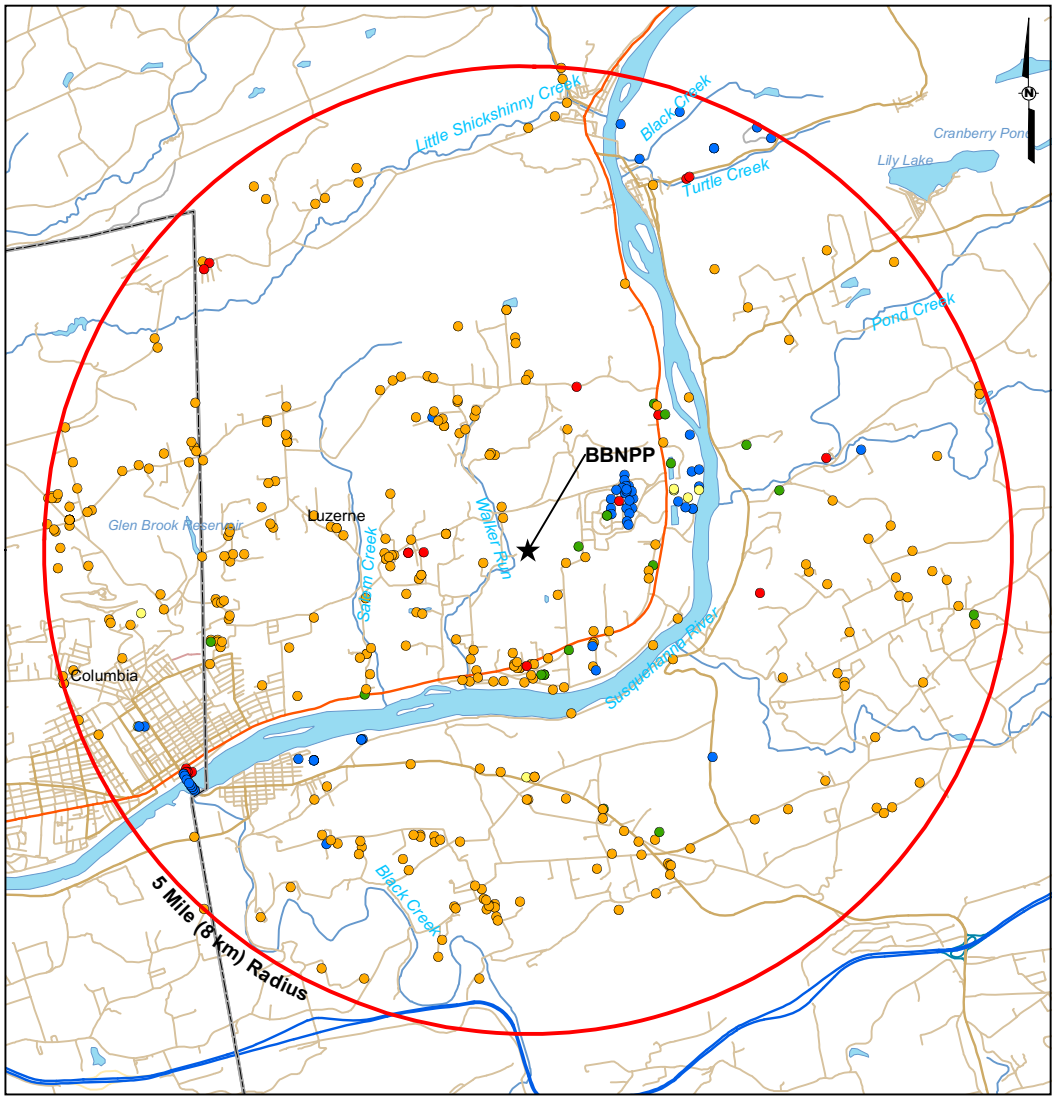


Figure 2.3-75 {Groundwater Withdrawal within a 5-Mile (8-km) Radius}



LEGEND

★ Center Point of Proposed Bell Bend NPP (BBNPP)

Groundwater Well Location (PaGWIS, 2008)
- Public Supply Use
- Commercial Use
- Industrial Use
- Other Use
- Domestic Use

NPP Reactor 5 Mile (8 km) Radius
County Boundary
Interstate
Secondary State and County Highway
Local, Neighborhood, Rural, or City Street
Streams and Rivers
Waterbody

0 0.5 1 2 Miles
0 0.5 1 2 Kilometers

REFERENCE
- ESRI StreetMap Pro [CD-ROM], 2007,rivers, waterbodies, and county boundaries.
- PA Topographic & Geologic Survey, Pa Groundwater Information System (PaGWIS). http://www.dcnr.state.pa.us/topogeo/groundwater/ Database Accesses February 2008.

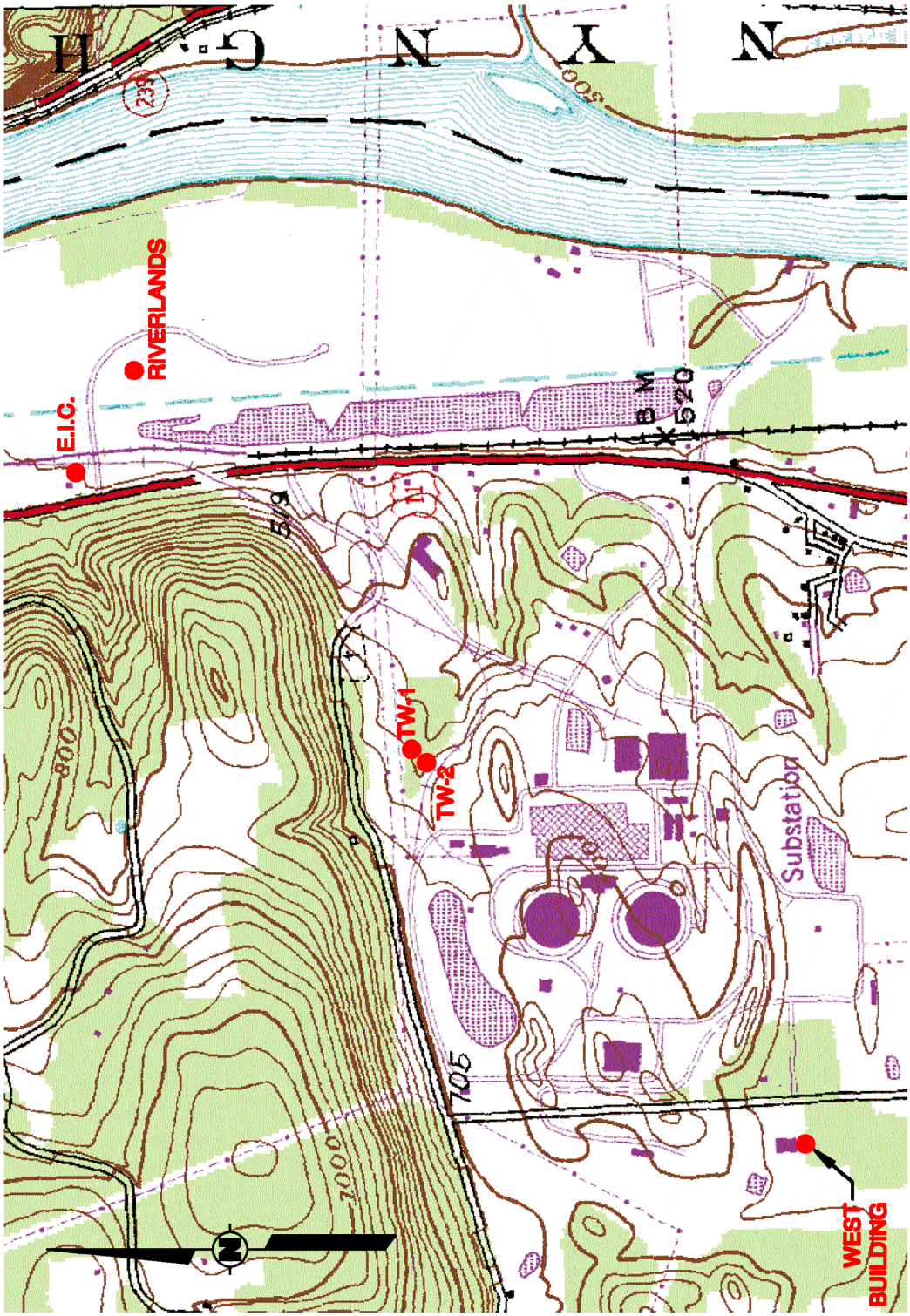
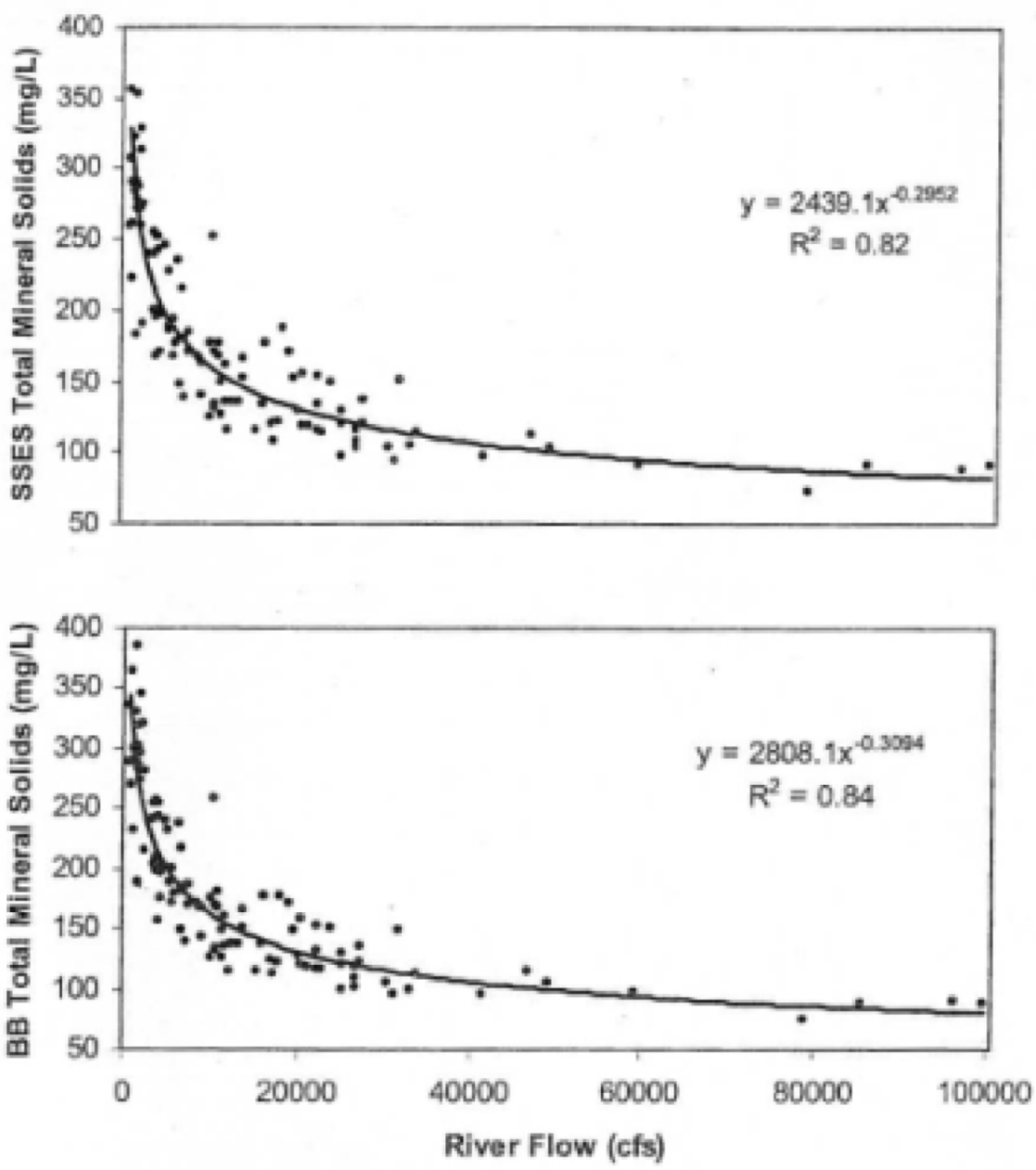


Figure 2.3-76 {Groundwater Production Wells at SSES}

Figure 2.3-77 {Potentially Stressed Areas and Water Challenged Areas in the Susquehanna River Basin}

Reference: SRBC, 2005

Figure 2.3-78 {Relationship Between Total Mineral Solids and Flow Rates in the Susquehanna River}



Reference: Ecology III, 2007

2.4 ECOLOGY

2.4.1 TERRESTRIAL ECOLOGY

{Field studies to characterize the terrestrial ecology of the BBNPP Owner Controlled Area (OCA) were initiated in July 2007 and continued through September 2008. The field studies included a flora survey (Summer 2008), a faunal survey (October 2007 through September 2008), and wetlands delineation and mapping efforts (July 2007 through August 2008). The subsections below summarize relevant information from each of these studies and provide other data on existing terrestrial ecology in accordance with the guidance in NUREG-1555 (NRC, 1999a).

A topographic map of the site is provided as Figure 2.4-1.

2.4.1.1 Terrestrial Habitats

The flora survey covers each plant community type (terrestrial habitat type) observed on the BBNPP OCA in 2007 and 2008. A map of the plant community types is presented in Figure 2.4-2, and each plant community type is briefly discussed below.

Old Field/Former Agricultural

Old-field vegetation cover was composed of a largely upland-preferring assemblage of grasses and herbaceous plants, and, during 2007, extended over much of the fallow farmland in the western section of the OCA. During 2008, some of this habitat was returned to agricultural use for the production of corn. Dominant species included daisy fleabane (*Erigeron annuus*), Canada thistle (*Cirsium arvense*), wrinkled goldenrod (*Solidago rugosa*), flat-top fragrant goldenrod (*Euthamia graminifolia*), Canada goldenrod (*Solidago canadensis*), giant foxtail grass (*Setaria faberi*), white heath aster (*Aster pilosus*), lamb's quarters (*Chenopodium album*), red clover (*Trifolium pretense*) and common ragweed (*Ambrosia artemisiifolia*). Included with this habitat type on the plant community map is an abandoned apple orchard several acres in size located on the hillside immediately north of the power block.

Upland Shrub Habitat

Upland shrub habitat was found mostly along transmission line corridors and in several abandoned farm fields located around the OCA that were undergoing secondary succession. This community consisted primarily of bush honeysuckle (*Lonicera tatarica*), multiflora rose (*Rosa multiflora*), Allegheny blackberry (*Rubus allegheniensis*), and Russian olive (*Elaeagnus angustifolia*).

Upland Deciduous Forest

Upland deciduous forest covered a large portion of the OCA to the west of Route 11. Common overstory species included northern red oak (*Quercus rubra*), white oak (*Quercus alba*), black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), shagbark hickory (*Carya ovata*), bitternut hickory (*Carya cordiformis*), sweet birch (*Betula lenta*), black walnut (*Juglans nigra*), black locust (*Robinia pseudoacacia*), yellow poplar (*Liriodendron tulipifera*) and red maple (*Acer rubrum*).

Upland forest understories were composed predominantly of spicebush (*Lindera benzoin*), round-leaved greenbrier (*Smilax rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*) and

saplings of overstory species. The groundcover included may-apple (*Podophyllum peltatum*), garlic mustard (*Allaria petiolata*), hayscented fern (*Dennsteadtia punctilobula*), tree clubmoss (*Lycopodium obscurum*), partridge berry (*Mitchella repens*), ground cedar (*Lycopodium tristachyum*) and stilt grass (*Eulalia viminea*).

Palustrine Emergent Wetlands

Palustrine emergent wetlands were located throughout the OCA. A diverse group of herbaceous hydrophytic plants was present including soft rush (*Juncus effusus*), sedges (*Carex spp.*), arrow-leaf tearthumb (*Polygonum sagittatum*), common boneset (*Eupatorium perfoliatum*), giant goldenrod (*Solidago gigantea*), seedbox (*Ludwigia alternifolia*), nutsedges (*Cyperus spp.*), blue vervain (*Verbena hasta*), New York ironweed (*Vernonia noveboracensis*), swamp aster (*Aster puniceus*), cut-leaf coneflower (*Rudbeckia laciniata*), broad-leaved cattail (*Typha latifolia*), reed canary grass (*Phalaris arundinacea*) and purple loosestrife (*Lythrum salicaria*).

Palustrine Scrub/Shrub Wetlands

Several large palustrine scrub/shrub wetlands were located in the western part of the study area and hydrophytic shrubs were a component of many wetlands across the site. Spicebush was overwhelmingly the most abundant wetland-preferring shrub onsite. Other frequently occurring wetland shrubs were highbush blueberry (*Vaccinium corymbosum*), meadowsweet (*Spirea latifolia*), alders (*Alnus spp.*), silky dogwood (*Cornus ammomum*), arrow-wood (*Viburnum dentatum*) and grey dogwood (*Cornus racemosa*).

Palustrine Forested Wetlands

Palustrine forested wetlands were the principal wetland type and large contiguous blocks of this habitat extended across the western section of the OCA. Trees commonly found in wetland forest habitat included red maple (*Acer rubrum*), silver maple (*Acer saccharinum*) black gum (*Nyssa sylvatica*), pin oak (*Quercus palustris*) and river birch (*Betula nigra*). In addition, upland-preferring species such as white ash and yellow poplar were present on upland microsites scattered throughout some forested wetlands.

Wetland forest understories were comprised largely of spicebush, highbush blueberry, arrow-wood and winterberry (*Ilex verticellata*). Skunk cabbage (*Symplocarpus foetidus*) predominated in the groundcover along with sedges, jewelweed (*Impatiens capensis*), sensitive fern (*Onoclea sensibilis*), clearweed (*Pilea pumila*), cinnamon fern (*Osmunda cinnamomea*), stout woodreed grass (*Cinna arundinacea*), and swamp dewberry (*Rubus hispidus*).

2.4.1.2 Important Terrestrial Species and Habitats

NUREG-1555 (NRC, 1999a) defines important species as: 1) species listed or proposed for listing as threatened, endangered, candidate, or of concern in 50 CFR 17.11 and 50 CFR 17.12 (CFR, 2007a), by the U.S. Fish and Wildlife Service, or the state in which the project is located; 2) commercially or recreationally valuable species; 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the structure and function of local terrestrial ecosystems; or 5) species that could serve as biological indicators of effects on local terrestrial ecosystems. Floral and faunal surveys that document observations made on the BBNPP OCA between August 2007 and August 2008 are summarized herein.

Table 2.4-1 lists each species and habitat identified as important for the BBNPP site and surrounding area according to the criteria in NUREG-1555 (NRC, 1999a). Each species deemed an important species is discussed in more detail below.

2.4.1.2.1 Mammals

Sixty-four species of native and introduced mammals currently reside in Pennsylvania (PBS, 2008) (Table 2.4-2). Virtually all of them could occur in the vicinity of the BBNPP site, based on range maps, with the possible exceptions of the eastern spotted skunk (*Spilogale putorius*), the thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*) and the least shrew (*Cryptotis parva*). Twenty-nine different mammalian species were identified at the BBNPP OCA during 61 field-days of terrestrial fauna observation, mammal trapping, and bat mist-netting efforts between October 16, 2007 and September 10, 2008 and are listed in Table 2.4-2.

Nine mammalian species have been identified as potentially "important" at the BBNPP site (Table 2.4-1) according to criteria defined in NUREG-1555 (NRC, 1999a). Four species qualify as rare (State or Federally listed as threatened or endangered): They include the Indiana bat (*Myotis sodalis*), eastern small-footed myotis (*Myotis leibii*), the Allegheny woodrat (*Neotoma magister*) and the northern myotis (*Myotis septeuntrionalis*). Two species meet the criteria of being commercially or recreationally valuable; white-tailed deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*). Three additional species are "important" to the structure and function of the local terrestrial ecosystem; the meadow vole (*Microtus pennsylvanicus*), deer mouse (*Peromyscus maniculatus*), and the white-footed mouse (*Peromyscus leucopus*).

In correspondence with the Pennsylvania Game Commission (PGC, 2008g) concerning mammalian impacts of the BBNPP site, it was determined that bat hibernacula were nearby and that the following species may be impacted: small-footed myotis (*Myotis leibii*), northern myotis (*Myotis septentrionalis*), little brown (*Myotis lucifugas*), big brown (*Eptesicus fuscus*) and the pipistrelle (*Pipistrellus subflavus*). The greatest impact, of course, would be if hibernacula were to be destroyed or made inaccessible to the bats. However, to date, no hibernacula have been located on the BBNPP site. Three of the five species of bats listed (little brown, big brown and pipistrelle) have a State status of common and do not meet the criteria of "important" as defined by NUREG-1555 (NRC, 1999a). The other two (small-footed myotis and northern myotis) are discussed below.

2.4.1.2.1.1 Rare Important Mammals

As described in more detail below, Rare Important Mammals at the BBNPP site include the Indiana bat, eastern small-footed myotis, Allegheny woodrat, and northern myotis.

A mist-net capture survey and habitat evaluation by an expert bat biologist was conducted during June and July 2008. No Indiana bats were captured, seen or heard. No small-footed myotis were captured. Four adult male northern myotis were captured and potentially suitable roosting and maternity den habitat was determined to be present by walking throught the BBNPP OCA and looking for natural tree cavities where bats could roost or rear offspring. Potential suitable roosting and maternity den habitat included most of the forested areas where loose bark of shagbark hickory (*Carya ovata*), wild black cherry (*Prunus serotina*), red maple (*Acer rubrum*) and ead snags > 5 in (13 cm) diameter at breast height were present.

Indiana Bat

The Indiana bat, which is Federally and State listed as endangered, is known to occupy hibernacula in Luzerne County, within 5 mi (8 km) of the BBNPP (PPL, 2006a). During non-hibernating periods (April through mid-November) the Indiana bat typically favors sites under exfoliating bark of large, often dead, trees as roosting sites and maternity dens. Though the Indiana bat is not known to occur on the BBNPP site, there is favorable forested habitat (loose bark of shagbark hickory (*Carya ovata*), wild black cherry (*Prunus serotina*) and red maple (*Acer rubrum*) and dead snags > 5 in (13 cm) diameter at breast height (dbh)) that may be used by the Indiana bat during non-hibernating periods.

USFWS recommends that all tree cutting activities be restricted to the period November 15 through March 31, while the Indiana bat is hibernating, so that removal of trees does not inadvertently injure or kill roosting individuals (maternity dens). If cutting is necessary from April 1 through November 15, then no trees > 5 in (13 cm) dbh should be cut or disturbed. Increase of old-growth forest acreage and forest contiguity, especially within several miles of hibernation sites, is recommended to improve prospects for this species (PDCNR, 2008a). Consultation with USFWS will be performed for tree-cutting activities from April 1 through November 15, if necessary.

Indiana bat hibernation usually occurs during winter in caves or abandoned mines in diagnostically dense clusters of about 250 bats per square foot (2,700 bats per square meter). Hibernation habitat requirements for the Indiana bat are quite specific and suitable locations, that are also free of excessive human disturbance, appear to be a limiting factor (USFWS, 2007). Cool humid caves with stable temperatures, under 50°F (10°C) but above freezing, are required.

In the spring, when temperatures rise, the Indiana bat migrates from hibernation sites to summer habitat in wooded areas where it usually roosts under loose tree bark on dead or dying trees. Males usually roost alone or in small groups during summer while females roost in larger groups of up to 100 or more (USFWS, 2008a). Maternity dens are usually behind flaking bark of dead or dying snags along stream or river corridors and frequently in upland forests (PGC, 2008a).

The breeding season for the Indiana bat is in the fall, just before entering caves to hibernate. Females experience delayed fertilization, storing the sperm through the winter and becoming pregnant in spring, soon after emerging from hibernation and leaving their caves. In the summer, females form maternity colonies, and the young stay with their maternity colony throughout their first summer. Typically, females only produce a single pup per year. The Indiana bat eats mostly flies, wasps, beetles, leafhoppers, aphids, and caddisflies. Predators of the Indiana bat include mink, black snakes, and screech owls.

The range of the Indiana bat includes at least 20 eastern states but its distribution is patchy as nearly half of the national population hibernates each winter in caves in southern Indiana (USFWS, 2008a). Nationwide population estimates from 1981 to 2007 have fluctuated from about 362,000 to slightly over half a million (USFWS, 2008b). Pennsylvania's population estimates have varied from about 700 to slightly over 1,000, between 2001 and 2007, and makes up only about 0.2% of the total national Indiana bat population (USFWS, 2008b). This currently poor representation of the Indiana bat in Pennsylvania is not just a recent trend as it appears its historical occurrence was restricted to just eight natural caves (PGC, 2008a).

Eastern Small-footed Myotis

The eastern small-footed myotis is listed as threatened in Pennsylvania and has been documented in hibernacula within 5 mi (8 km) of the BBNPP site. It is known to hibernate in caves and mine shafts. Unlike most other bats, the eastern small-footed myotis does not appear to hibernate in large colonies. In Pennsylvania, the largest known hibernating population consisted of less than fifty individuals and in a majority of caves where eastern small-footed myotis was found, less than five individuals were found in each cave. They have rarely been encountered during the non-hibernating period so very little is known about the habitat requirements or food habitats of this rare bat.

Allegheny Woodrat

The Allegheny woodrat is classified as threatened in Pennsylvania. It has very specific habitat requirements that seriously limit its distribution. The Allegheny woodrat is almost always found in caves, cliff faces, in boulder piles or talus slopes along mountain tops. The closest active site where the Allegheny woodrat is known to occur is in Carbon County. No observations of this species have been made during current or previous studies on the BBNPP site and no suitable habitat has been identified. Accordingly, it is unlikely that the Allegheny woodrat will be impacted by the BBNPP site.

Northern Myotis

The current status of northern myotis in Pennsylvania is candidate rare. It is known to occupy hibernacula in Luzerne County near the BBNPP site. Northern myotis hunt at night over small ponds, in forest clearings, at tree top level and along forest edges. They eat a variety of night-flying insects including caddisflies, moths, beetles, flies, and leafhoppers. This species uses caves and underground mines for hibernation and individuals may travel up to 35 mi (56 km) from their summer habitat for hibernation. Maternity roosts are located in tree cavities, under exfoliating tree bark and in buildings (PNHP, 2008). During the June/July mist-net survey four adult male northern myotis were captured. It is unlikely that this species will be significantly impacted by the BBNPP site.

2.4.1.2.1.2 Commercially/Recreationally Important Mammals

Commercially/Recreationally Important Mammals at the BBNPP site include the white-tailed deer and black bear.

White-tailed Deer

The white-tailed deer is, by far, the most important wild animal economically or recreationally in Pennsylvania. There are more deer hunters in Pennsylvania than any other State and the percentage of all hunters that hunt deer is higher (> 90%) in Pennsylvania than for any other State (USFWS, 2004). Deer hunting is a very popular activity in Luzerne County and most areas near the BBNPP site.

The white-tailed deer is ubiquitous and abundant throughout the BBNPP site and was observed frequently during the terrestrial vertebrate surveys. Although other mammal species were observed, none was as frequent or widespread over so many terrestrial habitats as white-tailed deer.

The white-tailed deer is a large herbivorous (plant-eating) mammal favoring fragmented brushy woods interspersed with abandoned fields and thickets. It is highly adaptable to most settings where there is sufficient browse, and cover, including suburban settings (Halls, 1984).

In Pennsylvania, white-tailed deer breed from late-October to mid-December and fawns are born just over 200 days later, from late-May through early July. Does first come into estrus when they reach about 80 lbs (36 kg), their first fall (at 6 months of age) in exceptionally good habitat, but more often don't start breeding until 1.5 years of age (Halls, 1984). First pregnancies usually yield a single fawn while subsequent pregnancies normally produce twins, but occasionally triplets. Does with better nutrition tend to begin breeding at younger ages and have larger litters. Does typically stay with their fawns for 12 months, until the next litter is born. Young females tend to continue living near their mother and associate with other female relatives lifelong. In contrast, most males disperse away from their natal home ranges and female relatives between 12 and 18 months of age. Males begin growing their first set of antlers in the spring, just under one year of age, and grow a new set each year thereafter.

Prior to European settlement, predation by gray wolf (*Canis lupus*), mountain lion (*Felis concolor*) and Native Americans helped keep white-tailed deer populations in balance with their forested ecosystems (Halls, 1984). During recent times, regulated hunting has been used in an attempt to control overabundant deer herds. An absence of major natural predators, a decline in hunter numbers, and land use changes that create abundant browse (abandonment of farmland and forest fragmentation due to development) have currently resulted in high white-tailed deer populations in Pennsylvania. Because none of these conditions is likely to change in the near future, white-tailed deer populations are expected to remain high in the region.

Black Bear

The black bear is known to occur in the vicinity of the BBNPP. Both tracks and scat of bears were detected during terrestrial faunal surveys of the BBNPP site.

The black bear is considered one of the premier big game animals in Pennsylvania and provides a great deal of quality recreation for hunters. About 125,000 hunters purchase specific licenses to hunt bears in Pennsylvania each year (PGC, 2006). The black bear also can be an indicator of ecosystem health, a symbol of wilderness, and have major economic impacts.

In terms of habitat requirements, the black bear is strongly associated with forests and attracted to dense vegetation, particularly dense shrub and tree growth in and around wetlands. Black bear den sites often include rock cavities, hollow trees, excavations under tree roots, or brush piles. The black bear is omnivorous but the bulk of its diet is vegetation such as skunk cabbage (*Symplocarpus foetidus*), and nuts and berries; especially acorns (*Quercus spp.*), beechnuts (*Fagus grandifolia*), black cherry (*Prunus serotinus*), blackberry (*Rubus spp.*), blueberry (*Vaccinium spp*), and juneberry (*Amelanchier spp.*). Because black bears need to accumulate large fat reserves prior to hibernating, acorns and beechnuts are critical (PGC, 2006).

Female black bears have a 2-year reproductive cycle. Most breeding occurs between mid-June and mid-July (Alt, 1989). Eggs are fertilized at that time but do not implant on the uterus until late-November or early-December (no matter when breeding occurred) in a process known as delayed implantation. Cubs are born in winter dens during January in Pennsylvania (Alt, 1989), after only about a 6-week developmental period, explaining their extremely altricial state. At birth, cubs average about 12 ounces (340 grams), are about 10 inches (25 centimeters) long

(from nose to tail), have about 0.1 in (0.3 cm) of hair covering their bodies and cannot see, hear or smell (Alt, 1989). Mothers and cubs usually leave their dens during late March or early April and travel together all year, weaning their cubs in the fall. They spend a second winter denning and hibernating together, then the family breaks up in late spring or early summer when the mother comes into estrus again-ending one reproductive cycle and starting another.

Female black bears do not begin reproducing until after they reach about 100 lbs (45 kg). In Pennsylvania, most females produce their first litter at age three or four (Alt, 1989). Litter size varies from one to five with larger litters being produced by older, heavier females (Alt, 1989).

The recovery of the black bear and its range expansion represents a remarkable success in the history of Pennsylvania wildlife management. In the 1970's, there was great concern about the future of the black bear. At that time, the statewide population was estimated at only about 2,500 and was largely restricted to about 20 counties in northcentral and northeastern Pennsylvania. However, due to management actions (closed hunting seasons and stocking of pregnant females) and impacts from long-term land use changes (conversion of farmland to forest) the bear population made a dramatic increase and their range more than doubled in recent decades. Currently, the black bear occupies more than 50 of Pennsylvania's 67 counties and population estimates in recent years have hovered around 15,000 (PGC, 2006).

2.4.1.2.1.3 Ecologically Important Mammals

Meadow Vole, Deer Mouse and White-footed Mouse

The meadow vole (*Microtus pennsylvanicus*), deer mouse (*Peromyscus maniculatus*) and white-footed mouse (*Peromyscus leucopus*) are of significant ecological importance to the BBNPP site. Nearly every terrestrial habitat at BBNPP is colonized with one or more of these species. Because of their abundance and ubiquitous distribution across nearly all habitats, these species form an essential link in the complex food web. They represent the major herbivore component bridging the gap between plants (producers) and carnivorous animals (consumers) (Merritt, 1987).

The meadow vole feeds throughout the day and night primarily on grasses, sedges, legumes, tubers, and roots (Reich, 1981) while the two Peromyscus species are primarily nocturnal and tend to feed more on insects and seeds (Lackey., 1985; Merritt, 1987). The insectivorous food habits of the deer mouse and white-footed mouse have been credited with helping control some insect infestations such as gypsy moth (*Lymantria dispar*) and its negative forest ecosystem impacts of tree defoliation and associated mortality, particularly among the oaks (*Quercus, spp.*) (Merritt, 1987).

Of all the mammalian species in Pennsylvania, the meadow vole, deer mouse, and white-footed mouse are among the most prolific. The breeding season for these small mammals in Pennsylvania runs from about March through October. The meadow vole, under ideal field conditions, are known to produce up to nine litters a year with each litter consisting of up to eight pups for a potential of 72 young produced in a single breeding season (Merritt, 1987). This potential is rarely obtained, of course, because of high predatory mortality. For the Peromyscus species, sexual maturity is reached at about two months of age and gestation is only about 23 days. Females ovulate immediately after parturition and often become pregnant while nursing. A single female may bear up to 28 young, in up to four litters, during the 8-month breeding season

(Merritt, 1987). In addition, females born in the early part of the breeding season are also contributing litters by late summer and fall.

Common predators of these small mammals include foxes, raccoons, skunks, weasels, minks, hawks, owls, crows, blue jays, and snakes. The distribution and abundance of the meadow vole, deer mouse, and white-footed mouse play an important role in the reproductive success and survival of many predators in the terrestrial ecosystem of the BBNPP OCA.

2.4.1.2.2 Birds

Two hundred forty-eight species of birds were observed within 5 mi (8 km) SSES (adjacent to the BBNPP site) during environmental studies between 1977 and 1994 (Ecology III, 1995). Gross (2004) reported 247 bird species (126 breeding bird species) on the Pennsylvania Important Bird Area #50, the Susquehanna Riverlands, of which the BBNPP site is a part. One hundred and sixteen different species of breeding birds were identified for areas close to the BBNPP site in both the first (1984 -1989) and second (2004 - 2008) Pennsylvania Breeding Bird Atlas surveys (CMNH, 2008). One hundred and twenty three bird species were observed during 41 field-days of terrestrial fauna observations between October 16, 2007 and September 10, 2008 in recent surveys at the BBNPP site. Table 2.4-3 lists bird species observed in each of the studies discussed above at or near the BBNPP OCA.

Five bird species have been identified as "important" at the BBNPP OCA (Table 2.4-1) according to criteria defined in NUREG-1555 (NRC, 1999a). Three bird species qualify as rare (bald eagle, peregrine falcon, and osprey), one species as commercially or recreationally valuable (wild turkey), and one species because of its ecological importance (scarlet tanager).

2.4.1.2.2.1 Rare Important Birds

None of the nearly 250 bird species observed during studies at or near the BBNPP site is listed on the Federal threatened or endangered list; however, ten species are listed on the State threatened or endangered list. They include the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), osprey (*Pandion haliaetus*), short-eared owl (*Asio flammeus*), upland sandpiper (*Bartramia longicauda*), American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exillis*), great egret (*Casmerodius alba*), black tern (*Chlidonias niger*), and the sedge wren (*Cistothorus platensis*). Of these 10 State-listed threatened or endangered species that could occur in the site vicinity, six are migrants with no history of local nesting and one, the American bittern, is a migrant that may have historically nested in the area, although no nestings have been documented recently (Ecology III, 1995). These seven migrant, non-breeding species are unlikely to be significantly impacted by the BBNPP site; therefore, no further discussion of them will follow. Though the peregrine falcon, bald eagle, and osprey are not known to nest at the BBNPP site, they have recently been nesting within 10 mi (16 km) of the BBNPP site. Observations have increased in recent years, and are discussed further below.

Peregrine Falcon

The peregrine falcon is listed as endangered in Pennsylvania. In the vicinity of BBNPP site its status was listed as "a rare but regular migrant" just over a decade ago (Ecology III, 1995). The peregrine falcon is one of the most widely distributed birds in the world, found on all continents except Antarctica, and on many oceanic islands (CLO, 2008). Sexual maturity occurs at 3 years of age. A clutch of 3 to 4 eggs is laid in April. Incubation lasts about 33 days, with both adults partaking in incubating and feeding the young. Young birds can fly in 35 to 42 days. Common

peregrine falcon prey consists of rock doves (*Columba livia*), ducks (*Anatidae*), blackbirds (*Icteridae*), and other birds. The peregrine falcon swoops down on its prey and strikes it with its talons. The peregrine falcon may be the fastest animal in the world, reaching speeds up to 200 mph (322 kph) in a dive (USFWS, 2008c).

In terms of habitat requirements, the peregrine falcon historically nested on high cliffs overlooking river systems where abundant avian prey was found (PGC, 2008b). Records indicate the peregrine falcon once nested at 44 sites in at least 21 Pennsylvania counties (PGC, 2008b) before their dramatic decline, nationwide, in the 1950's. This national decline, due to egg-shell thinning from accumulation of pesticides, especially DDT, resulted in the peregrine falcon being listed as a Federally endangered species in 1970 (USFWS, 2008c). DDT was banned in the United States in 1973.

The peregrine falcon was reintroduced through releases of captive-bred birds and the first nesting in Pennsylvania during recovery was documented in 1987 on a bridge in Philadelphia. The recovery continued slowly with additional reintroductions through the 1990's, reaching a total of 10 nesting pairs in 2000 (Brauning, 2007). The national population was recovering as well and the peregrine falcon was delisted from national endangered status in 1999. In 2003, the first successful nesting on a cliff occurred in Pennsylvania and in 2007 Pennsylvania reported its most successful year for peregrine falcon reproduction with 24 nesting pairs (Brauning, 2007).

In 2007, a pair of pergrine falcons nested and raised young along the Susquehanna River (Brauning, 2007), less than 2 mi (3 km) from the BBNPP OCA. In 2008, the pair successfully raised young at the same location.

Only one observation of a peregrine falcon was made at the BBNPP OCA during the 41 field-days of the terrestrial vertebrate survey.

Bald Eagle

The bald eagle is currently listed as threatened for Pennsylvania and was delisted from the Federal Endangered Species List on June 28, 2007. Bald eagle sightings in the OCA are increasingly common and nesting sites are known to exist within 10 mi (16 km) of the BBNPP OCA. However, there are no known nests on the BBNPP OCA, and no observations of bald eagles were made during the terrestrial fauna surveys.

Bald eagles prefer to perch and nest in tall trees within sight of rivers, lakes, and marshes where they can find fish, which is their staple food. They will also feed on waterfowl, turtles, rabbits, snakes and other small animals and carrion (USFWS, 2008d). Bald eagles require bodies of shallow water where adequate food exists and human disturbance is limited. Nesting eagles are particularly sensitive to human intrusions or disturbances (PGC, 2008c).

Breeding bald eagles typically lay one to three eggs in March or April which hatch after about 35 days of incubation. The young eagles fledge within 3 months and are on their own about a month later (USFWS, 2008d).

The bald eagle has made a dramatic recovery in recent decades both nationally and in Pennsylvania. Due to adverse effects of DDT on egg shell thickness and hatchability and other factors, the bald eagle was threatened with extinction by the early 1960's with an estimate of only 417 nesting pairs remaining in the lower 48 States (USFWS, 2008d). In response to a ban on

DDT and additional protection from the Endangered Species Act, and reintroduction efforts, the bald eagle numbers increased. By 2007, the USFWS estimated nearly 10,000 nesting pairs were in the contiguous United States and the bald eagle was removed from the Endangered Species List (USFWS, 2008d).

Even as late as 1980, there were only three pairs of bald eagles nesting in Pennsylvania (PGC, 2008c). In 2005, the Pennsylvania Game Commission surveys indicated the number of active nesting pairs had grown to 99 which fledged 118 eaglets that year alone (PGC, 2008d).

Osprey

The osprey is listed as threatened in Pennsylvania, is a regular and relatively common migrant along the Susquehanna River area near the BBNPP site, and is known to nest within 10 mi (16 km) of the site (Ecology III, 1995). However, there are no known nests on the BBNPP OCA, and no observations of osprey were made during the terrestrial fauna surveys.

In terms of habitat requirements, ospreys prefer lakes, ponds, rivers and marshes bordered by trees. They require open water containing adequate fishing opportunities. Their stick nests are usually built in large trees near water and are reused for multiple years (PGC, 2008e).

The osprey feeds almost exclusively on live fish. Breeding pairs bond for life. Males feed females while on the nest. Osprey usually lay 2 to 4 eggs that hatch after about a 30-day incubation. Chicks grow rapidly and are ready to test their wings in 5 to 7 weeks. Osprey arrive in Pennsylvania in the spring and depart in early fall. They migrate south to spend the winter in Central and South America.

Like the peregrine falcon and the bald eagle, DDT played an important role in decimating osprey numbers during the 1950's and 1960's. The osprey was listed as extirpated as a breeding bird in Pennsylvania in 1979. Reintroduction efforts in Pennsylvania and adjacent areas helped to restore the osprey. Between 1980 and 1996, 265 ospreys-obtained as nestlings from Chesapeake Bay nests-were released in Pennsylvania (PGC, 2008e) and it was downlisted from endangered to threatened in Pennsylvania in 1998. As of 2004, at least 65 pairs of ospreys nested in 17 counties in Pennsylvania (PGC, 2008e).

2.4.1.2.2.2 Commercially/Recreationally Important Birds

Wild turkey

Wild turkey (*Meleagris gallopovo*) was frequently observed on the BBNPP site during faunal surveys. Wild turkey is one of the most important birds in Pennsylvania commercially and recreationally. Currently in Pennsylvania greater than 225,000 hunters, more than any other state, are taking in excess of 40,000 turkeys in fall hunting seasons (PGC, 2008f) and it is a very popular activity in Luzerne County and around the vicinity of the BBNPP site.

Wild turkey depend on forested habitats but seem to do best in a mix of forested, actively farmed and reverting farmland habitat types (PGC, 2008f) which matches the habitat found at the BBNPP site.

The breeding season of the wild turkey is primarily from late March through May. Hens typically lay about 12 eggs though clutch size varies from 8 to 15. Incubation takes about 28 days. By 6 weeks of age the poults are fairly strong fliers and roost in trees with the hen.

Primary food items for the wild turkey in Pennsylvania include acorns, beechnuts, grapes, cherries, thornapples, crustaceans, insects, and green plant material. Foxes, bobcats, coyotes and great horned owls prey on nesting hens; eggs are also eaten by raccoons, opossums, mink, black snakes, skunks, crows and red squirrels.

During the late 1800's, the wild turkey was decimated by market hunting and habitat destruction as a result of the cutting of most of the eastern forests. In 1900, an estimated 5,000 wild turkeys, restricted to southcentral portions of the State, were all that remained in Pennsylvania (PGC, 2008f). Increased protection for this species as well as management actions (stocking new areas with wild-trapped turkeys) and conversion of agricultural habitat to forest due to land use changes set the stage for a remarkable comeback. Currently the Statewide wild turkey population is estimated at about 250,000 and they occur in all 67 counties (PGC, 2008f).

2.4.1.2.2.3 Ecologically Important Birds

Scarlet Tanager

The scarlet tanager (*Piranga olivacea*) is included as an important species because it can serve as a biological indicator of effects related to forest fragmentation. Given the relatively high frequency of observance at the BBNPP site and its forest interior habitat preference, a rarity or absence of observations could indicate a degradation of forest interior habitat.

The scarlet tanager represents one of the most frequently observed forest interior bird (FIB) species observed in the BBNPP OCA area during the late spring and summer of 2008 (as expected, this migratory species was not observed during fall of 2007 or winter or early spring 2008). Predictably, all of the FIB species were observed primarily in the forested sections of the project site area.

FIB species are birds that require large forested areas to breed successfully and maintain viable populations. Most FIB species have suffered noticeable population declines in Pennsylvania and elsewhere in the eastern United States concurrent with increased fragmentation of forest cover by urban development in the last 50 years.

The minimum area required for high, moderate, or low suitability for scarlet tanager breeding has been intensively studied and reported in the literature (Rosenberg, 1999). In the Appalachian Region, of which BBNPP site is a part, for a 2,500-acre (1,012-hectare) block which is only 40 percent forested, it only requires 25 acres of forest (10-hectare) to be classified high quality (Rosenberg, 1999). Many of the forested areas in southwestern and eastern portions of the BBNPP site exceed 25 acres (10-hectare) and would be classified excellent scarlet tanager breeding habitat.

The scarlet tanager breeds in woodland areas, constructing open-cup nests in the mid-story/ canopy. Eggs are laid in clutch sizes of three to five, with an incubation period of 13 to 14 days. Nine to 11 days are needed to fledge.

The scarlet tanager is a neotropical migrant that breeds in Pennsylvania but winters primarily in Central and South America. Most of the FIB species that have suffered the greatest population declines over the last 50 years are neotropical migrants. Neotropical migrant FIB species are sensitive not only to changes in their breeding habitats in eastern North America but also to changes to their wintering habits in Central and South America. The breeding season of the scarlet tanager peaks during the second week of June in Pennsylvania but observations of food carrying ranged from May 16 through August 9 (Braunning, 1992).

2.4.1.2.3 Reptiles and Amphibians

Seventy-four species of native, extant reptiles and amphibians currently occur in Pennsylvania, according to a publication of the Pennsylvania Fish and Boat Commission (PFBC, 2008a). Twenty-seven species of reptiles and amphibians were detected, either observed or heard, during the herptological survey on the BBNPP OCA.

Thirteen (18%) of Pennsylvania's 74 reptile and amphibian species are classified as State endangered, threatened or candidate and an additional 29 (39%) are classified as species of special concern (PFBC, 2008a) (Table 2.4-4). Based on available range maps (POHA, 2008) only one endangered species, the Eastern spadefoot (*Scaphiupus holbrookis*); one threatened species, the redbelly turtle (*Pseudemys rubriventris*); and one candidate species, the timber rattlesnake (*Crotalus horridus*) may possibly occur at the BBNPP OCA (Table 2.4-4). Using similar criteria, 15 of Pennsylvania's 29 species of special concern have ranges that include the BBNPP site (Table 2.4-4). They include the northern copperhead (*Agkistrodon contortrix*), eastern hognose snake (*Heterodon platirhinos*), smooth green snake (*Liochlorophis vemalis*), eastern ribbon snake (*Thamnophis sauritus*), eastern box turtle (*Terrapene carolina carolina*), spotted turtle (*Clemmys guttata*), wood turtle (*Glyptemys insculpta*), map turtle (*Graptemys geographica*), northern leopard frog (*Rana pipiens*), northern cricket frog (*Acris crepitans crepitans*), Fowler's toad (*Bufo fowleri*), eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*), Jefferson salamander (*Ambystoma jeffersonianum*), marbled salamander (*Ambystoma opacum*), and the four-toed salamander (*Hemidactylium scutatum*).

The only reptile or amphibian listed in correspondence from the Pennsylvania Fish & Boat Commission (PFBC, 2008b) regarding Species Impact Review (SIR) for rare, candidate, threatened and endangered species at the BBNPP site was the eastern hognose snake (*Heterodon platyrhinos*). A discussion for this species as well as the eastern spadefoot, redbelly turtle and timber rattlesnake is provided below.

2.4.1.2.3.1 Important Rare Reptiles and Amphibians

Eastern Spadefoot

The eastern spadefoot is currently listed as endangered in Pennsylvania. It was recorded in Luzerne County during the original Pennsylvania Herpetological Atlas work between 1997 and 2002 (POHA, 2008). However, to date (May 1, 2008) the eastern spadefoot has not been observed at the BBNPP site during the ongoing terrestrial or aquatic field studies.

Important breeding habitat for the eastern spadefoot includes temporary bodies of water; flooded fields, woodland ponds, ditches, and extensive puddles (Tyning, 1990). The breeding behavior of the eastern spadefoot is explosive and is brought on by heavy rains that create temporary pools usually between March and July, depending on location (Hulse, 2001). Development of the eggs is rapid because they must hatch before the vernal pools dry out. The larval period ranges from

12 to 40 days. The eastern spadefoot is nocturnal and carnivorous, feeding primarily on worms and various arthropods.

Redbelly Turtle

The redbelly turtle is currently listed as threatened in Pennsylvania. While working on the original Pennsylvania Herpetological Atlas, between 1997 and 2002, Dr. Hulse reported redbelly turtles in Luzerne County (POHA, 2008). To date (May 1, 2008), however, no redbelly turtles have been observed at the BBNPP site during the terrestrial or aquatic field studies.

The redbelly turtle produces one clutch each year consisting of eight to 22 eggs placed under about 4 in (10 cm) of sand in early June or July usually within 100 yd (91 m) of water. Females tend to return to the same nesting areas each year. The young emerge as hatchlings after 73 to 80 days, usually between August and October, and quickly make their way to the nearest water source, where they will develop into adults. They do not reach sexual maturity until 5 to 9 years of age (UMMZ, 2008). Mating occurs in shallow water in the spring and fall.

Timber Rattlesnake

The timber rattlesnake is listed as a candidate species of special concern in Pennsylvania and is known to occur in Luzerne County (POHA, 2008). However, to date (May 2, 2008) no timber rattlesnakes have been observed at the BBNPP OCA during the terrestrial or aquatic field studies, or during the reptile and amphibian survey efforts performed from August 2007 through September 2008. In addition, no suitable habitat, such as rock ledges, rock and boulder slides, and relatively wild forested habitat, for this species appears to exist in the OCA.

Timber rattlesnakes inhabit rocky, mountainous terrain and favor south-facing slopes for warmth and dryness (Allen, 1992). They require adequate plant growth for cover and food. Huckleberry bushes, scrub oak, and mountain laurel are plants often associated with good rattlesnake cover. The huckleberry bushes bear berries in late summer, which attract small mammals and birds that provide a source of food for timber rattlesnakes.

Timber rattlesnakes hibernate below frost line, deep within rocky crevices. Hibernation usually begins in late September and continues until late April or early May when ground temperatures are between 60° and 72° F (16° and 22° C) (Allen, 1992). Following hibernation, males and non-pregnant females (breeding may occur in late fall or early spring) fan out from the immediate location of the den site in search of food. Pregnant females usually do not stray as far, preferring to sunbathe and incubate the young, which are born in late August or early September (Allen, 1992). Litters consist of nine to eleven young. Females do not breed annually, and often skip 1 to 3 years between litters.

Eastern Hognose Snake

The hognose snake is a species of special concern in Pennsylvania. Its range includes the BBNPP OCA but it has not been observed there during the terrestrial or aquatic field studies. The lack of hognose snakes may be a result of habitat deficiencies, such as a lack of sandy area or a lack of toads, which it feeds on almost exclusively.

Eastern hognose snakes are primarily inhabitants of grasslands and open forests near water and show a strong preference for dry, sandy soil where they can burrow, both for protection and in

search of food (Hulse, 2001). In Pennsylvania, eastern hognose snakes are primarily found along sandy river and stream bottoms and on sand ridges in mountainous areas (Hulse, 2001).

In the Northeast, eastern hognose snakes emerge from hibernation in late April and early May. Activity increases to a peak in July and then slowly tapers off through August and September until it ceases in early or mid-October. They feed primarily on toads and frogs; however, salamanders, lizards, hatchling turtles, small mammals, earthworms, insects, and centipedes have also been reported as food items (Hulse, 2001). Mating occurs in the spring and/or fall prior to or shortly after hibernation. Egg laying usually takes place in late June. Eggs are buried in loose soil at a depth of about 4-6 in (10-15 cm). Clutch size is variable with most females having clutches that range from 15 to 25 eggs. Clutch size is correlated with female body size; larger females lay more eggs (Hulse, 2001). Incubation usually lasts from 45 to 64 days.

2.4.1.2.4 Insects

In January 2008, four butterfly species of special concern, thought to occupy areas near the BBNPP site were identified in correspondence with the Pennsylvania Department of Conservation and Natural Resources (DCNR) to the U.S. NRC. They were the Northern Pearly-Eye (*Enodia anthedon*), Baltimore Checkerspot (*Euphydras phaeton*), Mulberry Wing (*Poanes massasoit*) and Long Dash (*Polites mystic*). In July 2008, the entomologist who conducted the butterfly survey identified that two of the four original butterfly species of concern (northern pearly eye and long dash) are no longer PNDI tracked species due to a recent revision of the state ranks. However, one new butterfly species, the black dash (*Euphyes conspicua*) was added for Luzerne County.

The OCA potentially provides suitable habitat for the butterflies listed above based on habitat descriptions provided by DCNR and information collected through concerning life histories, and breeding/foraging preferences of these species. DCNR requested in its current response letter that attempts be made to minimize impacts to potential habitat for these butterflies within the OCA. Table 2.4-32 provides information on the occurrence of host plant species on the BBNPP OCA for each of the butterfly species listed. PDCNR requested that attempts be made to minimize impacts to potential habitat for these butterflies within the project area. Accordingly, care will be taken to prevent loss of plant species listed in Table 2.4-32.

At the request of the DCNR, a butterfly survey was conducted by an experienced entomlogist during June and July 2008. No northern pearly-eye, mulberry wing, or Baltimore checkerspot butterflies were located during the butterfly survey. One long dash butterfly and a pair of black dash butterflies were collected. In addition, 8 to 10 black dash butterflies were observed at the BBNPP OCA as part of the July 2008 butterfly survey.

2.4.1.2.5 Plants

Information concerning the presence of endangered, threatened and special concern plants within a 0.5-mile (0.8-kilometer) radius of the OCA was requested via correspondence submitted December 21, 2007, to the U. S. Fish and Wildlife Service (USFWS) and Pennsylvania Department of Conservation and Natural Resources (DCNR). USFWS jurisdiction includes flora designated as listed, proposed or candidate under the Federal Endangered Species Act. DCNR has jurisdiction over flora considered to be rare in Pennsylvania. Neither agency reported any known occurrences of plants designated as endangered, threatened or of special concern within the search area.

Plants meeting the NUREG-1555 criteria for important species include black cherry (*Prunus serotina*), red maple (*Acer rubrum*), river birch (*Betula nigra*), spicebush (*Lindera benzoin*), skunk cabbage (*Symplocarpus foetidus*) and Canada goldenrod (*Solidago canadensis*) (Table 2.4-1). Black cherry is commercially important and plentiful in upland forests onsite. Black cherry wood is one of Pennsylvania's most valuable forest products. Red maple, river birch, spicebush, skunk cabbage and Canada goldenrod represent ecosystem critical plants. These species are overwhelmingly dominant in one or more of the major plant communities vegetating the OCA. Due to their abundance, these plants would be very influential in shaping the structure and ecological processes of these communities.

2.4.1.2.6 Habitats

Palustrine wetland communities present in the BBNPP OCA were identified as important habitats and include emergent, scrub/shrub and forested cover types (Figure 2.4-2). Wetland boundaries were delineated during the period of July 2007 through August 2008 using the methodology presented in the U.S. Army Corps of Engineers Wetlands Delineation Manual (USACE, 1987), which involves the use of vegetation, soils, and hydrology to establish juridictional boundaries. The boundaries were marked with sequentially numbered flags that were then located by a registered professional surveyor. The surveyed boundaries were verified to ensure accuracy.

Additional property was added to the OCA between March and August 2008. Wetlands on these properties were identified using National Wetland Inventory mapping, soil surveys, and field inspections. These wetlands were mapped for planning purposes using Global Positioning System coordinates and engineering judgement.

The Susquehanna Riverlands Environmental Preserve was also identified as an important habitat and bounds the eastern end of the OCA. The 1,200-acre (486-hectare) preserve encompasses a wide variety of upland and wetland habitats along both sides of the Susquehanna River, and includes a 400-acre (161-hectare) public recreation area.

2.4.1.3 Habitat Importance

Indiana Bat: Though Indiana bats have been documented to use hibernacula within 5 mi (8 km) of the BBNPP site, no Indiana bats or potential hibernacula have been located in the OCA. Potential roosting areas and maternity dens in the form of exfoliating bark of larger tree species, notably shagbark hickory, is present in some of the forested areas of the OCA.

White-tailed Deer, Black Bear, and Wild Turkey: Each of these species, which have been identified as commercially and recreationally important, and are abundant in the BBNPP site area, have flourished in the mosaic of forest and agriculture habitats so common in Luzerne County and adjacent areas. Because of the demonstrated ability of these species to adapt to a variety of habitats and circumstances, their populations are not generally sensitive to localized habitat changes.

Bald Eagle, Peregrine Falcon, and Osprey: Though each of these species have been seen with increasing frequency in recent years along the Susquehanna River, most of their activity has been concentrated closer to the river than the BBNPP site. No nesting or roosting sites have been documented on the BBNPP construction site itself. Only one peregrine falcon was observed on the OCA during the faunal survey.

Scarlet Tanager (and other Forest Interior Birds): At the BBNPP site, based on forest block and tree sizes (Rosenberg, 1999), the majority of the forests in the site constitute moderate to high breeding habitat quality for scarlet tanager.

Plant communities and constituent plant species identified within the BBNPP site are common throughout northeastern Pennsylvania. Development of the OCA may result in a cumulative local loss of these communities and species. However, the regional impact would be relatively insignificant. Impacts to wetlands will be mitigated through the construction of similar wetland habitat.

2.4.1.4 Disease Vector and Pest Species

A disease vector is an organism (commonly an insect) that carries disease agents (commonly bacteria or fungi) to a receptor host, which can be man, domestic or wild animals, or crops or wild plants. One disease vector known to occur on the BBNPP site is the deer tick (*Ixodes scapularis*), which transmits Lyme disease to humans. Lyme disease is a non-fatal but potentially debilitating disease whose victims can display fever and severe joint pain. The causal agent is a bacterium, Borrelia burgdorferi, which is transmitted by the deer tick from white-tailed deer, mice, squirrels, and other mammalian wildlife to humans (CDC, 2008).

West Nile Virus is another disease vector which occurs in the BBNPP site area. West Nile Virus is a mosquito-borne disease that can, in rare instances, cause encephalitis, a brain inflammation, capable of causing death. Mosquitoes spread the virus after they feed on infected birds and then bite people, other birds, and animals. Most West Nile Virus cases in Pennsylvania occur in mid-summer or early fall.

The first recorded cases of West Nile Virus were in New York City in 1999. By 2003, there were 9,175 human cases (including 230 deaths) reported including every continental State in the United States except for Maine, Oregon and Washington. In Pennsylvania, during 2003, the CDC reported 247 human cases and 8 deaths (PWNVSP, 2008).

Mosquitoes need standing water to live and can develop into adults in a minimum of 4 days. Mosquito control includes pesticide use and removal of standing water. Bird species most often killed by West Nile Virus include crows, blue jays, hawks and owls.

Non-native invasive plants occur abundantly within particular upland and wetland habitats in the OCA. Wetland invaders include reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), and common reed (*Phragmites australis*), which are herbaceous plants that commonly colonize emergent wetland habitat. Reed canary grass is a dominant species throughout much of the emergent wetlands within the OCA and forms near monocultures in some areas. Purple loosestrife is moderately abundant and common reed is currently limited to a small foothold near the southeastern corner. These species will likely colonize additional emergent wetland habitat over time.

Upland invaders include garlic mustard (*Allaria petiolata*), stilt grass (*Eulalia viminea*), multiflora rose (*Rosa multiflora*), and bush honeysuckle (*Lonicera tartarica*). Garlic mustard and stilt grass are herbaceous plants that are very common in the groundcover of upland forests. Multiflora rose and bush honeysuckle are shrubby plants that occur in dense concentrations in successional old-field habitat and along forest edges.

Native wildlife is adapted to habitats composed of indigenous vegetation. Typically, non-native plants have little or no value to native animals. Aggressive non-native plants, such as those identified above, tend to spread rapidly, form monocultures and out-compete native flora with negative consequences for native wildlife.

2.4.1.5 Wildlife Travel Corridors

Wildlife tends to move across landscapes using distinct corridors of favorable habitat. Movement of most forest wildlife across fragmented agricultural and suburban landscapes is enhanced by linear corridors of forest that can consist of forested hedgerows, forested stream valleys, or forested ridge tops. The minimum width for a forest corridor to benefit wildlife is not known but may vary among wildlife species depending on body size. Wildlife movement is also enhanced by strings of closely spaced patches of favorable habitat that form "stepping stones" across areas of unfavorable habitat. For forest wildlife, such stepping stones can consist of woodlots in agricultural landscapes or parks and other undeveloped forest tracts in suburban landscapes (PGC, 2006).

The landscape of southwestern Luzerne County consists predominantly of forest land interspersed with fallow or agricultural fields. The majority of both Luzerne (82%) and Columbia (91%) (adjacent county just west of BBNPP) Counties are dominated by forest and agricultural lands. The landscape is crossed by a network of forested stream valleys that form corridors that facilitate the movement of forest wildlife around farm fields and developed areas. The BBNPP site is bordered on the south and east by the Susquehanna River and Susquehanna Riverlands Important Bird Area, which acts as a corridor for bird and other animal movements (Gross, 2004).

2.4.1.6 Existing Natural and Man-Induced Ecological Effects

The OCA landscape has been substantially altered to support agriculture, electric power generation and canal transportation uses. Much of the original forest cover was cleared and the remainder became highly fragmented as a result of these activities. In the past, these forests would also have been intensively used for the production of lumber and firewood. No active timber cutting for these purposes was observed during current field studies.

Current vegetation management consists largely of agricultural crop production and maintenance of transmission line corridors. Prescribed burns are not used as a vegetation management tool in the OCA, and no evidence of recent natural wildfires was detected. In addition to changes in the historic vegetation, the OCA has also undergone extensive hydrologic modifications. In the western end of the OCA, most of Walker Run and its eastern tributary were channelized in the past to facilitate farming operations. At the eastern end of the OCA, construction of Lake Took-A-While, the North Brach Canal, and SSES-related activities would have greatly changed hydrologic conditions in the Susquehanna Riverlands.

2.4.1.7 Ongoing Ecological and Biological Studies

Pre-construction terrestrial ecological studies were conducted between July 2007 and September 2008 to inform preparation of this ER in accordance with NUREG 1555 and NRC Regulatory Guide 4.2. Wetlands delineation started in July 2007 and continued through March 2008; wetlands mapping for planning purposes occurred from June through August 2008. Field observations of terrestrial vertebrates (reptiles, amphibians, mammals and birds) began in mid-October 2007, and continued through September 2008, to achieve approximately biweekly observations in four seasons over a 1 year period. The observations include visual and auditory

observations of the animals, their tracks, scat and sign by an experienced field biologist. A comprehensive live trapping program for mammals, reptiles and amphibians started in May 2008 and continued through September 2008. A bat mist-net survey was conducted during June and July 2008. A survey of plant species and community identity and relative abundance was conducted in late spring and summer 2008.

The U.S. Fish and Wildlife Service oversees a national program of breeding bird survey routes. One of these routes, PA 902, is located partially in Luzerne County near Bell Bend. The route has been surveyed annually for most years since 1982, and it is likely that it will continue for the foreseeable future. The surveys are conducted by volunteers using a standard protocol.

The Pennsylvania Game Commission is sponsoring a volunteer, statewide 2nd Pennsylvania Breeding Bird Atlas (BBA) from 2004 through 2008 breeding seasons (CMNH, 2008). Several blocks near and on the BBNPP site are being studied (Sectors 52D12 and 52D14).

The BBNPP OCA is partly comprised of Susquehanna Riverlands Important Bird Area (IBA) #50. There will likely be ongoing monitoring of bird populations on this IBA.

The Pennsylvania Game Commission has ongoing monitoring programs for Allegheny woodrat and their habitat and bat hibernacula. It is likely that the known bat hibernacula within 5 mi (8 km) of BBNPP and any active or former woodrat colonies in Luzerne or adjacent counties will be monitored in the future.

2.4.1.8 Regulatory Consultation

The U.S. Fish and Wildlife Service was consulted for information on known occurrences of Federally-listed threatened, endangered, or special status species and critical habitats (USFWS, 2008e). For State-listed threatened, endangered, or special status species and critical habitats, the Pennsylvania Game Commission was consulted concerning mammals and birds (PGC, 2008g); the Pennsylvania Fish and Boat Commission was consulted concerning reptiles and amphibians (PFBC, 2008b), and the Pennsylvania Department of Conservation and Natural Resources was consulted concerning plants, natural communities, terrestrial invertebrates, and geologic features (PDCNR, 2008a). Wetlands regulatory officials with the U.S. Army Corps of Engineers and Pennsylvania Department of Environmental Protection were consulted regarding wetlands issues. Identification of the important species discussed above was based in part on information provided by that consultation.

2.4.1.9 Offsite Transmission and Access Corridors

There are no new offsite transmission or access corridors associated with the construction and operation of BBNPP.}

2.4.2 AQUATIC ECOLOGY

{Characterization of the aquatic ecology related to BBNPP required both collection of new field data and acquisition of data collected by others for the waterbodies located within or adjacent to the Owner Controlled Area (OCA). These waters include Walker Run, an abandoned section of the North Branch Canal, six on-site ponds, Unnamed Tributary 2, two off-site stream locations (Unnamed Tributaries 1 and 3), and the Susquehanna River, the waterbody from which cooling water will be withdrawn. The aquatic ecology of the ponds and Walker Run on and adjacent to the BBNPP site was characterized through a series of macroinvertebrate and fish field studies conducted in 2007 and 2008. Benthic macroinvertebrate surveys were completed during 2008 for Unnamed Tributaries 2 and 3. Unnamed Tributary 1 was dry, thus no sample was collected. The fish community present within the North Branch Canal is typical of other warmwater fish communities near the site. Sampling in the Canal had been planned to be completed during the summer of 2008; however, excessive aquatic vegetation made effective fish sampling impossible. For the Susquehanna River, a historic record of field studies dating back to the early 1970s was available for both macroinvertebrates and fish related to monitoring for SSES. However, only recent data for fish (2004 to 2007) and benthic macroinvertebrates (2007) were included in this Section, because the more recent data best represents the current status of the river environment.

Important aquatic species are discussed below in the sections which describe the ecology of the on-site waterbodies and the Susquehanna River. NUREG-1555 (NRC, 1999a) defines important species as: 1) species listed or proposed for listing as threatened, endangered, candidate, or of concern in 50 CFR 17.11 and 50 CFR 17.12 (CFR, 2007a), by the U.S. Fish and Wildlife Service, or the state in which the project is located; 2) commercially or recreationally valuable species; 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the structure and function of local aquatic ecosystems; or 5) species that could serve as biological indicators of effects on local aquatic ecosystems.

Information concerning the presence of species of special concern within a 0.5-mile radius of an area encompassing the OCA, adjacent PPL owned lands to the north and the Susquehanna Riverlands was requested via correspondence submitted 21 December 2007 to the U. S. Fish and Wildlife Service (USFWS) and Pennsylvania Fish and Boat Commission (PFBC). This coordination documents review of the Pennsylvania Natural Diversity Inventory database records for species and resources of special concern in Pennsylvania. USFWS has jurisdiction over species of flora and fauna designated as listed, proposed or candidate under the federal Endangered Species Act. PFBC has jurisdiction over fishes, reptiles, amphibians, aquatic invertebrates and freshwater mussels designated as special concern in Pennsylvania. Responses from these agencies are referenced in applicable sections below. There are no Federal or State listed, proposed or candidate rare, threatened or endangered fish, mussels or benthic invertebrates known to occur at the BBNPP site.

The subsections below summarize relevant information from each of these studies and provide data on existing aquatic ecology in accordance with the guidance in NUREG-1555.

2.4.2.1 On-site Waterbodies

Waterbodies at the BBNPP site are described in Section 2.3.1. The locations of the on-site surface water monitoring locations are provided in Figure 2.4-3. Summary descriptions of the on-site waterbodies' hydrological and physicochemical characteristics are given in Section 2.3.1. Locations of the on-site waterbody aquatic biota sampling locations are shown in Figure 2.4-3.

Several of the biological monitoring stations are in close proximity to the surface water monitoring stations described in Section 2.3.1. The following indicates the biological monitoring station name and the corresponding surface monitoring station designator used in Section 2.3.1 in parentheses: Farm Pond (G8), Unnamed Pond 1 (G9), Beaver Pond (G7), Johnson's Pond (G6), Walker Run 6 (G1), Walker Run 1 (G2),Walker Run 3 (G3).

Walker Run is a second order tributary to the Susquehanna River. It is a low to moderate gradient stream that flows through a section of the proposed BBNPP site. The main stem of Walker Run flows south through the western portion of the site and a secondary branch (east fork) flows west through the center of the site until its confluence with the main stem of Walker Run. Both branches are shallow and flow through a mixture of agricultural and forested lands. Unnamed Tributary 2 is a small stream that flows in an easterly direction from near the southeastern corner of the SSES site and eventually enters Lake Took-a-While. It flows through a mixture of grasses and scrubby vegetation. Six ponds are located on the BBNPP site. Four of the ponds; West Building Pond, Unnamed Pond 1, Unnamed Pond 2, and Farm Pond; are small and shallow, averaging less than 1 ft (0.3 m) in depth. Beaver and Johnson's Pond are the largest ponds ranging up to 5 ft (1.5 m) in depth. The North Branch Division of the Pennsylvania Canal System was constructed along the Susquehanna River in 1834 and is no longer in use. On the BBNPP site, a short section of the North Branch Canal is less than 0.25 mi (0.4 km) from, and runs parallel to, the Susquehanna River. The Canal is fairly deep and steep-sided at this location.

Sampling was performed to determine the community composition of fish inhabiting the six ponds, Unnamed Tributary 2, and Walker Run, as all potentially could be affected by construction of the plant. Five of the ponds (excluding Unnamed Pond 2) and Walker Run were surveyed for fish during fall 2007 as shown on Figure 2.4-3. Additional fish sampling in Walker Run occurred during spring and summer 2008. Benthic macroinvertebrate collections were completed in Unnamed Tributary 2 during summer 2008. Unnamed Tributary 2 was too overgrown to sample for fish, although no fish were observed during visual inspection. All six ponds were surveyed for fish during summer 2008. Fish were sampled using several gear types depending upon access and pond depth including seine, electrofishing boat, and towed electrofishing pram. Three stations were surveyed for fish in Walker Run within the BBNPP OCA boundary during 2007. These three plus two stations downstream of the BBNPP site were sampled during 2008. For summer 2008, all five previously mentioned Walker Run stations and an additional upstream station were surveyed. A towed electrofishing pram was used to collect fish in Walker Run.

Benthic macroinvertebrates were collected from two stations in Walker Run within the BBNPP site during fall 2007 and from four stations in Walker Run both within and downstream of the BBNPP site boundary during Spring 2008 as shown on Figure 2.4-3. During summer 2008, benthic macroinvertebrates were collected from five stations on Walker Run. A D-frame dip net was utilized for the collections.

2.4.2.1.1 Ponds

Fall 2007

No fish were collected in the West Building Pond or Unnamed Pond 1. Fish were present in the other three ponds from which a total of 254 specimens representing seven species and one hybrid was collected as described in Table 2.4-5. Beaver Pond yielded a total of 164 fish representing five species and one hybrid. Brown bullhead was the dominant species in Beaver

Pond, comprising 61% of the catch. A total of 89 fish representing three species was collected from Johnson's Pond with bluegill numerically dominant, comprising 96% of the catch. A single creek chub was collected from Farm Pond.

Summer 2008

No fish were collected from West Building Pond, Unnamed Pond 1, or Unnamed Pond 2. For the other three ponds (Beaver, Johnson's, Farm) a total of 356 fish representing nine species and one hybrid was collected as described in Table 2.4-6. A total of 64 fish representing four species and one hybrid was collected from Beaver Pond. The predominate species in Beaver Pond was brown bullhead, comprising 39% of the catch. Johnson's Pond yielded a total of 240 fish representing three species and one hybrid with bluegill being numerically dominant, comprising 86% of the catch. Fifty-two fish representing three species and one hybrid was collected from Farm Pond, creek chub was the predominate species accounting for 83% of the catch.

The fish assemblages observed within Beaver Pond and Johnson's Pond were characteristic of a typical warm-water pond in Pennsylvania (Cooper, 1983). Most of the species including largemouth bass, bluegill, and brown bullhead are commonly recommended by extension agencies for stocking in small ponds in Pennsylvania (PSU, 2000) In both ponds, the predominant fish species were from the families Centrarchidae and Ictaluridae. Several species within these two families are common inhabitants of ponds throughout Pennsylvania. Beaver Pond had the most balanced and diverse fish assemblage with both brown bullhead and green sunfish being abundant. Three centrarchids were present in Johnson's Pond with bluegill being abundant. Community composition was similar within both ponds during Fall 2007 and Summer 2008. The Farm Pond was not representative of a typical fish community for ponds in Pennsylvania. Many of the species collected in Farm Pond during July 2008 including creek chub, white sucker, and blacknose dace normally inhabit streams and rivers and are not found in ponds (Cooper, 1983). It is probable that these fish were washed into Farm Pond during flood events that caused Walker Run to overflow it's banks. None of the species collected in the three ponds are considered ecologically important. No rare, threatened, endangered, or species of special concern were collected. Several of the fishes have the potential to be recreationally important, but angler access to the on-site ponds is prohibited. Fish residing in the ponds may be ecologically important as prey for piscivorous birds and other predators.

Water quality data for the ponds are presented in Table 2.3-43.

2.4.2.1.2 Walker Run

Fish

Seven species of fish and one hybrid totaling 299 individuals were collected from three stations on Walker Run during the fall of 2007 as described in Table 2.4-7. Station 1, at the southwest corner of the site and the most downstream on-site station, yielded 151 individual fish of five species with blacknose dace and creek chub being collected in greatest numbers. A total of 56 fish representing five species was collected from Station 2 which is located in a partially channelized reach along the western boundary of the site. Species composition and relative abundance was similar for Stations 1 and 2 with blacknose dace and creek chub being co-dominant. At Station 3, in the east fork of Walker Run, 92 fish representing five species and one hybrid were collected with creek chub being numerically dominant, comprising 70% of the catch.

In the spring of 2008 the three stations discussed above plus two others downstream of the BBNPP site were sampled. Ten species and 857 fish were collected from the five stations as described in Table 2.4-8. A total of 112 individuals representing six species was collected from Station 1; Station 2 yielded 101 individuals and four species of fish. Blacknose dace was numerically dominant at Stations 1 and 2 where it comprised 43.8% and 45.5% of the total, respectively. At Station 3, 50 fish of four species was collected. Creek chub was most numerous and comprised 32.0% of the total.

The two additional sampling sites, Stations 4 and 5, were added in the reach downstream of the BBNPP site to allow future assessment of potential off-site effects due to plant construction and operation. Station 4 was approximately 0.5 mi (0.8 km) downstream of the site boundary and Station 5 was approximately 0.25 mi (0.4 km) downstream of Station 4. Station 4 yielded 371 individuals of nine species, and at Station 5 six species and 223 specimens were collected. The dominant species at Station 4 was white sucker, comprising 40.7% of the total catch, while at Station 5 blacknose dace was numerically dominant, comprising 83.4% of total. The dominance of blacknose dace at Station 5 was related to the high stream gradient and abundance of cobble, ideal habitat for this species. Pool habitat was absent which explains the low numbers of white sucker and creek chub compared to Station 4.

During summer 2008, the five previously discussed Walker Run stations and one additional Walker Run station were sampled. An additional upstream station (Station 6) was added as a result of expansion of the OCA near this location. Overall, ten species and one hybrid fish totaling 921 individuals were collected from the six stations as described in Table 2.4-9. Station 4 yielded the greatest number of individuals (430) and the most species (9). The fewest number of fish (51) were collected from Station 3 in the east fork of Walker Run with only four species present. Blacknose dace, creek chub, and white sucker were among the predominate species at most of the stations. The fish assemblage observed in Walker Run was characteristic of similar-sized coolwater streams throughout eastern Pennsylvania (Fairchild, 1998, Horwitz, 2008). A mixture of both coldwater and warmwater species was collected throughout the watershed. Walker Run is currently designated as a cold water fishery (PA, 1980). This designation indicates that in Walker Run the maintenance or propagation, or both, of fish species including the family Salmonidae occurs.

In Walker Run, a general trend of increasing species diversity and abundance was observed at stations that were farther downstream, which is a common characteristic of smaller headwater streams. Similar species composition and abundance was observed during the fall, spring, and summer sampling events. Although brown trout was present during the spring and summer but not the fall sampling effort. Seasonal movement of brown trout within the stream most likely explains their presence during spring and summer and not during the fall. The fish appeared to be naturally reproduced, wild brown trout. Trout are not stocked in Walker Run by the PFBC. The low numbers, small size, and limited occurrence of brown trout in Walker Run indicate the stream has relatively low value as a recreational fishing resource. Four species that were relatively abundant throughout the surveyed locations in Walker Run; blacknose dace, creek chub, white sucker, and tessellated darter; have potential ecological importance as prey for fish eating predators. The abundance of blacknose dace and creek chub in Walker Run offers an important forage base for brown trout and other predatory fish. Blacknose dace distribution is widespread in Pennsylvania and nearly every stream in Pennsylvania contains blacknose dace (Cooper, 1983). Additionally, white sucker, creek chub, and tessellated darter are also widely distributed throughout Pennsylvania.

Qualitative collections of crayfish were completed while electrofishing in the lower reaches of Walker Run during summer 2008 (Stations 4 and 5) Crayfish were extremely abundant and only one species was collected, *Orconectes obscurus*. Another species, *Cambarus bartonii bartonii*, however, was collected in Walker Run benthic macroinvertebrate samples. Crayfish constitute a forage source for fish as well as terrestrial predators such as raccoon. No rare, threatened, endangered, or species of special concern were collected nor would any be expected in Walker Run. Two mussel species of special concern (yellow lampmussel and green floater) were identified by PFBC to potentially occur near the BBNPP site. However, both species typically occur in larger creeks and rivers such as in the adjacent Susquehanna River (PNHP 2007a, 2007b). It is highly unlikely that either species would occur in the Walker Run watershed. Based on coordination with PFBC no rare, threatened, endangered, or species of special concern are thought to occur within Walker Run (PFBC, 2008).

Benthos

Fall

A combined total of 2,510 macroinvertebrates was collected from Stations 1 and 2 representing 66 taxonomic categories (usually genus) during fall 2007 (Table 2.4-10 and Table 2.4-11). Taxa are defined as any named taxonomic groups of any rank in the hierarchical classification of organisms. Diptera (true flies) was the dominant group both numerically (48.1%) and by number of taxa (n=15). The group Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) made up a large proportion of the total taxa and was represented by 30 genera.

A total of 1,349 individuals representing 46 taxa was collected from Station 1 (Table 2.4-10). Diptera was the dominant group at Station 1, comprising 73% of the macroinvertebrates; most of the dipterans were in the family Chironomidae (midges). Diptera was also the most diverse group with 13 taxa being collected. The EPT grouping comprised 12.3% of the macroinvertebrates with a total of 12 taxa present from this group. The caddisfly *Cheumatopsyche* was the most abundant EPT taxon representing 4.3% of the macroinvertebrates.

At Station 2 a total of 1,161 macroinvertebrates from 52 taxa was collected (Table 2.4-11). Of these, two groups were essentially co-dominant, Ephemeroptera and Coleoptera (beetles), comprising 33.6% and 31.4% of the total, respectively. Diptera were also fairly numerous accounting for 19.2% of the macroinvertebrates. The combined contribution of the EPT group accounted for 45.9% of the macroinvertebrates and over half of the total taxa (n= 26 taxa). The mayfly Stenonema was the most abundant EPT taxon, comprising 22.8% of the macroinvertebrates.

Spring

A total of 15,228 organisms of 69 taxa was collected from Walker Run during Spring 2008 (Table 2.4-12 to Table 2.4-15). Similar to fall 2007, Diptera was the dominant group both numerically (81.1%) and by number of taxa (15) in spring 2008. The EPT group comprised 13.8% of the macroinvertebrates and a large number of the total taxa (27 genera).

For Station 1, a total of 1,510 organisms and 44 taxa was collected (Table 2.4-12). Diptera was most abundant comprising 65.2% of organisms with most of the dipterans being in the family

Chironomidae. The EPT group was also common comprising 25.7% of macroinvertebrates. The mayfly *Eurylophella* was the dominant EPT taxon, comprising 18.1% of the macroinvertebrates.

At Station 2, a total of 43 taxa and 3,765 organisms was collected (Table 2.4-13). Diptera was the dominant group, accounting for 60.0% of organisms. The blackfly *Prosimulium* was the most numerous taxon comprising 53.8% of all organisms. The EPT group accounted for 22.4% of organisms and 21 taxa. Several mayflies were numerous with Ephemerella being the dominant EPT taxon, accounting for 6.2% of all organisms.

A total of 2,481 organisms and 35 taxa was collected from Station 4 (Table 2.4-14). Diptera was the predominate group comprising 72.7% of all organisms. Of these, Chironomidae was the dominant organism accounting for 63.5% of the total. The EPT group accounted for 20.4% of organisms and 13 taxa with the mayfly *Ephemerella* being most numerous at 11%.

At the most downstream location, Station 5, a total of 7,472 organisms and 24 taxa was collected (Table 2.4-15). The blackfly *Prosimulium* was the predominate organism accounting for 83.9% of the total. The EPT group comprised 4.9% of the total with 9 taxa from the group being identified.

Summer

A total of 7,247 organisms and 59 taxa was collected from Walker Run during the summer of 2008 (Table 2.4-25 through Table 2.4-29). Similar to both fall 2007 and spring 2008, Diptera was the most abundant group both numerically (30.9%) and by number of taxa (13). The EPT group comprised a large number of the total taxa with 22 being identified.

At Station 1, a total 1,233 organisms and 36 taxa was collected (Table 2.4-25). Diptera was the most abundant group comprising 44.3% of all organisms, with Chironomidae accounting for a large proportion of the group at 41.8%. The EPT group accounted for 28.5% of all organism and 12 taxa with the caddisfly Cheumatopsyche being most numerous at 13.4%.

For Station 2, a total of 689 organisms and 31 taxa was collected (Table 2.4-26). Diptera was the most abundant group comprising 41.9% of organisms with most of the dipterans being in the family Chironomidae. The EPT group was also common, comprising 33.1% of the macroinvertebrates and 13 taxa. The mayfly Baetis was the dominant EPT taxon comprising 12.5% of all organisms.

Station 4 yielded a total of 1,796 organisms and 36 taxa (Table 2.4-27). Trichoptera was the most abundant group, comprising 47.1% of all organisms. A majority of the trichopterans were Cheumatopsyche (29.7%) and Hydropsyche (11.1%). Overall, the EPT group comprised 54.0% of all organisms with the afformentioned Cheumatopsyche being the most abundant taxon within the group. A total of 12 EPT taxa was collected.

At Station 5, a total of 774 organisms and 33 taxa was collected (Table 2.4-28). Trichoptera was the most abundant group, comprising 44.1% of all organisms with Chimarra being the most numerous organism in the group (24.9%). A total of 14 EPT taxa was collected and this group comprised 63.8% of all organisms.

Station 6, the most upstream station, yielded 2,755 organisms and 34 taxa (Table 2.4-29). Ephemeroptera was the dominant group accounting for 33.7% of all organisms with Baetis being

the most numerous organism in the group (23.8%). A total of 13 EPT taxa was collected which comprised 60.9% of all organisms.

The macroinvertebrate community present in Walker Run was diverse and representative of a small coolwater stream in eastern Pennsylvania. Almost half of the taxa were comprised of the EPT group. Taxa within this group are generally considered intolerant to most types of water pollution and habitat degradation. The benthic macroinvertebrates present in Walker Run are indicative of a healthy, clean-water stream community.

For the most part, species abundance and composition was similar among stations and between seasons. However, one notable exception was the large "bloom" of the blackfly *Prosimulium* at Stations 2, 4, and 5. Most species within this genus mature in the spring and can be highly abundant if habitat conditions are especially favorable (Adler, 1986). These habitat conditions include swift currents for feeding and stable, size-specific substrate for attachment. Both of these parameters were present at Stations 2, 4, and 5 and appear to explain the large abundance of blackfly in each of the areas.

No rare, threatened, endangered, or species of special concern were collected and none were identified during agency coordination. Additionally, based on the Pennsylvania Natural Diversity Inventory database no rare, threatened, endangered or species of special concern are thought to occur within the Walker Run watershed (PFBC, 2008).

Water quality data for Walker Run is provided in Table 2.3-43.

2.4.2.1.3 North Branch Canal

The composition of the fish assemblage in the Canal is similar to the fish assemblage in Lake Took-a-While which consists mainly of sunfish, bass, cyprinids (minnows), and catfish (Ecology III, 2000). The Lake is hydrologically connected to the Canal and is located approximately 0.25 mi (0.4 km) from the proposed BBNPP intake structure at the Susquehanna River. The fish community in the Lake is typical of other warmwater lentic waterbodies in Pennsylvania. No Threatened, Endangered, or Species of Special Concern are believed to inhabit the Canal. Fish of recreational importance are likely present in the Canal and anglers can apparently gain access to sections the Canal away from the BBNPP OCA.

2.4.2.1.4 Unnamed Tributary 2

A total of 8,161 organisms and 16 taxa was collected from Unnamed Tributary 2 (Table 2.4-30). The macroinvertebrate community was dominated by the amphipod Gammarus which comprised 95.9% of all organisms. A single EPT taxon, the mayfly Baetis, was collected which comprised 0.3% of the collection.

2.4.2.1.5 Important Species

Benthic macroinvertebrates are useful indicator organisms that can be used to monitor the potential impacts of the construction or operation of BBNPP on Walker Run (EPA, 1999). In particular, the three insect orders Ephemeroptera, Plecoptera, and Trichoptera (EPT) are commonly used as a monitoring tool (Wallace, 1996). The EPT grouping is commonly utilized because this group is generally considered to be intolerant of many forms of water pollution and habitat degradation. Tracking the abundance and distribution of these groups will elucidate water quality changes that occur as a result of construction or operation of the plant. Occurrence and

numbers of species within these three insect orders will be useful in estimating changes in the distribution and abundance of sensitive species. Additionally, macroinvertebrates are an important part of the trophic structure of aquatic systems. These organisms provide a food source for most of the fishes collected in Walker Run. In turn, these insectivorous fishes provide a forage base for piscivorous fishes and other animals.

2.4.2.1.6 Nuisance Species

No nuisance species were collected or are known to be present onsite within the ponds, streams, or other waterbodies.

2.4.2.1.7 Habitat Importance

The on-site streams (Walker Run, Unnamed Tributary 2), North Branch Canal, and ponds are typical habitats found throughout eastern Pennsylvania. None of these waterbodies are of regional significance in terms of either unique habitat or utilization by a rare species, although headwaters are important components of stream ecosystems and locally the waters appear to support important ecological functions. Much of the recent scientific literature promotes the protection of headwaters streams and the role they play in determining downstream water quality (Lowe, 2005). Both Walker Run and Unnamed Tributary 2 are important in this respect.

Reconstruction of a small section of Walker Run (approximately 1000 ft (305 m)) along the western boundary of the BBNPP site may result in temporary disruption of both benthic and fish community habitat in this section. After re-routing, it is expected that the former community will recolonize the created stream section within a fairly short time frame. The section of stream to be relocated does not follow a natural course and was previously channelized for agricultural purposes. The banks are incised and show signs of extensive erosion. The relocated channel will be west of the existing channel, closer to Market St. The relocated stream channel will be constructed to incorporate natural features of the stream similar to a reference section of Walker Run. The method called Natural Channel Design will be used for the new channel construction. Construction of the new channel will adhere to the PADEP Chapter 105 regulations (PA, 1978). The new channel will be constructed, habitat features added and bank vegetation will be established prior to diverting stream flow into the new channel. The new channel will be constructed with both riffle and pool habitats. Meanders will be created to mimic the reference channel. Rock substrate will be added to the channel to create habitat for benthic macroinvertebrates and fish. The banks will be constructed to minimize erosion and will be stabilized with native vegetation, and the riparian area will be planted with native vegetation. The restoration goal for the relocated portion of Walker Run is to create habitat in the constructed channel that is similar to the reference condition. Success shall be measured in terms of establishment of fish and benthic macroinvertebrate communities similar to reference sections of Walker Run.

Farm Pond will be filled which will eliminate the aquatic community within it. All of the aquatic species collected on site are common in the region and actions taken during construction and operation are not anticipated to cause loss of critical habitat in the ponds, streams or Canal.

2.4.2.1.8 Pre-existing Environmental Stresses

No pre-existing environmental stresses have been identified in either the on-site ponds or streams. However, the historic land use within much of the site was agriculture, which included row crop planting and the associated land disturbances from these activities. The section of

Walker Run in the vicinity of Station 2 appears to have been previously channelized and its flow pattern has not reverted back to what would be considered its natural course. It also appears that the section of the east fork of Walker Run that flows through the agricultural fields has been straightened. No pre-existing environmental stresses have been identified in the man-made Canal.

2.4.2.2 Susquehanna River

The proposed BBNPP site is on the west bank of the Susquehanna River about 5 mi (8 km) upstream of Berwick and about 22 mi (35 km) downstream of Wilkes-Barre. Major upstream tributaries include the Lackawanna and the Chemung rivers. The total drainage area above the site is nearly 10,240 square mi (26,522 km^2). Additional description of the River in vicinity of site is provided in Section 2.3.1.1.1.

Detailed description of Hydrology is given in Section 2.3.1.1.1.3.

Detailed description of Physiochemistry is given in Section 2.3.1.1.1.

2.4.2.2.1 Aquatic Biota Sampling

Recent surveys of the fish community present in the Susquehanna River were completed from 2004 through 2007 (Ecology III 2005; Ecology III, 2007a; Ecology III, 2007b; Ecology III, 2008). Sampling was performed both upstream and downstream of SSES, which spatially conforms to being upstream and downstream of the proposed BBNPP intake and discharge locations. Fish were collected monthly in the spring, summer, and fall. Five collections were completed during 2004, 2005, and 2007. Only three collections were completed during 2006 due to high river flows that prevented normally scheduled sampling. Both boat electrofishing and seining were used to collect fish. Two sections of the river on both shorelines were surveyed, one upstream of the SSES intake and one downstream of the SSES intake at Bell Bend (Figure 2.4-4). Additional fish sampling was completed during the summer of 2008.

Benthic macroinvertebrates were collected from two locations in the Susquehanna River, one station upstream and one station downstream of SSES during summer 2007 and summer 2008. Replicate samples were collected at each of the stations from the river bottom using a 1.75 ft^2 (0.163 m^2) dome suction sampler. Figure 2.4-5 identifies the location of the macroinvertebrate sample stations.

A qualitative mussel survey was performed during fall 2007 to determine the community composition of mussels inhabiting the Susquehanna River upstream and downstream of the proposed BBNPP intake and discharge structures (Figure 2.4-6). At the time of the survey, the exact locations of the proposed intake/discharge structures were unknown, thus the survey effort focused on the approximate locations which are in the vicinity of the SSES intake and discharge structures. Surveys were completed by wading and viewing the river bottom with and without the aid of a transparent-bottom bucket. Only wadeable sections of the river were surveyed.

2.4.2.2.2 Fish Community

A total of 20 species and 1,034 individual fish was collected by seining at the SSES (upstream) station from 2004 to 2007 (Table 2.4-16). A majority of the species collected were from three families: Cyprinidae (minnow family), Centrarchidae, and Percidae (perch family). Two cyprinids

were numerically dominant, spotfin and spottail shiner, comprising 40.4% and 23.5% of the catch, respectively. Other abundant taxa included white sucker (13.3%) and bluntnose minnow (7.7%). Year-to-year variation was evident in both numbers of individuals and number of species collected. Greater numbers of individuals (434) and species of fish (14) were collected during 2007 than any other year. At Bell Bend (downstream) a total of 19 species and 3,664 individuals was collected by seining from 2004 to 2007 (Table 2.4-17). Similar to the SSES station, most of the collected species were from three families: Cyprinidae, Centrarchidae, and Percidae. The dominant taxa numerically were spotfin shiner (49.8%) and spottail shiner (26.1%); white sucker (14.3%) and bluntnose minnow (5.4%) were also abundant. Year-to-year variation was more pronounced than at the upstream station with significantly fewer individuals and species collected during 2006 than the other years as a result of fewer sampling events during 2006.

Twenty-one fish species and 1,921 individuals were collected by electrofishing at SSES from 2004 to 2007 (Table 2.4-18). Centrarchidae made up a large portion of the total catch and seven species from this family were collected. The dominant taxa were smallmouth bass (21.6%), walleye (16.1%), quillback (11.8%), northern hog sucker (11.0%), shorthead redhorse (8.3%), and rock bass (8.1%). Fewer species and numbers of fish were collected during 2006 than the other years as a result of fewer sampling events in 2006. At Bell Bend, 1,971 individuals representing 23 fish species were collected by electrofishing from 2004 to 2007 (Table 2.4-19). Similar to the SSES station, Centrarchidae was the dominant fish family with seven species being collected. Smallmouth bass was the dominant taxon representing 30.2% of the total catch. Other abundant species included: walleye (19.3%), quillback (12.6%), and rock bass (8.2%). Inter-annual variation was evident with fewer species and individuals collected during 2006 than the other sample years coincident with fewer sampling events during 2006.

Similar fish assemblages were present upstream and downstream of the proposed intake/ discharge structures, although fewer fish were collected at the upstream seining station in comparison to the downstream station. Seasonal fish abundance and distribution was also similar between the stations. The fish assemblage in this reach of River is similar to other sections of the River, both upstream and downstream. Additionally, the fish community is similar to other large rivers in Pennsylvania (NAI, 1996).

All of the fish species collected via seining and electrofishing are year-round residents of the Susquehanna River in the vicinity of the BBNPP site. No migratory fish species were collected.

Historically, two migratory species, the American shad and American eel, were abundant within this reach of the Susquehanna River (PFBC, 2003). However, construction of four large hydroelectric dams (Conowingo, Holtwood, Safe Harbor, and York Haven Dam) in the lower reaches of the Susquehanna River stopped up-river migration of fish. At the present time few American eel and no adult American shad are present within the River in the vicinity of BBNPP.

The PFBC has been working toward American shad restoration in the Susquehanna River for many years (PFBC, 2003). This effort has primarily focused on hatchery culture and stocking of larval American shad and installation of fish passage structures to aid upriver migration past the dams. Technical difficulties related to successful use of the fish passage structures by American shad have resulted in limited numbers of shad successfully migrating upstream of the fourth (York Haven) large hydroelectric dam on the River. Upriver migration of adult American shad has not yet been documented in the upper reaches of the River in the vicinity of BBNPP.

2.4.2.2.3 Sport Fishery

Numerous recreationally important fishes are present in the Susquehanna River in the vicinity of BBNPP including smallmouth bass, muskellunge, northern pike, channel catfish, walleye, yellow perch, bluegill, and redbreast sunfish. Creel surveys performed during 1986 near BBNPP indicated that the majority of anglers fished for walleye, muskellunge, and smallmouth bass and that walleye, smallmouth bass, and channel catfish were the species most often caught (PPL, 2006). Although no recent creel data are available, anecdotal evidence suggests that these same species continue to be sought and harvested by fishermen near the BBNPP site. Additionally, the number of anglers targeting smallmouth bass seems to have increased, partly related to larger numbers of smallmouth in the river and the growing popularity of this species among anglers.

No commercial fishing occurs in the Susquehanna River in vicinity of BBNPP.

2.4.2.2.4 Macroinvertebrate Community

The macroinvertebrate community present in the Susquehanna River is diverse and characteristic of a large river system. Three groups were dominant at the two sample stations: Ephemeroptera (mayflies), Coleoptera (beetles), and Mollusca (snails and clams). Many taxa were present in relatively low proportions (less than 2%); a large proportion of the total number of organisms was contributed by a few taxa including the mayfly *Anthopotamus*, a beetle *Stenelmis*, and fingernail clam *Musculium*. A summary of the specific characteristics of the macroinvertebrates at each of the four stations follows.

A total of 35 taxa and 1,550 organisms were collected in the SSES replicate I sample during 2007 (Table 2.4-20). Two groups, Coleoptera and Mollusca, were essentially co-dominant representing 35.4% and 35.0% of the macroinvertebrates at the station. Three taxa comprised a large portion of the macroinvertebrates: the riffle beetle *Stenelmis* (35.0%), fingernail clam *Musculium* (32.3%), and mayfly *Anthopotamus* (10.3%). Overall the benthic community was numerically dominated by few taxa. A total of 18 EPT taxa was collected which comprised 19.1% of the benthic community. Of particular interest, however, was the collection of a single individual of the green floater (*Lasmigona subviridis*), a mussel that is imperiled throughout much of its range. For SSES replicate II a total of 1,890 organisms and 30 taxa was collected (Table 2.4-21). Ephemeroptera and Coleoptera were the dominant groups comprising 27.7% and 29.9% of the macroinvertebrates. The Ephemeroptera group was comprised mostly of one taxon, the mayfly Anthopotamus (25.0%). Similarly, the beetle group Coleoptera was dominated by one taxon, the riffle beetle Stenelmis (29.8%). EPT taxa were a large component of the benthic community with 19 EPT taxa comprising 36% of the sample.

For Bell Bend replicate I, a total of 1,486 organisms and 30 taxa was collected (Table 2.4-22). The mayflies, Ephemeroptera, were dominant comprising 33.1% of the macroinvertebrates followed by Mollusca (22.3%) and Coleoptera (15.4%). Three taxa were abundant and comprised over 50% of the macroinvertebrates and they include: Anthopotamus (24.6%), Stenelmis (15.1%), and Chironomidae (14.7%). A total of 13 EPT taxa was collected, 35.7% of the total. A total of 33 taxa and 1,690 individuals was collected from Bell Bend replicate II (Table 2.4-23). Mollusca and Ephemeroptera were numerically dominant comprising 34.7% and 27.4 % of total, respectively. Two taxa within these groups were numerically dominant, Anthopotamus at 19.6% and Corbicula at 17.5%. EPT comprised 30.3% of the organisms and a total of 16 EPT taxa was collected.

The Susquehanna River macroinvertebrate community at each station was similar. No significant difference existed between the upstream and downstream station or among replicates. The observed differences are largely explained by the heterogeneous or patchy distribution of aquatic macroinvertebrates. Both the upstream and downstream replicates were comprised of many taxa (primarily within the EPT group) that are intolerant of many forms of pollution and do not live in degraded waters. The EPT group varied from 13 to 18 taxa with one taxon, Anthopotamus, being dominant at each of the four stations.

2.4.2.2.5 Mussel Community

Live individuals of five species of mussels were observed during the 2-day mussel survey effort (Table 2.4-24). No mussels were observed at Station 4. However, most or all five species were collected from each section of the river that was surveyed. With the exception of the eastern elliptio, dozens of individuals of each species were collected.

None of the collected species is listed as threatened or endangered by the Commonwealth of Pennsylvania or the Federal government. However, one species that was collected, the yellow lampmussel (*Lampsilis cariosa*), is considered to be a species of special interest by the Pennsylvania Fish and Boat Commission. Also, a single specimen of a species that is thought to be rare in Pennsylvania, the green floater (*Lasmigona subviridis*), was collected in a benthic macroinvertebrate dome sample. The survey results show the relatively wide distribution and common occurrence of four species of mussels, including the yellow lampmussel, in the vicinity of the proposed plant.

Susquehanna River water quality data are presented in Table 2.3-41 and Table 2.3-42.

2.4.2.2.6 Important Species

Two species of mussels were identified as being species of special concern according to the Pennsylvania Natural Diversity Inventory and recent coordination with the PFBC (PFBC, 2008). Eight species of fish were also deemed important species because of their recreational value. Additionally, several species of fish are important as a food source (forage fish) for many of the recreationally important fish species. Fish descriptions taken from Cooper (1983) and Smith (1985).

Yellow Lampmussel

Yellow lampmussel (*Lampsilis cariosa*) was collected during mussels surveys completed near SSES intake/discharge structures during fall 2007. The yellow lampmussel is a medium sized mussel attaining a maximum length of 4.9 in (125 mm). It commonly inhabits medium to large rivers but is known from lakes and ponds in the northern part of its range. Yellow lampmussel is distributed from Novia Scotia south to Georgia and west to West Virginia. This species occurs in the Susquehanna and Delaware River drainages in Pennsylvania, and its populations are considered to be vulnerable to relatively stable by the Pennsylvania Natural Heritage Program (PNHP, 2007a). Though it appears to be relatively abundant within the main stem Susquehanna River, it is less common in tributaries and other river systems. Its preferred substrate includes sand, silt, cobble, and gravel, especially in riffles and flowing portions of rivers. White perch and yellow perch are the only known larval host for this species (PNHP, 2007a). The yellow lampmussel is thought to be mildly tolerant of eutrophication and siltation and intolerant of toxins.

Green Floater

A single green floater (*Lasmigona subviridis*) was present in a benthic macroinvertebrate sample collected with a dome sampler upstream of the SSES intake during summer 2007. The collection location of this individual was within the vicinity of where the mussel survey was completed. The green floater is a mussel that is categorized as imperiled throughout much of its historic range by the Pennsylvania Natural Heritage Program (PNHP, 2007b). It occurs throughout the Atlantic Slope from North Carolina to New York, as well as in the Kanawha River basin in West Virginia. This species is not common in Pennsylvania, but has been collected in the Susquehanna, Delaware, and Ohio River Drainages. It is a small mussel that is typically less than 2.2 in (55 mm) in length that prefers to inhabit gravel and sand substrate in water depths of 1 to 4 ft (0.3 to 1.2 m). This species inhabits pools and other calm areas of hydrologically stable creeks and rivers and it is intolerant of strong currents (Strayer, 1997). A decline in population numbers of this species has occurred throughout much of its range. The green floater is hermaphroditic and the hosts for its larval stage (glochidia) are not known.

Smallmouth Bass

Smallmouth bass (*Micropterus dolomieu*) was extremely abundant in fish surveys in the Susquehanna River. The species is widely distributed in streams and rivers throughout Pennsylvania. It is not native to the Susquehanna River drainage, and has successfully spread to all of the major drainages in Pennsylvania. It is a spring spawner that builds nests over gravel in shallow water, often along the shoreline. Male smallmouth bass construct and guard the nest. Smallmouth bass is an opportunistic feeder consuming insects, crayfish and other fish. This species is considered one of North America's most prized game fish.

Northern Pike

Only a few northern pike (*Esox lucius*) were collected during fish surveys. However, this species is an important sport fish in Pennsylvania and is stocked by the PFBC in order to develop sport fisheries throughout the state. This species is not native to the Susquehanna River drainage. It is a spring spawner that migrates into flooded marshes and spawns over vegetation and debris. Spawning success is variable in many of the waters in which this species has been introduced. Northern pike are often stressed by warm summer temperatures in Pennsylvania, and is therefore most successful in deep mesotrophic reservoirs. Adults of this species have extensive feeding territories and it is one of the largest predatory fish in Pennsylvania.

Muskellunge

Similar to northern pike, only a few muskellunge (*Esox masquinongy*) were collected during fish surveys. It also has been stocked throughout Pennsylvania and is not native to the Susquehanna River drainage. Muskellunge spawn in the spring. They move into shallow water areas and broadcast their eggs over submerged aquatic vegetation and debris. Spawning success is variable in many of the waters in which this species has been introduced. Adult muskellunge have a smaller home range than northern pike and it is also one of the largest predatory fish in Pennsylvania.

Walleye

Walleye (*Stizostedion vitreum*) was abundant in electrofishing surveys in the Susquehanna River. Walleye is a popular food and game fish. This species has been introduced into the Susquehanna River drainage. Along with northern pike and muskellunge, walleye are a top fish

predator. Walleye spawn in the spring and will migrate long distances to spawn. Typically walleye return to the same spawning site year after year and spawn over gravel areas with swift currents. Adults are piscivorous and commonly feed upon yellow perch where the two species coexist. Walleye typically feed at night during much of the year.

Yellow Perch

Few yellow perch (*Perca flavescens*) were collected during fish surveys collected in the Susquehanna River. Yellow perch are widely distributed throughout North America. It is an early spring spawner that deposits eggs over vegetation, gravel, and rubble in shallow water. Adult yellow perch feed on a wide variety of organisms including small fish, crayfish and other large invertebrates. Yellow perch normally form schools of many individuals and it provides a forage base for walleye.

Channel Catfish

Channel catfish (*Ictalurus punctatus*) was common in electrofishing surveys in the Susquehanna River. This species has been widely introduced to many waters across North America and was introduced to the Susquehanna River drainage. It provides excellent angling opportunity and is considered the most important catfish species in North America. Channel catfish spawn in the spring under logs, rocks and debris. Males guard the nest until shortly after the young hatch. This species is omnivorous and will consume a wide range of food items.

Bluegill

Bluegill (*Lepomis macrochirus*) was common in electrofishing surveys in the Susquehanna River. This species is widely distributed throughout rivers and lakes in Pennsylvania. The species spawns from spring through summer. The males guard the nests that are constructed in gravel and sand substrate. Bluegill are generalist feeders that consume zooplankton, invertebrates, and small fish. It prefers standing or slow water habitat where vegetation and shelter are present. Bluegill tend to form schools, particularly in the fall. This is a popular species that is sought after by anglers.

Redbreast Sunfish

Few redbreast sunfish (*Lepomis auritus*) were collected during fish surveys in the Susquehanna River. This species is widely distributed throughout Pennsylvania and is native to the Susquehanna River drainage. It is a spring through early summer spawner. Males construct and guard the nests. It is a general feeder consuming worms, mollusks, insects, and small fish.

Forage fish

Several species of fish are important as a food source for predatory fish within the River. Spotfin shiner (*Cyprinella spiloptera*) and spottail shiner (*Notropis hudsonius*) were extremely abundant in seining surveys performed in the Susquehanna River. These two species are likely among the two most important species of forage fish based upon their abundance and small size. Other species that are also provide a forage base for predatory fish include bluntnose minnow (Pimephales notatus) and larvae and juveniles of white sucker (Catostomus commersoni), northern hog sucker (*Hypentelium nigricans*), and quillback (*Carpiodes cyprinus*). These smaller

fishes provide an important food source for the previously discussed recreationally important fish species.

2.4.2.2.7 Key Aquatic Indicator Organisms

The macroinvertebrate community present within the Susquehanna River is expected to be a useful indicator of impacts associated with construction and operation of the plant. In particular, the EPT group is widely utilized as an indicator metric of the health of macroinvertebrate communities and the associated water quality (EPA, 1999). Tracking the abundance and distribution of these groups will help elucidate water quality changes that may have occurred as a result of construction or operation of the plant. Occurrence and numbers of species within these three insect orders will be useful in estimating changes in the distribution and abundance of sensitive species.

2.4.2.2.8 Nuisance Species

The Asiatic clam (*Corbicula fluminea*) is the only known nuisance species to occur in the Susquehanna River in the vicinity of the BBNPP site. It was not present in the macroinvertebrate collections taken in 1994 (Ecology III, 1995), which were the most recent until the sampling performed in 2007. But it has successfully established a population in this section of the river over the past few years. In the macroinvertebrate samples collected in 2007 Asiatic clam numerically accounted for nearly 7% of the macroinvertebrates collected in the vicinity of the BBNPP site.

No other nuisance species are known from the Susquehanna River in vicinity of BBNPP site. However, the zebra mussel (*Driessena polymorpha*) was recently confirmed in the Susquehanna River upstream of Great Bend, approximately 65 mi (105 km) upriver of the BBNPP site, during fall 2007 by PADEP. Previously, zebra mussels were discovered in Cowanesque Lake, Tioga County, Pennsylvania during the summer of 2007. This lake is located approximately 170 river mi (274 km) upstream from the BBNPP site. The zebra mussel was also confirmed to be present in the main stem Susquehanna River in Goodyear Lake which is located in New York. Goodyear Lake is the first major impoundment on the main stem Susquehanna River and is located approximately 240 river mi (386 km) up-river of the BBNPP site.

It is probable that the down-river migration of zebra mussels will continue and that sometime in the near future they will be present in the river near BBNPP.

2.4.2.2.9 Habitat Importance

The Susquehanna River in the vicinity of the proposed BBNPP intake/discharge structures is functionally similar to and composed of habitats that are common both upstream and downstream in the River. All of the fish species that inhabit the River are common in the area. No loss of critical habitat is expected within the River. Additionally, there are no known unique spawning or nursery areas within the vicinity of the proposed BBNPP intake/discharge structures.

2.4.2.2.10 Preexisting Environmental Stresses

Susquehanna River water quality was degraded by a long legacy of mining and other anthropogenic sources. However, water quality in the Susquehanna River in the vicinity of the BBNPP site has improved steadily since the early 1970's (PPL, 2006). The water quality improvements have been attributed to a reduction in acid mine drainage pollutants from

upstream sources and a reduction in point source pollutants from upstream municipal water treatment plants and industries. The most obvious water quality improvement has been the reduction in total iron levels along with decreasing concentrations of several other water quality indicators including turbidity, sulfate, and total suspended solids.

2.4.2.3 Offsite Unnamed Tributaries

Two unnamed tributaries were scheduled for benthic macroinvertebrate and fish surveys. The locations of Unnamed Tributary 1 and Unnamed Tributary 3 are provided in Figure 2.4-3. Both tributaries flow directly into the Susquehanna River. These tributaries were selected for monitoring because their watersheds are adjacent to or within the BBNPP OCA boundary. No direct impact from construction or other on-site activities will occur within the streams. However, it is possible that runoff from the BBNPP site could affect these streams, as such, these waters were evaluated during the summer of 2008.

Unnamed Tributary 1 was completely dry at the intended time of sampling and was not sampled. It is a small intermittent stream that flows through a forested patch of land near the assessment location. Stream channel width ranged to 5 ft (1.5 m). Unnamed Tributary 3 had limited flow during sampling. This section of stream flowed through a narrow forested patch of land and stream width ranged to 5 ft (1.5 m). The stream was mostly fed by a small impoundment along Confers Lane. Upstream of this point the stream channel was dry.

A benthic macroinvertebrate survey was completed for Unnamed Tributary 3. Visual inspection of the stream reach near the benthic station indicated that no fish were present. Very little water was present in the stream channel (less than 1 inch (2.5 mm) in depth), thus standard fish collection protocols were not utilized.

A total of 444 organisms and 17 taxa was collected from Unnamed Tributary 3 (Table 2.4-31). Diptera was the dominant group comprising 73.4% of all organisms with Chironomidae accounting for 52.3% of the dipterans. The EPT group comprised 18.9% of all organisms and a total of 6 taxa was collected.}

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Table 2.4-1 {Important Terrestrial Species and Habitats at the BBNPP OCA}

(Page 1 of 4)

Name	Common Name	Description	Location	Rationale
Mammals				
Myotis sodalist	Indiana Bat	Small, insectivorous mammal. Favors sites under exfoliating bark of large, often dead, trees as roosting sites and maternity dens.	Known to occur in hibernacula within 5 miles (8 km) of BBNPP site but has not been observed on site to date (5/1/08).	Federal and Pennsylvania Endangered
Myotis leibii	Eastern Small-footed Myotis	Small, insectivorous mammal. Little known about habitat requirements.	Known to occur in hibernacula within 5 miles (8 km) of BBNPP site but not observed on site to date (5/1/08).	Pennsylvania Threatened
Neotoma magister	Allegheny Woodrat	Mammalian rodent that favors caves, cliff faces, boulder piles, and talus slopes along mountain tops.	Range includes BBNPP site but suitable habitat appears to be lacking and none have ever been observed on site to date (5/1/08).	Pennsylvania Threatened
Myotis septeuntrionalis	Northern Myotis	Small insectivorous mammal (bat). Favors tree cavities and exfoliating tree bark for maternity roosts.	Known to occur in hibernacula within 5 miles (8 km) of BBNPP site but not obwerved on site to date (5/2/08)	Pennsylvania Candidate Rare
Odocoileus virginianus	White-tailed Deer	Large, herbivorous mammal. Favors forest edge habitat. Game species	Observed in all terrestrial habitats at the BBNPP site and adjacent landscape.	Commercially and Recreationally Important
Ursus americanus	Black Bear	Large omnivorous mammal. Favors very dense vegetation, especially shrub-dominated wetland.	Tracks and scat located on BBNPP site.	Commercially and Recreationally Important
Microtus pennsylvanicus	Meadow Vole	Small mammalian rodent, primarily herbivorous, that provides prey base for carnivores.	Common, especially in herbaceous areas such as early-stage regeneration fields of the BBNPP site.	Ecologically Important
Peromyscus maniculatus	Deer Mouse	Small mammalian rodent, primarily insectivorous, that provides prey base for carnivores.	Common in most of the terrestrial habitats of the BBNPP site.	Ecologically Important
Peromyscus leucopus	White-footed Mouse	Small mammalian rodent, primarily insectivorous, that provides prey base for carnivores.	Common in most of the terrestrial habitats of the BBNPP site.	Ecologically Important
Birds				
Falco peregrinus	Peregine Falcon	Large predatory bird that specialized in feeding on other birds.	Nested along river within two miles of the BBNPP site in 2007 but not known to nest or perch on the proposed site itself.	Pennsylvania Endangered
Haliaeetus leucocephalus	Bald Eagle	Large, piscivorous (fish-eating) bird.	Known to nest within 10 miles (16 km) and sightings are increasingly common along adjacent areas of Susquehanna River.	Pennsylvania Threatened

Table 2.4-1 {Important Terrestrial Species and Habitats at the BBNPP OCA}

Name	Common Name	Description	Location	Rationale
Pandion haliaetus	Osprey	Large, piscivorous (fish-eating) bird.	Known to nest within 10 miles (16 km) and sightings are increasingly common along adjacent areas of Susquehanna River.	Pennsylvania Threatened
Meleagris gallopovo	Wild Turkey	Large upland game bird that fees on acorns, beechnuts, grapes, cherries, thornapples, grains, vegetation and insects.	Frequently observed in forests and fields at the BBNPP site.	Commercially and Recreationally Important
Piranga olivacea	Scarlet Tanager	Neotropical migratory bird that breeds in North America in late spring and early summer and winters in Central and South America in fall and winter. Favors large tracts of forest, especially forest with lots of dead or declining trees, for breeding territory.	Heard frequently throughout forested areas on the BBNPP site. Common in other forested areas in surrounding landscape based on previous ecological studies.	Ecologically Important
Reptiles				
Pseudemys rubriventris	Redbelly Turtle	Turtle that feeds primarily on aquatic vegetation and algae and secondarily on crayfish, snails, fish, and tadpoles.	Known to occur in Luzerne County though none were observed at the site to date (5/1/08)	Pennsylvania Threatened
Crotalus horridus	Timber Rattlesnake	Large poisonous snake that feeds primarily on small mammals and birds. Favors rocky, mountainous terrain.	Known to occur in Luzerne County but has not been observed on site to date (5/1/08).	Pennsylvania Candidate.
Heterodon platyrhinos	Eastern Hognose Snake	Snake that favors grasslands and open forests near water and dry sandy soil where they can burrow. They feed primarily on toads and frogs.	The range of the hognose snake includes the BBNPP site but none have been observed on the site to date (5/1/08).	Pennsylvania Species of Special Concern
Amphibians				
Scaphiopus holbrookii	Eastern Spadefoot	Toad that requires temporary bodies of water for breeding. They feed primarily on worms and arthropods.	The range of the eastern spadefoot includes the BBNPP site but none have been observed on the site to date (5/1/08).	Pennsylvania Endangered
Insects				
Enodia anthedon	Northern Peary-eye	Butterfly that feeds on dung, fungi, carrion, and sap from willows, poplars, and birch. Caterpillar hosts include various grasses.	Known to use area just east of the site, by Rt. 11, and may be found on site.	Originally identified as Pennsylvania Vulnerable. No longer tracked by PNDI

Table 2.4-1 {Important Terrestrial Species and Habitats at the BBNPP OCA}

Name	Common Name	Description	Location	Rationale
Polites mystic	Long Dash	Butterfly that feeds on nectar from flowers including common milkweed, selfheal, mountain laurel,. Caterpillar hosts are bluegrasses.	Known to use area just east of the site, by Rt. 11, and may be found on site.	Originally identified as Pennsylvania Vulnerable. No longer tracked by PNDI
Poanes massasoit	Mulberry Wing	Butterfly that feeds on flower nectar. Caterpillar host is uptight sedge.	Known to use area just east of the site, by Rt. 11, and may be found on site.	Pennsylvania Vulnerable
Euphydryas phoeton	Baltimore Checkerspot	Butterfly that feeds on nectar from milkweed, viburnum, and wild rose.	Known to use area just east of the site, by Rt. 11, and may be found on site.	Pennsylvania Vulnerable
Euphyes conspicua	Black Dash	Butterfly that feeds on nectar from buttonbush, jewelweed, and swampthistle. Caterpillar hosts are sedges.	Observed on the BBNPP OCA. Captured a pair and observed eight or ten more during a butterfly survey.	Pennyslvania Vulnerable
Plants				
Prunus serotina	Black Cherry	Deciduous Tree	Common tree of upland forests.	Commercially Important
Acer rubrum	Red Maple	Deciduous Tree	Dominant overstory species in most upland and wetland forests.	Ecosystem Critical
Betula nigra	River Birch	Deciduous Tree	Dominant tree of forested wetlands in the Susquehanna Riverlands.	Ecosystem Critical
Lindera benzoin	Spicebush	Deciduous Shrub	Most commonly occurring shrub in upland and wetland forests.	Ecosystem Critical
Symplocarpus foetidus	Shunk Cabbage	Perennial Forb	Forms a dense groundcover in most forested wetlands.	Ecosystem Critical
Solidago candaadensis	Canada goldenrod	Perennial Forb	Dominant species of old field habitat.	Ecosystem Critical
Habitats				
Palustrine Emergent Wetlands		Dominated by hydrophytic herbaceous plants typical of poorly drained soils.	Present throughout the site with the largest areas adjacent to Walker Run.	Wetland
Palustrine Scrub/Shrub Wetlands		Dominated by spicebush, highbush blueberry, alders, meadowsweet, arrow-wood, silky dogwood and grey dogwood.	A component of wetland communities across the site.	Wetland
Palustrine Forested Wetlands		Dominated by red maple, pin oak, black gum, silver maple and river birch.	Principal wetland type within the OCA within large contiguous blocks extending across the western section of this area.	Wetland

Table 2.4-1 {Important Terrestrial Species and Habitats at the BBNPP OCA}

Name	Common Name	Description	Location	Rationale
Susquehanna Riverlands Environmental Preserve		A 1,200 acre (486 hectares) preserve consisting of a wide variety of upland and wetland habitats along the eastern and western banks of the Susquehanna River. Includes a 400-acre public recreation area.	Approximately 1 mile (1.6 km) east of the power block and the location for the intake/ discharge structure.	Private-Owned Preserve

Table 2.4-2 {Pennsylvania Mammals Observed or that are likely to Occur in the Vicinity of BBNPP Site}

Common Name	Scientific Name	Status	Habitat	Behavior	Observations
Marsupiala (pouched mammals)					
Didelphidae (New World Opossums)					
Virginia opossum	*Didelphis virginiana*	C	G	N,C	O
Insectivora (shrews and moles)					
Soricidae (shrews)					
masked shrew	*Sorex cinereus*	C	G	A	
long-tailed shrew	*Sorex dispar*	I	M,R		
Maryland shrew	*Sorex fontinalis*	C	G	A	
smoky shrew	*Sorex fumeus*	C	M,D,X	A	
pygmy shrew	*Sorex hoyi*	C	G	A	
water shrew	*Sorex palustris*	R,T	M,S	A	
northern short-tailed shrew	*Blarina brevicauda*	C	G	A	O
least shrew	*Cryptotis parva*	E	A,N	A	
Talpidae (moles)					
hairy-tailed mole	*Parascalops breweri*	C	G	A,Y	
eastern mole	*Scalopus aquaticus*	C	G	A,Y	
star-nosed mole	*Condylura cristata*	C	W,S	A,Y	
Chiroptera (bats)					
Vespertilionidae (plain-nosed bats)					
eastern small-footed myotis	*Myotis leibii*	T	S	H	
little brown myotis	*Myotis lucifugus*	C	L,S	H	
northern myotis	*Myotis septentrionalis*	R	L,S	H	
Indiana myotis	*Myotis sodalis*	E	S	H	
red bat	*Lasiurus borealis*	U	X	M	
hoary bat	*Lasiurus cinereus*	U	X	M	
seminole bat	*Lasiurus seminolus*	U	G,H		
silver-haired bat	*Lasionycteris noctivagans*	R	X	M	
eastern pipistrelle	*Pipistrellus subflavus*	C	C,S	H	
big brown bat	*Eptesicus fuscus*	C	C	H	
evening bat	*Nycticeius humeralis*	R	G,H	T,H	

Table 2.4-2 {Pennsylvania Mammals Observed or that are likely to Occur in the Vicinity of BBNPP Site}

Common Name	Scientific Name	Status	Habitat	Behavior	Observations
Lagomorpha (rabbits and hares)					
Leporidae					
eastern cottontail	*Sylvilagus floridanus*	C	B,G	A,Y	O
Appalachian cottontail	*Sylvilagus obscurus*	A	M	A,Y	
snowshoe hare	*Lepus americanus*	A	M,C	N,Y	
Rodentia (gnawing mammals)					
Sciuridae (squirrels)					
eastern chipmunk	*Tamias striatus*	C	G	D,H	O
woodchuck	*Marmota monax*	C	B,N,A	D,H	O
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	I	N,A	D,H	
gray squirrel	*Sciurus carolinensis*	C	D,G	D,T	O
fox squirrel	*Sciurus niger*	R,E,C	D,A	D,T	
red squirrel	*Tamiasciurus hudsonicus*	C	D,X	D,T	O
northern flying squirrel	*Glaucomys sabrinus*	I	X,C	N,T	
southern flying squirrel	*Glaucomys volans*	C	D,X	N,T	
Castoridae (beavers)					
beaver	*Castor canadensis*	C	S,L	C,Y	T
Cridetidae (native rats, mice, and voles)					
white-footed mouse	*Peromyscus leucopus*	C	G	N	
deer mouse	*Peromyscus maniculatus*	C	G	N	
Allegheny woodrat	*Neotoma magister*	T	M,R	N,Y	
southern red-backed vole	*Clethrionomys gapperi*	C	X,C,R	N	
rock vole	*Microtus chrotorrhinus*	A	X,R	D,Y	
meadow vole	*Microtus pennsylvanicus*	C	N,W	A,Y	
woodland vole	*Microtus pinetorum*	C	D,A	A,Y	
common muskrat	*Ondatra zibethicus*	C	W,L,S	N	
southern bog lemming	*Synaptomys cooperi*	I	X,N,W	A,Y	
Muridae (old world rats and mice)					
Norway rat	*Rattus norvegicus*	C	H,A	N	
house mouse	*Mus musculus*	C	H,A	N	

Table 2.4-2 {Pennsylvania Mammals Observed or that are likely to Occur in the Vicinity of BBNPP Site}

Common Name	Scientific Name	Status	Habitat	Behavior	Observations
Zapodidae (jumping mice)					
meadow jumping mouse	*Zapus hudsonius*	C	N,A	H,N	
woodland jumping mouse	*Napaeozapus insignis*	C	M,S	H,N,C	
Erethizontidae (new world porcupines)					
porcupine	*Erethizon dorsatum*	C	M,X	N,Y	O
Carnivora (carnivores)					
Canidae (dogs and foxes)					
coyote	*Canis latrans*	C	G	A	O
red fox	*Vulpes vulpes*	C	B,A	N	T,S
gray fox	*Urocyon cinereoargenteus*	C	B,D	N	
Ursidae (bears)					
black bear	*Ursus americanus*	C	M,C,D	N	T,S
Procyonidae (raccoons)					
raccoon	*Procyon lotor*	C	G	N,T	T
Mustelidae (weasels, skunks, and otters)					
ermine	*Mustela erminea*	C	B,A	N	
long-tailed weasel	*Mustela frenata*	C	G	N	O
least weasel	*Mustela nivalis*	U	B,A	N	
mink	*Mustela vison*	C	W,S	C	
eastern spotted skunk	*Spilogale putorius*	A	R,M	D	
striped skunk	*Mephitis mephitis*	C	G	N	T
northern river otter	*Lutra canadensis*	A	S,L	A	
Felidae (cats)					
bobcat	*Felis rufus*	A	M,B,R	N	T
Artiodactyla (even-toed hoofed mammals)					
Cervidae (deer)					
wapiti or elk	*Cervus elaphus*	A	G	A	
white-tailed deer	*Odocoileus virginianus*	C	G	A	O

Table 2.4-2 {Pennsylvania Mammals Observed or that are likely to Occur in the Vicinity of BBNPP Site}

Common Name	Scientific Name	Status	Habitat	Behavior	Observations
Status:	Habitats:	Behavior:		Observations:	
C -Common	M - mountain woodlands	C - crepuscular		O - Observed	
I - Restricted	B - brush thickets, hedgerows	A - active day and night		S - Scat	
U - Undetermined	S - streams, rivers	M - migratory		T - Tracks/Signs	
R - Rare	N - grasslands	N - nocturnal			
A - At Risk	D - deciduous forests	Y - active year-round			
T - Threatened	A - agricultural lands, old fields	T - nests in tree hollows			
E - Endangered	H - near humans	H - hibernator			
	G- generalized habitat requirements	D - diurnal			
	R - rocky areas				
	W - marshes				
	L - lakes, ponds				
	C - coniferous forests				
	X - mixed forests				

Table 2.4-3 {Birds Observed or Likely to Occur in the Vicinity of BBNPP OCA}

Common Name	Scientific Name	Status	NAI	IBA	IBA(breeding)	BBA 84-89	BBA 04-08
Snow Goose	*Chen caerulescens*	Regular	O	X			
Brant	*Branta bernicla*	Regular		X			
Canada Goose	*Branta canadensis*	Regular	X	X	X	X	X
Mute Swan	*Cygnus olor*	Regular					
Tundra Swan	*Cygnus columbianus*	Regular		X			
Wood Duck	*Aix sponsa*	Regular	X	X	X	X	X
Gadwall	*Anas strepera*	Regular		X			
American Wigeon	*Anas americana*	Regular	O	X			
American Black Duck	*Anas rubripes*	Regular	O	X	X	X	
Mallard	*Anas platyrhynchos*	Regular	X	X	X	X	X
Blue-winged Teal	*Anas discors*	Regular		X			
Northern Shoveler	*Anas clypeata*	Regular		X			
Northern Pintail	*Anas acuta*	Regular		X			
Green-winged Teal	*Anas crecca*	Regular	O	X			
Canvasback	*Aythya valisineria*	Regular					
Redhead	*Aythya americana*	Regular		X			
Ring-necked Duck	*Aythya collaris*	Regular	O	X			
Greater Scaup	*Aythya marila*	Regular		X			
Lesser Scaup	*Aythya affinis*	Regular		X			
White-winged Scoter	*Melanitta fusca*	Regular		X			
Surf Scoter	*Melanitta perspicillala*	Regular		X			
Black Scoter	*Melanitta nigra*	Regular		X			
Long-tailed Duck	*Clangula hyemalis*	Regular		X			
Bufflehead	*Bucephala albeola*	Regular		X			
Common Merganser	*Mergus merganser*	Regular		X	X	X	X
Red-breasted Merganser	*Mergus serrator*	Regular		X			
Ruddy Duck	*Oxyura jamaicensis*	Regular		X			
Ring-necked Pheasant	*Phasianus colchicus*	Regular	X	X	X	X	PO
Ruffed Grouse	*Bonasa umbellus*	Regular	X	X	X	X	PO
Wild Turkey	*Meleagris gallopavo*	Regular	X	X	X	X	X
Northern Bobwhite	*Colinus virginianus*	Regular		X	X		
Red-throated Loon	*Gavia stellata*	Regular		X			

Table 2.4-3 {Birds Observed or Likely to Occur in the Vicinity of BBNPP OCA}

Common Name	Scientific Name	Status	NAI	IBA	IBA(breeding)	BBA 84-89	BBA 04-08
Common Loon	*Gavia immmer*	Regular		X			
Pied-billed Grebe	*Podilymbus podiceps*	Regular		X			
Horned Grebe	*Podiceps auritus*	Regular		X			
Red-necked Grebe	*Podiceps grisegena*	Regular		X			
Double-crested Cormorant	*Phalacrocorax auritus*	Regular	O	X			PR
American Bittern	*Botaurus lentiginosus*	Regular		X			
Least Bittern	*Ixobrychus exilis*	Regular		X			
Great Blue Heron	*Ardea herodias*	Regular	O	X			PO
Great Egret	*Ardea albua*	Regular		X			
Snowy Egret	*Egretta thula*	Regular		X			
Little Blue Heron	*Egretta caerulea*	Regular		X			
Cattle Egret	*Bubulcus ibis*	Regular		X			
Green Heron	*Butorides virescens*	Regular	X	X	X	X	PO
Black-crowned Night Heron	*Nycticorax nycticorax*	Regular					
Glossy Ibis	*Plegadis falcinellus*	Regular		X			
Black Vulture	*Coragyps atratus*	Regular	X	X			PO
Turkey Vulture	*Cathartes aura*	Regular	X	X	X	PO	PO
Osprey	*Pandion haliaetus*	Regular		X			O
Mississippi Kite	*Ictinia mississippiensis*	Casual		X			
Bald Eagle	*Haliaeetus leucocephalus*	Regular		X			PO
Northern Harrier	*Circus cyaneus*	Regular	O	X			
Sharp-shinned Hawk	*Accipiter striatus*	Regular	O	X	X	PR	PO
Cooper's Hawk	*Accipiter cooperii*	Regular	O	X	X	PR	PO
Northern Goshawk	*Accipiter gentilis*	Regular		X			
Red-shouldered Hawk	*Buteo lineatus*	Regular	X	X	X		PO
Broad-winged Hawk	*Buteo platypterus*	Regular	X	X	X	X	PO
Swainson's Hawk	*Buteo swainsoni*	Accidental		X			
Red-tailed Hawk	*Buteo jamaicensis*	Regular	X	X	X	X	PO
Rough-legged Hawk	*Buteo lagopus*	Regular		X			
Golden Eagle	*Aquila chrysaetos*	Regular		X			
American Kestrel	*Falco sparverius*	Regular	X	X	X	X	PO
Merlin	*Falco columbarius*	Regular		X			

Table 2.4-3 {Birds Observed or Likely to Occur in the Vicinity of BBNPP OCA}

Common Name	Scientific Name	Status	NAI	IBA	IBA(breeding)	BBA 84-89	BBA 04-08
Peregrine Falcon	*Falco peregrinus*	Regular	O	X	X		X
Virginia Rail	*Rallus limicola*	Regular		X	X	X	PO
Sora	*Porzana carolina*	Regular		X	X	X	
Common Moorhen	*Gallinula chloropus*	Regular		X		PR	
American Coot	*Fulica americana*	Regular		X			
Black-bellied Plover	*Pluvialis squatarola*	Regular		X			
Semipalmated Plover	*Charadrius semipalmatus*	Regular		X			
Killdeer	*Charadrirrs vociferus*	Regular	X	X	X	X	PO
Greater Yellowlegs	*Tringa melanoleuca*	Regular		X			
Lesser Yellowlegs	*Tringa flavipes*	Regular		X			
Solitary Sandpiper	*Tringa solitaria*	Regular		X			
Spotted Sandpiper	*Actitis macularia*	Regular		X	X	X	PO
Semipalmated Sandpiper	*Calidris pusilla*	Regular		X			
Least Sandpiper	*Calidris minutilla*	Regular		X			
White-rumped Sandpiper	*Calidris fuscicollis*	Regular		X			
Pectoral Sandpiper	*Calidris melantus*	Regular		X			
Dunlin	*Calidris alpina*	Regular		X			
Short-billed Dowitcher	*Limnodromus griseus*	Regular		X			
Wilson's Snipe	*Gallinago delicata*	Regular		X			
American Woodcock	*Scolopax minor*	Regular	X	X	X	PR	
Wilson's Phalarope	*Phalaropus tricolor*	Regular		X			
Laughing Gull	*Larus atricilla*	Regular		X			
Bonaparte's Gull	*Larus philadelphia*	Regular		X			
Ring-billed Gull	*Larus delawarensis*	Regular	O	X		PO	
Herring Gull	*Larus argentatus*	Regular		X			
Lesser Black-backed Gull	*Larus fuscus*	Regular					
Great Black-backed Gull	*Larus marinas*	Regular		X			
Common Tern	*Sterna hirundo*	Regular		X			
Black Tern	*Chlidonias niger*	Regular		X			
Rock Pigeon	*Columba livia*	Regular	X	X	X	X	PO
Eurasian Collared Dove	*Streptopelia decaocto*	Casual					
Mourning Dove	*Zenaida macroura*	Regular	X	X	X	X	X

Table 2.4-3 {Birds Observed or Likely to Occur in the Vicinity of BBNPP OCA}

Common Name	Scientific Name	Status	NAI	IBA	IBA(breeding)	BBA 84-89	BBA 04-08
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Regular	X	X	X	X	PO
Yellow-billed Cuckoo	*Coccyzus americanus*	Regular	X	X	X	X	PO
Barn Owl	*Tyto alba*	Regular		X	X	X	
Eastern Screech-Owl	*Megascops asio*	Regular		X	X	X	PO
Great Horned Owl	*Bubo virginianus*	Regular	O	X	X	X	PO
Snowy Owl	*Bubo scandiacus*	Regular					
Barred Owl	*Strix varia*	Regular		X	X		PO
Long-eared Owl	*Asio otus*	Regular		X			
Short-eared Owl	*Asio flammeus*	Regular		X			
Northern Saw-whet Owl	*Aegolius acadicus*	Regular		X			
Common Nighthawk	*Chordeiles minor*	Regular		X	X		
Whip-poor-will	*Caprimulgus vociferus*	Regular		X	X		
Chimney Swift	*Chaetura pelagica*	Regular	X	X	X	PR	PO
Ruby-throated Hummingbird	*Archilochus colubris*	Regular	O	X	X	X	PO
Belted Kingfisher	*Ceryle alcyon*	Regular	O	X	X	X	PO
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Regular		X			
Red-bellied Woodpecker	*Melanerpes carolinus*	Regular	X	X	X	X	X
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Regular		X			PO
Downy Woodpecker	*Picoides pubescens*	Regular	X	X	X	X	X
Hairy Woodpecker	*Picoides villosus*	Regular	X	X	X	X	X
Northern Flicker	*Colaptes auratus*	Regular	X	X	X	X	PR
Pileated Woodpecker	*Dryocopus pileatus*	Regular	X	X	X	X	PO
Olive-sided Flycatcher	*Contopus cooperi*	Regular		X			
Eastern Wood-Pewee	*Contopus virens*	Regular	X	X	X	X	PO
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Regular	O	X			
Acadian Flycatcher	*Empidonax virescens*	Regular	O	X	X	PR	PO
Alder Flycatcher	*Empidonax alnorum*	Regular		X	X	PR	PO
Willow Flycatcher	*Empidonax traillii*	Regular	X	X	X	X	PO
Least Flycatcher	*Empidonax minimus*	Regular		X	X	X	PO
Eastern Phoebe	*Sayornis phoebe*	Regular	X	X	X	X	PO
Great Crested Flycatcher	*Myiarchus crinitus*	Regular	X	X	X	X	X
Western Kingbird	*Tyrannus verticalis*	Casual		X			

Table 2.4-3 {Birds Observed or Likely to Occur in the Vicinity of BBNPP OCA}

Common Name	Scientific Name	Status	NAI	IBA	IBA(breeding)	BBA 84-89	BBA 04-08
Eastern Kingbird	*Tyrannus tyrannus*	Regular	X	X	X	X	PO
Loggerhead Shrike	*Lanius ludovicianus*	Regular		X			
Northern Shrike	*Lanius excubitor*	Casual					
White-eyed Vireo	*Vireo griseus*	Regular	X	X	X	PO	
Yellow-throated Vireo	*Vireo flavifrons*	Regular	X	X	X	X	PR
Blue-headed Vireo	*Vireo solitarius*	Regular	O	X	X		PO
Warbling Vireo	*Vireo gilvus*	Regular		X	X	X	PO
Philadelphia Vireo	*Vireo philadelphicus*	Regular		X			
Red-eyed Vireo	*Vireo olivaceus*	Regular	X	X	X	X	PO
Blue Jay	*Cyanocitta cristata*	Regular	X	X	X	X	PO
American Crow	*Corvus brachyrhynchos*	Regular	X	X	X	X	PO
Fish Crow	*Corvus ossifragus*	Regular	X	X	X	X	PO
Common Raven	*Corvus corax*	Regular	X	X	X		PO
Horned Lark	*Eremophila alpestris*	Regular		X			X
Purple Martin	*Progne subis*	Regular	O	X	X	PO	
Tree Swallow	*Tachycineta bicolor*	Regular	X	X	X	X	X
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Regular	X	X	X	X	PO
Bank Swallow	*Riparia riperia*	Regular	X	X	X	X	X
Cliff Swallow	*Petrochelidon pyrrhonota*	Regular	O	X	X	X	
Barn Swallow	*Hirundo rustica*	Regular	O	X	X	X	X
Carolina Chickadee	*Poecile carolinensis*	Regular					
Black-capped Chickadee	*Poecile atricapillus*	Regular	X	X	X	X	X
Tufted Titmouse	*Baeolophrus bicolor*	Regular	X	X	X	X	X
Red-breasted Nuthatch	*Sitta canadensis*	Regular		X	X	PO	
White-breasted Nuthatch	*Sitta carolinensis*	Regular	X	X	X	X	PO
Brown Creeper	*Certhia americana*	Regular	O	X	X	X	PO
Carolina Wren	*Thryothorus ludovicianus*	Regular	X	X	X	X	X
House Wren	*Troglodytes aedon*	Regular	X	X	X	X	PO
Winter Wren	*Troglodytes troglodytes*	Regular		X	X		PO
Sedge Wren	*Cistothorus platensis*	Casual		X			
Marsh Wren	*Cistothorus palustris*	Regular		X			
Golden-crowned Kinglet	*Regulus satrapa*	Regular	O	X	X		

Table 2.4-3 {Birds Observed or Likely to Occur in the Vicinity of BBNPP OCA}

Common Name	Scientific Name	Status	NAI	IBA	IBA(breeding)	BBA 84-89	BBA 04-08
Ruby-crowned Kinglet	*Regulus calendula*	Regular	O	X			
Blue-gray Gnatcatcher	*Polioptila caerulea*	Regular	X	X	X	X	PR
Eastern Bluebird	*Sialia sialis*	Regular	X	X	X	X	X
Veery	*Catharus fuscescens*	Regular	X	X	X	X	PR
Gray-cheeked Thrush	*Catharus minimus*	Regular		X			
Swainson's Thrush	*Catharus ustulatus*	Regular		X			
Hermit Thrush	*Catharus guttatus*	Regular	O	X	X		PO
Wood Thrush	*Hylocichla mustelina*	Regular	X	X	X	X	PO
American Robin	*Turdus migratorius*	Regular	X	X	X	X	X
Gray Catbird	*Dumetella carolinensis*	Regular	X	X	X	X	X
Northern Mockingbird	*Mimus polyglottos*	Regular	X	X	X	X	PO
Brown Thrasher	*Toxostoma rufum*	Regular	X	X	X	PR	PO
European Starling	*Sturnus vulgaris*	Regular	X	X	X	X	PR
American Pipit	*Anthus rubescens*	Regular		X			
Cedar Waxwing	*Bombycilla cedrorum*	Regular	O	X	X	X	PO
Blue-winged Warbler	*Vermivora pinus*	Regular	X	X	X		
Golden-winged Warbler	*Vermivora chrysoptera*	Regular		X	X	PO	
Tennessee Warbler	*Vermivora peregrina*	Regular		X			
Orange-crowned Warbler	*Vermivora celata*	Regular		X			
Nashville Warbler	*Vermivora ruficapilla*	Regular		X			
Northern Parula	*Parula americana*	Regular	O	X	X	X	PO
Yellow Warbler	*Dendroica petechia*	Regular	X	X	X	X	PR
Chestnut-sided Warbler	*Dendroica pensylvanica*	Regular	X	X	X	X	PO
Magnolia Warbler	*Dendroica magnolia*	Regular		X	X		
Cape May Warbler	*Dendroica tigrina*	Regular	O	X			
Black-throated Blue Warbler	*Dendroica caerulescens*	Regular		X	X		PO
Yellow-rumped Warbler	*Dendroica coronata*	Regular	O	X	X		
Black-throated Green Warbler	*Dendroica virens*	Regular	O	X	X	PR	PO
Blackburnian Warbler	*Dendroica fusca*	Regular		X	X	PR	PO
Yellow-throated Warbler	*Dendroica dominica*	Regular		X			
Pine Warbler	*Dendroica pinus*	Regular		X	X	X	
Prairie Warbler	*Dendroica discolor*	Regular	X	X	X	X	PO

Table 2.4-3 {Birds Observed or Likely to Occur in the Vicinity of BBNPP OCA}

Common Name	Scientific Name	Status	NAI	IBA	IBA(breeding)	BBA 84-89	BBA 04-08
Palm Warbler	*Dendroica palmarum*	Regular	O	X			
Bay-breasted Warbler	*Dendroica castanea*	Regular		X			
Blackpoll Warbler	*Dendroica striata*	Regular		X			
Cerulean Warbler	*Dendroica cerulea*	Regular		X			
Black-and-white Warbler	*Mniotilta varia*	Regular	X	X	X	PR	PO
American Redstart	*Setophaga ruticilla*	Regular	X	X	X	X	PR
Prothonotary Warbler	*Protonotaria citrea*	Regular		X			
Worm-eating Warbler	*Helmitheros vermivorus*	Regular		X	X	X	
Ovenbird	*Seiurus aurocapilla*	Regular	X	X	X	X	PO
Northern Waterthrush	*Seiurus noveboracensis*	Regular	O	X		PR	
Louisiana Waterthrush	*Seiurus motacilla*	Regular		X	X	PR	PO
Kentucky Warbler	*Oporornis formosus*	Regular		X	X	X	
Connecticut Warbler	*Oporornis agilis*	Regular		X			
Mourning Warbler	*Oporornis philadelphia*	Regular	O	X	X		
Common Yellowthroat	*Geothlypis trichas*	Regular	X	X	X	X	PR
Hooded Warbler	*Wilsonia citrina*	Regular	X	X	X	X	
Wilson's Warbler	*Wilsonia pusilla*	Regular		X			
Canada Warbler	*Wilsonia canadensis*	Regular		X	X	X	PO
Yellow-breasted Chat	*Icteria virens*	Regular	X	X	X	X	
Summer Tanager	*Piranga rubra*	Regular		X			
Scarlet Tanager	*Piranga olivacea*	Regular	X	X	X	X	PR
Eastern Towhee	*Pipilo erythrophthalmus*	Regular	X	X	X	X	PO
American Tree Sparrow	*Spizella arborea*	Regular	O	X			
Chipping Sparrow	*Spizella passerina*	Regular	X	X	X	X	PR
Field Sparrow	*Spizella pusilla*	Regular	X	X	X	X	PO
Vesper Sparrow	*Pooecetes gramineus*	Regular	O	X	X	PR	PO
Savannah Sparrow	*Passerculus sandwichensis*	Regular		X	X	PR	PO
Grasshopper Sparrow	*Ammodramus savannarum*	Regular		X	X	PO	PO
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	Regular		X			
Fox Sparrow	*Passerella iliaca*	Regular	O	X			
Song Sparrow	*Melospiza melodia*	Regular	X	X	X	X	X
Lincoln's Sparrow	*Melospiza lincolnii*	Regular		X			

Table 2.4-3 {Birds Observed or Likely to Occur in the Vicinity of BBNPP OCA}

Common Name	Scientific Name	Status	NAI	IBA	IBA(breeding)	BBA 84-89	BBA 04-08
Swamp Sparrow	*Melospiza georgiana*	Regular	X	X	X	X	X
White-throated Sparrow	*Zonotrichia albicollis*	Regular	PO	X			
White-crowned Sparrow	*Zonotrichia leucophrys*	Regular	O	X			
Dark-eyed Junco	*Junco hyemalis*	Regular	O	X	X		PO
Lapland Longspur	*Calcarius lapponicus*	Regular		X			
Snow Bunting	*Plectrophenax nivalis*	Regular		X			
Northern Cardinal	*Cardinalis cardinalis*	Regular	X	X	X	X	PR
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Regular	X	X	X	X	PO
Blue Grosbeak	*Passerina caerulea*	Regular		X			
Indigo Bunting	*Passerina cyanea*	Regular	X	X	X	X	PO
Dickcissel	*Spiza americana*	Regular		X			
Bobolink	*Dolichonyx oryzivorus*	Regular		X	X	PO	PO
Red-winged Blackbird	*Agelaius phoeniceus*	Regular	X	X	X	X	X
Eastern Meadowlark	*Sturnella magna*	Regular	X	X	X	X	PO
Rusty Blackbird	*Euphagus carolinus*	Regular	O	X			
Common Grackle	*Quiscalus quiscula*	Regular	X	X	X	X	X
Brown-headed Cowbird	*Molothrus ater*	Regular	X	X	X	X	PR
Orchard Oriole	*Icterus spurius*	Regular	X	X	X	X	X
Baltimore Oriole	*Icterus galbula*	Regular	X	X	X	X	PR
Pine Grosbeak	*Pinicola enucleator*	Regular		X			
Purple Finch	*Carpodacus purpureus*	Regular	X	X	X		PO
House Finch	*Carpodacus mexicanus*	Regular	X	X	X	X	PR
Red Crossbill	*Loxia curvirostra*	Regular		X			
White-winged Crossbill	*Loxia leucoptera*	Regular		X			
Common Redpoll	*Carduelis flammea*	Regular		X			
Pine Siskin	*Carduelis pinus*	Regular		X	X		
American Goldfinch	*Carduelis tristis*	Regular	X	X	X	X	PR
Evening Grosbeak	*Coccothraustes vespertinus*	Regular		X			
House Sparrow	*Passer domesticus*	Regular	O	X	X	X	PO
	Total number of species:		123	245	132	116	116

Table 2.4-3 {Birds Observed or Likely to Occur in the Vicinity of BBNPP OCA}

Common Name	Scientific Name	Status	NAI	IBA	IBA(breeding)	BBA 84-89	BBA 04-08

Notes:

NAI = species accounted for during field observation in 2007-2008 by Normandeau Associates, Inc.

IBA = species recorded in Important Bird Area #50 (Susquehanna Riverlands)

IBA (breeding) = recorded in PPL Birds of the Susquehanna Riverlands as breeding in immediate area

BBA 84-89 = Breeding Bird Atlas survey completed from 1984-1989 in sectors 52D12 and 52D14

BBA 04-08 = Breeding Bird Atlas survey completed from 2004-2008 in sectors 52D12 and 52D14

Note: Two hybrid species of the Blue-winged warbler and Golden-winged warbler have been excluded from the list. They were the Brewster's warbler and Lawrence's warbler

Key for BBA 84-89 and BBA 04-08

X = species observed showing breeding activity

PO = species breeding possible

PR = species breeding probable

O = species observed

Table 2.4-4 {Pennsylvania Reptiles and Amphibians Observed or Likely to Occur in the Vicinity of BBNPP Site. Modified After Pennsylvania Fish and Boat Commission List of Native, Extant, Reptiles and Amphibians (PFBC 2008a)}

(Page 1 of 4)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study
Lizards				
Eumeces anthracinus	northern coal skink	S		
Eumeces fasciatus	five-lined skink	A	X	
Eumeces laticeps	broadhead skink	C		
Sceloporus undulates	northern fence lizard	S		
Snakes				
Agkistrodon contortrix	northern copperhead	S	X	
Carphophis amoenus	worm snake	S	X	
Clonophis kirtlandii	Kirtland's snake	E		
Coluber constrictor constrictor	northern black racer	A	X	X
Crotalus horridus	timber rattlesnake	C	X	
Diadophis punctatus	ringneck snake	A	X	X
Elaphe alleghaniensis	eastern ratsnake	A	X	
Heterodon platirhinos	eastern hognose snake	S	X	
Lampropeltis triangulum triangulum	eastern milksnake	A	X	X
Liochlorophis vernalis	smooth green snake	S	X	
Nerodia sipedon sipedon	northern water snake	A	X	X
Opheodrys aestivus	rough green snake	E		
Regina septemvittata	queen snake	S		
Sistrurus catenatus catenatus	eastern massasauga	E		
Storeria dekayi dekayi	northern brown snake	A	X	X
Storeria occipitomaculata occipitomaculata	northern redbelly snake	A	X	
Thamnophis brachystoma	shorthead garter snake	S		
Thamnophis sauritus	eastern ribbon snake	S	X	X
Thamnophis sirtalis sirtalis	eastern garter snake	A	X	X
Virginia pulchra	mountain earth snake	S		
Virginia valeriae	smooth earth snake	S		
Turtles				
Apalone mutica mutica	midland smooth softshell	X		

Table 2.4-4 {Pennsylvania Reptiles and Amphibians Observed or Likely to Occur in the Vicinity of BBNPP Site. Modified After Pennsylvania Fish and Boat Commission List of Native, Extant, Reptiles and Amphibians (PFBC 2008a)}

(Page 2 of 4)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study
Apalone spinifera spinifera	eastern spiny softshell	S		
Chelydra serpentina	snapping turtle	A	X	X
Chrysemys picta marginata	midland painted turtle	A		
Chrysemys picta picta	eastern painted turtle	A	X	X
Clemmys guttata	spotted turtle	S	X	
Emys blandingii	Blanding's turtle	C		
Glyptemys insculpta	wood turtle	S	X	X
Glyptemys muhlenbergii	bog turtle	E		
Graptemys geographica	map turtle	S	X	X
Kinosternon subrubrum subrubrum	eastern mud turtle	X		
Pseudemys rubriventris	red-bellied turtle	T	X	
Sternotherus odoratus	Stinkpot	A		
Terrapene carolina carolina	eastern box turtle	S	X	X
Frogs & Toads				
Acris crepitans crepitans	northern cricket frog	S	X	X
Bufo americanus americanus	eastern American toad	A	X	X
Bufo fowleri	Fowler's toad	S	X	
Hyla versicolor	gray treefrog	A	X	X
Pseudacris brachyphona	mountain chorus frog	S		
Pseudacris crucifer crucifer	northern spring peeper	A	X	X
Pseudacris feriarum feriarum	upland chorus frog	S		
Pseudacris feriarum triseriata	western chorus frog	S		
Pseudacris triseriata kalmi	New Jersey chorus frog	E		
Rana catesbeiana	Bullfrog	A	X	X
Rana clamitans	green frog	A	X	X
Rana palustris	pickerel frog	A	X	X
Rana pipiens	northern leopard frog	S	X	
Rana sphenocephala	coastal plain leopard frog	E		
Rana sylvatica	wood frog	A	X	X
Scaphiopus holbrookii	eastern spadefoot	E	X	

Table 2.4-4 {Pennsylvania Reptiles and Amphibians Observed or Likely to Occur in the Vicinity of BBNPP Site. Modified After Pennsylvania Fish and Boat Commission List of Native, Extant, Reptiles and Amphibians (PFBC 2008a)}

(Page 3 of 4)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study
Salamanders				
Ambystoma jeffersonianum	Jefferson salamander	S	X	
Ambystoma maculatum	spotted salamander	A	X	
Ambystoma opacum	marbled salamander	S	X	
Ambystoma tigrinum	tiger salamander	X		
Aneides aeneus	green salamander	T		
Cryptobranchus alleganiensis alleganiensis	eastern hellbender	S	X	
Desmognathus fuscus	dusky salamander	A	X	X
Desmognathus monticola	seal salamander	A		
Desmognathus ochrophaeus	mountain dusky salamander	A	X	
Eurycea bislineata	northern two-lined salamander	A	X	X
Eurycea longicauda longicauda	longtail salamander	A	X	X
Gyrinophilus porphyriticus porphyriticus	spring salamander	A	X	
Hemidactylium scutatum	four-toed salamander	S	X	
Necturus maculosus	Mudpuppy	S		
Notophthalmus viridescens viridescens	eastern red-spotted newt	A	X	X
Plethodon cinereus	redback salamander	A	X	X
Plethodon glutinosus	slimy salamander	A	X	X
Plethodon hoffmani	valley and ridge salamander	S		
Plethodon richmondi	ravine salamander	S		
Plethodon wehrlei	Wehrle's salamander	A		
Pseudotriton montanus montanus	eastern mud salamander	E		
Pseudotriton rubber ruber	northern red salamander	A	X	X

Table 2.4-4 {Pennsylvania Reptiles and Amphibians Observed or Likely to Occur in the Vicinity of BBNPP Site. Modified After Pennsylvania Fish and Boat Commission List of Native, Extant, Reptiles and Amphibians (PFBC 2008a)}

(Page 4 of 4)

Scientific Name	Common Name	Pennsylvania Status	Range includes BBNPP: (x) indicates that it does	Observed at BBNPP Site during NAI study

Legend:
A = Abundant
C = Candidate Species
E = Endangered Species
S = Species of special concern, rare, not common due to one or more of the following factors: range restriction, population decline, limited distribution, direct threats from habitat alteration, collection
T = Threatened Species
X = Extirpated, no longer occurs in PA

Table 2.4-5 {Number and Percent Composition of Fish Collected from Three Ponds Located within the BBNPP Site, November 8, 2007}

Common Name	Scientific Name	Beaver Pond		Johnson's Pond		Farm Pond	
		Number	Percent	Number	Percent	Number	Percent
Bluegill	*Lepomis macrochirus*	5	3	85	96		
Brown bullhead	*Ameiurus nebulosus*	100	61				
Creek chub	*Semotilus atromaculatus*	1	1			1	100
Golden shiner	*Notemigonus crysoleucas*	1	1				
Green sunfish	*Lepomis cyanellus*	48	29				
Largemouth bass	*Micropterus salmoides*			3	3		
Sunfish hybrid	*Lepomis sp.*	9	5				
White crappie	*Pomoxis annularis*			1	1		
Total number or organisms		164		89		1	
Total number of species (1)		5		2		1	

Note that no fish were collected from either the West Building Pond or Unnamed Pond 1

1) Excludes Sunfish hybrid

Table 2.4-6 {Number and Percent Composition of Fish Collected from Three Ponds Located within the Proposed BBNPP Site, July 2008}

Common Name	Scientific Name	Beaver Pond		Johnson's Pond		Farm Pond	
		Number	Percent	Number	Percent	Number	Percent
Blacknose dace	*Rhinichthys atratulus*					4	7.7
Bluegill	*Lepomis macrochirus*	1	1.6	206	85.8		
Brown bullhead	*Ameiurus nebulosus*	25	39.1				
Creek chub	*Semotilus atromaculatus*					43	82.7
Golden shiner	*Notemigonus crysoleucas*	17	26.6			3	5.8
Green sunfish	*Lepomis cyanellus*	20	31.3				
Largemouth bass	*Micropterus salmoides*			23	9.6		
Sunfish hybrid	*Lepomis sp.*	1	1.6	4	1.7		
White crappie	*Pomoxis annularis*			7	2.9		
White sucker	*Catostomus commersoni*					2	3.8
Total number of organisms		64		240		52	
Total number of species (1)		4		3		4	

1) Excludes Sunfish hybrid

Table 2.4-7 {Number and Percent Composition of Fish Collected from Three Stations in Walker Run Located within the Proposed BBNPP Site, November 8, 2007}

Common Name	Scientific Name	Station 1		Station 2		Station 3	
		Number	Percent	Number	Percent	Number	Percent
Blacknose dace	*Rhinichthys atratulus*	59	39	17	30	3	3
Bluegill	*Lepomis macrochirus*					7	8
Creek chub	*Semotilus atromaculatus*	46	30	18	32	64	70
Fallfish	*Semotilus corporalis*	22	15	1	2		
Green sunfish	*Lepomis cyanellus*			2	4	10	11
Sunfish hybrid	*Lepomis sp.*					4	4
Tessellated darter	*Etheostoma olmstedi*	4	3				
White sucker	*Catostomus commersoni*	20	13	18	32	4	4
Total number of organisms		151		56		92	
Total number of species (1)		5		5		5	

Table 2.4-8 {Number and Percent Composition of Fish Collected from Five Stations in Walker Run Located within and Downstream of the Proposed BBNPP Site, April 7 and 8, 2008}

Common name	Scientific name	Station 1		Station 2		Station 3		Station 4		Station 5	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Blacknose dace	*Rhinichthys atratulus*	49	43.8	46	45.5	11	22.0	39	10.5	186	83.4
Bluegill	*Lepomis macrochirus*							1	0.3		
Brown trout	*Salmo trutta*	1	0.9	3	3.0			4	1.1	2	0.9
Creek chub	*Semotilus atromaculatus*	43	38.4	32	31.7	16	32.0	99	26.7	16	7.2
Fallfish	*Semotilus corporalis*							23	6.2		
Green sunfish	*Lepomis cyanellus*	1	0.9			9	18.0	1	0.3		
Longnose dace	*Rhinichthys cataractae*									15	6.7
Pumpkinseed	*Lepomis gibbosus*							1	0.3		
Tessellated darter	*Etheostoma olmstedi*	5	4.5					52	14.0	2	0.9
White sucker	*Catostomus commersoni*	13	11.6	20	19.8	14	28.0	151	40.7	2	0.9
Total number of organisms		112		101		50		371		223	
Total number of species (1)		6		4		4		9		6	
(1) Excludes Sunfish hybrid											

Table 2.4-9 {Number and Percent Composition of Fish Collected from Five Stations in Walker Run Located within and Downstream of the Proposed BBNPP Site, July 2008}

Common Name	Scientific Name	Station 1		[1]Station 2		Station 3		Station 4		Station 5		Station 6	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Blacknose dace	*Rhinichthys atratulus*	52	41.6	8	10.0	30	58.8	27	6.3	112	68.3	34	47.9
Bluegill	*Lepomis macrochirus*	1	0.8					1	0.2	1	0.6		
Brown trout	*Salmo trutta*			1	1.3			3	0.7	1	0.6	9	12.7
Creek chub	*Semotilus atromaculatus*	62	49.6	21	26.3	17	33.3	81	18.8	22	13.4	7	9.9
Fallfish	*Semotilus corporalis*	1	0.8	3	3.8			13	3.0			2	2.8
Green sunfish	*Lepomis cyanellus*	1	0.8	3	3.8	1	2.0	36	8.4	4	2.4		
Largemouth bass	*Micropterus salmoides*							1	0.2				
Sunfish hybrid	*Lepomis sp.*									1	0.6		
Longnose dace	*Rhinichthys cataractae*									15	9.1		
Tessellated darter	*Etheostoma olmstedi*	4	3.2					87	20.2				
White sucker	*Catostomus commersoni*	4	3.2	44	55.0	3	5.9	181	42.1	8	4.9	19	26.8
Total number of organisms		125		80		51		430		164		71	
Total number of species (2)		7		6		4		9		7		5	

[1]sample location downstream of original sample boundary
(2) excludes Sunfish hybrid

Table 2.4-10 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 1 in Walker Run, November 8, 2007}

(Page 1 of 2)

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
OLIGOCHAETA		5	5	0.4	0.4
CRUSTACEA		2		0.1	
	Amphipoda		1		0.1
	Cambarus		1		0.1
PLECOPTERA		5		0.4	
	Allocapnia		4		0.3
	Taeniopteryx		1		0.1
EPHEMEROPTERA		86		6.4	
	Acerpenna		12		0.9
	Eurylophella		14		1.0
	Paraleptophlebia		6		0.4
	Stenonema		54		4.0
TRICHOPTERA		74		5.5	
	Cheumatopsyche		58		4.3
	Chimarra		1		0.1
	Hydatophylax		8		0.6
	Hydropsyche		4		0.3
	Neophylax		2		0.1
	Nyctiophylax		1		0.1
COLEOPTERA		136		10.1	
	Anchytarsus		1		0.1
	Dubiraphia		111		8.2
	Ectopria		1		0.1
	Helichus		1		0.1
	Optioservus		6		0.4
	Oulimnius		5		0.4
	Promoresia		5		0.4
	Stenelmis		6		0.4
DIPTERA		985		73.0	
	Alluaudomyia		7		0.5
	Antocha		7		0.5
	Bezzia		7		0.5
	Chelifera		2		0.1
	Chironomidae		847		62.8
	Chrysops		11		0.8
	Culicoides		7		0.5
	Dicranota		2		0.1
	Hemerodromia		2		0.1
	Hexatoma		5		0.4
	Probezzia		8		0.6
	Prosimulium		7		0.5
	Sphaeromias		73		5.4
MOLLUSCA		21		1.6	

Table 2.4-10 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 1 in Walker Run, November 8, 2007}

(Page 2 of 2)

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
	Ferrissia		7		0.5
	Physa		1		0.1
	Musculium		13		1.0
OTHER		35		2.6	
	Acariformes		16		1.2
	Nematoda		2		0.1
	Aeshnidae		2		0.1
	Calopterygidae		2		0.1
	Gomphidae		7		0.5
	Nigronia		4		0.3
	Sialis		2		0.1
TOTAL		1,349	1,349	100	100

Table 2.4-11 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 2 in Walker Run, November 8, 2007}

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
CRUSTACEA					
	Cambarus	4	4	0.3	0.3
PLECOPTERA		30		2.6	
	Acroneuria		6		0.5
	Agnetina		1		0.1
	Leuctra		1		0.1
	Paracapnia		1		0.1
	Pteronarcys		1		0.1
	Sweltsa		12		1.0
	Taeniopteryx		8		0.7
EPHEMEROPTERA		390		33.6	
	Acentrella		1		0.1
	Baetis		1		0.1
	Acerpenna		6		0.5
	Ephemera		1		0.1
	Ephemerella		14		1.2
	Eurylophella		46		4.0
	Leptophlebia		1		0.1
	Paraleptophlebia		49		4.2
	Serratella		5		0.4
	Stenacron		1		0.1
	Stenonema		265		22.8
TRICHOPTERA		113		9.7	
	Cheumatopsyche		68		5.9
	Chimarra		25		2.2
	Dolophilodes		1		0.1
	Hydropsyche		2		0.2
	Lype		2		0.2
	Micrasema		4		0.3
	Neophylax		8		0.7
	Polycentropus		3		0.3
COLEOPTERA		364		31.4	
	Anchytarsus		16		1.4
	Dubiraphia		2		0.2
	Optioservus		67		5.8
	Oulimnius		239		20.6
	Promoresia		34		2.9
	Stenelmis		6		0.5
DIPTERA		223		19.2	
	Antocha		8		0.7
	Chironomidae		172		14.8
	Dicranota		15		1.3
	Hemerodromia		2		0.2

Table 2.4-11 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 2 in Walker Run, November 8, 2007}

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
	Palpomyia gr.		8		0.7
	Pericoma		1		0.1
	Pilaria		1		0.1
	Probezzia		1		0.1
	Prosimulium		14		1.2
	Tipula		1		0.1
MOLLUSCA		16		1.4	
	Ferrissia		2		0.2
	Physa		4		0.3
	Pisidium		10		0.9
OTHER		21		1.8	
	Prostoma		1		0.1
	Tricladida		1		0.1
	Aeshnidae		1		0.1
	Gomphidae		12		1.0
	Nigronia		5		0.4
	Sialis		1		0.1
TOTAL		1,161	1161	100	100

Table 2.4-12 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 1 in Walker Run, April 7, 2008}

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
OLIGOCHAETA		38	38	2.5	2.5
CRUSTACEA		2		0.1	
	Cambarus		2		0.1
PLECOPTERA		6		0.4	
	Amphinemura		2		0.1
	Isoperla		1		0.1
	Leuctra		2		0.1
	Prostoia		1		0.1
EPHEMEROPTERA		329		21.8	
	Cinygmula		8		0.5
	Epeorus		16		1.1
	Eurylophella		273		18.1
	Stenonema		32		2.1
TRICHOPTERA		53		3.5	
	Brachycentrus		1		0.1
	Cheumatopsyche		30		2.0
	Chimarra		1		0.1
	Hydropsyche		3		0.2
	Lepidostoma		1		0.1
	Neophylax		8		0.5
	Oecetis		1		0.1
	Pycnopsyche		7		0.5
	Rhyacophila		1		0.1
COLEOPTERA		44		2.9	
	Dubiraphia		28		1.9
	Helichus		1		0.1
	Optioservus		9		0.6
	Oulimnius		5		0.3
	Promoresia		1		0.1
DIPTERA		984		65.2	
	Antocha		2		0.1
	Bezzia		1		0.1
	Chironomidae		752		49.8
	Chrysops		1		0.1
	Dicranota		3		0.2
	Pilaria		1		0.1
	Probezzia		4		0.3
	Prosimulium		162		10.7
	Sphaeromias		7		0.5
	Stegopterna		48		3.2
	Tipula		3		0.2
MOLLUSCA		31		2.1	
	Ferrissia		1		0.1
	Physa		3		0.2

Table 2.4-12 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 1 in Walker Run, April 7, 2008}

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
	Musculium		15		1.0
	Pisidium		12		0.8
OTHER		23		1.5	
	Acariformes		5		0.3
	Nematoda		8		0.5
	Aeshnidae		1		0.1
	Gomphidae		6		0.4
	Nigronia		3		0.2
TOTAL		1,510	1510	100	100

Table 2.4-13 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 2 in Walker Run, April 7, 2008}

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
OLIGOCHAETA		15	15	0.4	0.4
CRUSTACEA		2		0.1	
	Amphipoda		1		<0.1
	Cambarus		1		<0.1
PLECOPTERA		38		1.0	
	Acroneuria		11		0.3
	Amphinemura		8		0.2
	Leuctra		8		0.2
	Isoperla		10		0.3
	Pteronarcys		1		<0.1
EPHEMEROPTERA		766		20.3	
	Baetis		117		3.1
	Cinygmula		136		3.6
	Ephemerella		234		6.2
	Epeorus		198		5.3
	Isonychia		9		0.2
	Stenonema		27		0.7
	Serratella		45		1.2
TRICHOPTERA		42		1.1	
	Cheumatopsyche		6		0.2
	Chimarra		15		0.4
	Diplectrona		2		0.1
	Hydropsyche		7		0.2
	Leucotrichia		1		<0.1
	Lype		1		<0.1
	Neophylax		4		0.1
	Polycentropus		1		<0.1
	Rhyacophila		5		0.1
COLEOPTERA		594		15.8	
	Anchytarsus		3		0.1
	Curculionidae		1		<0.1
	Optioservus		84		2.2
	Oulimnius		434		11.5
	Promoresia		72		1.9
DIPTERA		2,259		60.0	
	Antocha		1		<0.1
	Chironomidae		228		6.1
	Clinocera		2		0.1
	Dicranota		2		0.1
	Pilaria		1		<0.1
	Prosimulium		2,024		53.8
	Tipula		1		<0.1
MOLLUSCA		12		0.3	
	Pisidium		8		0.2

Table 2.4-13 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 2 in Walker Run, April 7, 2008}

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
	Sphaerium		4		0.1
OTHER		37		1.0	
	Acariformes		1		<0.1
	Nematoda		1		<0.1
	Cordulegastridae		8		0.2
	Gomphidae		24		0.6
	Nigronia		3		0.1
TOTAL		3,765	3,765	100	100

Table 2.4-14 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 4 in Walker Run, April 8, 2008}

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
OLIGOCHAETA		71	71	2.9	2.9
CRUSTACEA		23		0.9	
	Amphipoda		23		1.2
PLECOPTERA		8		0.3	
	Amphinemura		8		0.3
EPHEMEROPTERA		368		14.8	
	Cinygmula		8		0.3
	Ephemerella		272		11.0
	Epeorus		24		1.0
	Eurylophella		8		0.3
	Stenonema		56		2.9
TRICHOPTERA		132		5.3	
	Cheumatopsyche		88		3.5
	Chimarra		8		0.3
	Diplectrona		1		<0.1
	Hydropsyche		23		0.9
	Micrasema		2		0.1
	Neophylax		1		<0.1
	Psychomyia		9		0.4
COLEOPTERA		55		2.2	
	Anchytarsus		5		0.2
	Hydrobius		1		<0.1
	Optioservus		3		0.1
	Oulimnius		15		0.6
	Promoresia		8		0.3
	Stenelmis		23		0.9
DIPTERA		1,804		72.7	
	Antocha		20		0.8
	Chelifera		6		0.2
	Chironomidae		1,228		49.5
	Clinocera		7		0.3
	Dasyhelea		2		0.1
	Prosimulium		530		21.4
	Sphaeromias		3		0.1
	Stegopterna		8		0.3
MOLLUSCA		5		0.2	
Pisidium			5		0.2
OTHER		15		0.6	
	Acariformes		4		0.2
	Nematoda		4		0.2
	Aeshnidae		1		<0.1
	Gomphidae		3		0.1
	Sialis		3		0.1
TOTAL		2,481	2,481	100	100

Table 2.4-15 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 5 in Walker Run, April 8, 2008}

Group	Taxon	Total Number		Percent of Total	
		Group	Taxon	Group	Taxon
CRUSTACEA		1		0.0	
	Cambarus		1		<0.1
PLECOPTERA		2		0.0	
	Amphinemura		2		<0.1
EPHEMEROPTERA		288		3.9	
	Ephemerella		288		3.9
TRICHOPTERA		76		1.0	
	Cheumatopsyche		14		0.2
	Chimarra		23		0.3
	Hydropsyche		14		0.2
	Micrasema		3		<0.1
	Neophylax		19		0.3
	Polycentropus		1		<0.1
	Rhyacophila		2		<0.1
COLEOPTERA		17		0.2	
	Ectopria		1		
	Optioservus		6		0.1
	Oulimnius		5		0.1
	Promoresia		3		<0.1
	Stenelmis		2		<0.1
DIPTERA		6,634		88.8	
	Antocha		2		<0.1
	Chironomidae		356		4.8
	Clinocera		2		<0.1
	Dicranota		1		<0.1
	Hemerodromia		1		<0.1
	Prosimulium		6,272		83.9
MOLLUSCA		4		0.1	
	Pisidium		4		0.1
OTHER		450		6.0	
	Nematoda		449		6.0
	Nigronia		1		<0.1
TOTAL		7,472	7,472	100	100

Table 2.4-16 {Number and Percent Composition of Fish Collected by Seining at SSES on the Susquehanna River, 2004-2007}

Taxon	2004		2005		2006		2007		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Spotfin shiner	49	28.5	52	20.9	116	64.8	195	44.9	412	40.4
Comley shiner			1	0.4					1	0.1
Spottail shiner	29	16.9	76	30.5	52	29.1	83	19.1	240	23.5
Bluntnose minnow	64	37.2	12	4.8			3	0.7	79	7.7
Blacknose dace							12	2.8	12	1.2
Fallfish	1	0.6	8	3.2	1	0.6	1	0.2	11	1.1
White sucker	2	1.2	61	24.5			73	16.8	136	13.3
Northern pike			1	0.4					1	0.1
Muskellunge			3	1.2					3	0.3
Channel catfish							1	0.2	1	0.1
Rock bass	7	4.1	1	0.4			2	0.5	10	1.0
Redbreast sunfish	1	0.6			2	1.1			3	0.3
Green sunfish							1	0.2	1	0.1
Bluegill			15	6.0	3	1.7	24	5.5	42	4.1
Smallmouth bass	5	2.9	12	4.8	1	0.6	17	3.9	35	3.4
Black crappie					2	1.1			2	0.2
Tessellated darter	11	6.4	4	1.6	2	1.1	9	2.1	26	2.5
Yellow perch	1	0.6							1	0.1
Banded darter			1	0.4			2	0.5	3	0.3
Walleye	2	1.2	2	0.8			11	2.5	15	1.5
Total number of fish	172		249		179		434		1,034	
Total number of species	11		14		8		14		20	

Table 2.4-17 {Number and Percent Composition of Fish Collected by Seining at Bell Bend on the Susquehanna River, 2004-2007}

Taxon	2004		2005		2006		2007		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Gizzard shad	1	0.1							1	*
Spotfin shiner	263	36.3	235	36.3	243	49.5	1,082	60.1	1,823	49.8
Comley shiner			1	0.2					1	*
Spottail shiner	325	44.8	47	7.3	245	49.9	338	18.8	955	26.1
Bluntnose minnow	92	12.7	42	6.5	1	0.2	63	3.5	198	5.4
Blacknose dace							3	0.2	3	0.1
Yellow bullhead					1	0.2			1	*
Fallfish	5	0.7							5	0.1
Quillback			5	0.8					5	0.1
White sucker	15	2.1	273	42.1			235	13.1	523	14.3
Northern hog sucker							2	0.1	2	0.1
Rock bass			4	0.6			5	0.3	9	0.2
Redbreast sunfish	1	0.1							1	*
Bluegill			4	0.6			15	0.8	19	0.5
Smallmouth bass	4	0.6	13	2.0	1	0.2	41	2.3	59	1.6
Tessellated darter	12	1.7	11	1.7			14	0.8	37	1.0
Banded darter			2	0.3			2	0.1	4	0.1
Yellow perch	1	0.1	1	0.2					2	0.1
Walleye	6	0.8	10	1.5					16	0.4
Total number of fish	725		648		491		1,800		3,664	
Total number of species	11		13		5		11		19	

* less than 0.1%

Table 2.4-18 {Number and Percent Composition of Fish Collected by Electrofishing at SSES on the Susquehanna River, 2004-2007}

Taxon	2004		2005		2006		2007		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Gizzard shad	1	0.2	3	0.8	1	0.4	6	0.7	11	0.6
Common carp	13	2.9	7	1.8	8	3.3	21	2.5	49	2.6
River chub	2	0.4					1	0.1	3	0.2
Fallfish	3	0.7	3	0.8	1	0.4	13	1.6	20	1.0
Quillback	101	22.3	65	16.3	5	2.1	55	6.6	226	11.8
White sucker	11	2.4	3	0.8	4	1.7	4	0.5	22	1.1
Northern hog sucker	29	6.4	50	12.5	23	9.6	110	13.3	212	11.0
Shorthead redhorse	38	8.4	49	12.3	22	9.2	51	6.2	160	8.3
Sucker spp.	2	0.4	2	0.5					4	0.2
Yellow bullhead			1	0.3					1	0.1
Channel catfish	9	2.0	11	2.8	16	6.7	14	1.7	50	2.6
Northern pike	1	0.2	1	0.3	2	0.8	3	0.4	7	0.4
Muskellunge	4	0.9	6	1.5	3	1.3	2	0.2	15	0.8
Pike spp.			2	0.5	1	0.4			3	0.2
Brown trout			1	0.3					1	0.1
Rock bass	39	8.6	36	9.0	11	4.6	69	8.3	155	8.1
Redbreast sunfish	2	0.4	3	0.8	1	0.4	1	0.1	7	0.4
Green sunfish	6	1.3							6	0.3
Pumpkinseed			2	0.5					2	0.1
Bluegill	11	2.4	9	2.3	1	0.4	2	0.2	23	1.2
Smallmouth bass	66	14.6	71	17.8	61	25.4	216	26.1	414	21.6
Sunfish spp.	6	1.3	10	2.5	1	0.4	7	0.8	24	1.2
Yellow perch							4	0.5	4	0.2
Walleye	42	9.3	27	6.8	46	19.2	195	23.5	310	16.1
Fish (unidentified)	67	14.8	37	9.3	33	13.8	55	6.6	192	10.0
Total number of fish	453		399		240		829		1,921	
Total number of species *	17		18		15		18		21	

* Excludes Sucker Spp., Pike Spp., and Fish (unidentified)

Table 2.4-19 {Number and Percent Composition of Fish Collected by Electrofishing at Bell Bend on the Susquehanna River, 2004-2007}

Taxon	2004		2005		2006		2007		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Gizzard shad			1	0.2	1	0.3	1	0.1	3	0.2
Common carp	21	3.9	27	6.4	17	5.8	26	3.6	91	4.6
River chub	2	0.4		0.0	1	0.3			3	0.2
Fallfish	4	0.7	7	1.7		0.0	5	0.7	16	0.8
Quillback	122	22.6	62	14.7	8	2.7	56	7.8	248	12.6
White sucker	7	1.3	6	1.4	1	0.3	10	1.4	24	1.2
Northern hog sucker	1	0.2	5	1.2	4	1.4	29	4.1	39	2.0
Shorthead redhorse	22	4.1	5	1.2	9	3.1	14	2.0	50	2.5
Sucker spp.			3	0.7	2	0.7			5	0.3
Brown bullhead	1	0.2	1	0.2		0.0			2	0.1
Yellow bullhead							1	0.1	1	0.1
Channel catfish	8	1.5	5	1.2	14	4.8	10	1.4	37	1.9
Northern pike	4	0.7	2	0.5		0.0	5	0.7	11	0.6
Muskellunge	1	0.2	5	1.2	3	1.0			9	0.5
Chain pickerel			1	0.2		0.0			1	0.1
Pike spp.			2	0.5		0.0			2	0.1
Rock bass	61	11.3	41	9.7	11	3.8	48	6.7	161	8.2
Redbreast sunfish	2	0.4	2	0.5	2	0.7			6	0.3
Green sunfish	4	0.7	4	0.9	1	0.3	1	0.1	10	0.5
Pumpkinseed	1	0.2		0.0		0.0			1	0.1
Bluegill	12	2.2	10	2.4	4	1.4	6	0.8	32	1.6
Smallmouth bass	104	19.3	135	32.0	122	41.6	235	32.8	596	30.2
White crappie	1	0.2		0.0		0.0			1	0.1
Sunfish spp.	9	1.7	26	6.2	2	0.7	5	0.7	42	2.1
Yellow perch	2	0.4	2	0.5		0.0	3	0.4	7	0.4
Walleye	81	15.0	31	7.3	60	20.5	208	29.1	380	19.3
Fish (unidentified)	70	13.0	39	9.2	31	10.6	53	7.4	193	9.8
Total number of fish	540		422		293		716		1971	
Total number of species *	20		19		15		16		23	

* Excludes Sucker Spp., Pike Spp., and Fish (unidentified)

Table 2.4-20 {Number and Percent Total of Benthic Macroinvertebrates Collected with a Dome Sampler at SSES (replicate 1) in the Susquehanna River, August 15, 2007}

Group	Taxon	Group		Taxon	
		Number	% Total	Number	% Total
OLIGOCHAETA		1	0.1	1	0.1
CRUSTACEA		59	3.8		
	Amphipoda			59	3.8
PLECOPTERA		20	1.3		
	Agnetina			10	0.6
	Chloroperlidae			1	0.1
	Neoperla			9	0.6
EPHEMEROPTERA		202	13.0		
	Anthopotamus			160	10.3
	Caenis			4	0.3
	Isonychia			1	0.1
	Leucrocuta			10	0.6
	Serratella			1	0.1
	Stenacron			2	0.1
	Stenonema			5	0.3
	Tricorythodes			19	1.2
TRICHOPTERA		74	4.8		
	Ceraclea			10	0.6
	Cheumatopsyche			11	0.7
	Chimarra			3	0.2
	Protoptila			6	0.4
	Hydropsyche			2	0.1
	Macrostemum			28	1.8
	Neureclipsis			14	0.9
COLEOPTERA		548	35.4		
	Dineutus			2	0.1
	Optioservus			4	0.3
	Stenelmis			542	35.0
DIPTERA		73	4.7		
	Chironomidae			73	4.7
MOLLUSCA		543	35.0		
	Ferrissia			5	0.3
	Corbicula			8	0.5
	Lasmigona subviridis			1	0.1
	Leptoxis			1	0.1
	Musculium			500	32.3
	Pisidium			28	1.8
OTHER		30	1.9		
	Acariformes			1	0.1
	Alloeocoela			4	0.3
	Prostoma			1	0.1
	Tricladida			22	1.4
	Coenagrionidae			2	0.1
Total number of organisms		1550		1,550	
Total number of taxa		9		35	

Table 2.4-21 {Number and Percent Total of Benthic Macroinvertebrates Collected with a Dome Sampler at SSES (replicate 2) in the Susquehanna River, August 15, 2007}

Group	Taxon	Group		Taxon	
		Number	% Total	Number	% Total
CRUSTACEA		95	5.0		
	Amphipoda			95	5.0
PLECOPTERA		14	0.7		
	Agnetina			12	0.6
	Neoperla			2	0.1
EPHEMEROPTERA		523	27.7		
	Anthopotamus			473	25.0
	Caenis			1	0.1
	Isonychia			1	0.1
	Leucrocuta			19	1.0
	Serratella			7	0.4
	Stenacron			1	0.1
	Stenonema			8	0.4
	Tricorythodes			13	0.7
TRICHOPTERA		144	7.6		
	Ceraclea			9	0.5
	Cheumatopsyche			19	1.0
	Chimarra			7	0.4
	Protoptila			12	0.6
	Hydropsyche			3	0.2
	Macrostemum			69	3.7
	Neureclipsis			22	1.2
	Oecetis			3	0.2
COLEOPTERA		566	29.9		
	Dineutus			2	0.1
	Stenelmis			564	29.8
DIPTERA		105	5.6		
	Chironomidae			105	5.6
MOLLUSCA		248	13.1		
	Ferrissia			3	0.2
	Corbicula			4	0.2
	Musculium			202	10.7
	Pisidium			29	1.5
	Sphaerium			10	0.5
OTHER		195	10.3		
	Alloeocoela			7	0.4
	Prostoma			3	0.2
	Tricladida			185	9.8
Total number of organisms		1,890		1,890	
Total number of taxa		8		30	

Table 2.4-22 {Number and Percent Total of Benthic Macroinvertebrates Collected with a Dome Sampler at Bell Bend (replicate 1) in the Susquehanna River, August 15, 2007}

Group	Taxon	Group		Taxon	
		Number	% Total	Number	% Total
OLIGOCHAETA		26	1.7		
	Unidentified			26	1.7
CRUSTACEA		118	7.9		
	Amphipoda			118	7.9
PLECOPTERA		15	1.0		
	Agnetina			12	0.8
	Neoperla			3	0.2
EPHEMEROPTERA		492	33.1		
	Anthopotamus			366	24.6
	Caenis			20	1.3
	Isonychia			2	0.1
	Stenacron			22	1.5
	Stenonema			52	3.5
	Tricorythodes			30	2.0
TRICHOPTERA		24	1.6		
	Ceraclea			6	0.4
	Cheumatopsyche			1	0.1
	Protoptila			3	0.2
	Macrostemum			1	0.1
	Neureclipsis			13	0.9
COLEOPTERA		229	15.4		
	Dineutus			2	0.1
	Dubiraphia			1	0.1
	Psephenus			2	0.1
	Stenelmis			224	15.1
DIPTERA		219	14.7		
	Chironomidae			219	14.7
MOLLUSCA		331	22.3		
	Ferrissia			48	3.2
	Physa			1	0.1
	Corbicula			142	9.6
	Leptoxis			2	0.1
	Musculium			132	8.9
	Pisidium			6	0.4
OTHER		32	2.2		
	Alloeocoela			9	0.6
	Nematoda			6	0.4
	Tricladida			16	1.1
	Gomphidae			1	0.1
Total number of organisms		1,486		1,486	
Total number of taxa		9		30	

Table 2.4-23 {Number and Percent Total of Benthic Macroinvertebrates Collected with a Dome Sampler at Bell Bend (replicate 2) in the Susquehanna River, August 15, 2007}

Group	Taxon	Group		Taxon	
		Number	% Total	Number	% Total
OLIGOCHAETA		2	0.1	2	0.1
CRUSTACEA					
	Amphipoda	99	5.9	99	5.9
PLECOPTERA					
	Acroneuria	2	0.1	1	0.1
	Agnetina			1	0.1
EPHEMEROPTERA		463	27.4		
	Anthopotamus			332	19.6
	Caenis			31	1.8
	Habrophleboides			1	0.1
	Isonychia			1	0.1
	Leucrocuta			34	2.0
	Stenacron			38	2.2
	Stenonema			6	0.4
	Tricorythodes			20	1.2
TRICHOPTERA		48	2.8		
	Ceraclea			4	0.2
	Cheumatopsyche			15	0.9
	Protoptila			3	0.2
	Lepidostoma			1	0.1
	Neureclipsis			21	1.2
	Oecetis			4	0.2
COLEOPTERA		231	13.7		
	Dineutus			3	0.2
	Dubiraphia			2	0.1
	Psephenus			1	0.1
	Stenelmis			225	13.3
DIPTERA		212	12.5		
	Chironomidae			212	12.5
MOLLUSCA		587	34.7		
	Ferrissia			54	3.2
	Physa			1	0.1
	Corbicula			296	17.5
	Musculium			216	12.8
	Pisidium			20	1.2
OTHER		46	2.7		
	Alloeocoela			24	1.4
	Tricladida			18	1.1
	Coenagrionidae			1	0.1
	Gomphidae			1	0.1
	Sialis			2	0.1
Total number of organisms		1,690		1,690	

Table 2.4-23 {Number and Percent Total of Benthic Macroinvertebrates Collected with a Dome Sampler at Bell Bend (replicate 2) in the Susquehanna River, August 15, 2007}

Group	Taxon	Group		Taxon	
		Number	% Total	Number	% Total
Total number of taxa		9		33	

Table 2.4-24 {Species of Mussels Observed During Survey of Susquehanna River Completed Near the Proposed BBNPP Site, October 2007}

Common name	Scientific name
Yellow Lampmussel	Lampsilis cariosa
Eastern Elliptio	Elliptio complanata
Elktoe	Alasmidonta marginata
Triangle Floater	Alasmidonta undulata
Eastern Floater	Pyganodon cataracta

Table 2.4-25 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 1 in Walker Run on July 14, 2008}

Group Taxon	Total Number		Percent of Total	
	Group	Taxon	Group	Taxon
OLIGOCHAETA	4	4	0.3	0.3
CRUSTACEA	2		0.2	
Cambarus		1		0.1
Stygobromis		1		0.1
PLECOPTERA	38		3.1	
Acroneuria		5		0.4
Leuctra		30		2.4
Sweltsa		3		0.2
EPHEMEROPTERA	30		2.4	
Leptophlebiidae		1		0.1
Eurylophella		6		0.5
Serratella		1		0.1
Stenonema		22		1.8
TRICHOPTERA	284		23	
Brachycentrus		12		1
Cheumatopsyche		165		13.4
Chimarra		13		1.1
Hydropsyche		56		4.5
Hydroptila		38		3.1
COLEOPTERA	210		17	
Anchytarsus		1		0.1
Ectopria		4		0.3
Optioservus		66		5.4
Oulimnius		9		0.7
Promoresia		71		5.8
Stenelmis		59		4.8
DIPTERA	546		44.3	
Antocha		4		0.3
Bezzia		1		0.1
Chironomidae		516		41.8
Dicranota		21		1.7
Tipula		4		0.3
MOLLUSCA	8		0.6	
Ferrissia		4		0.3
Pisidium		4		0.3
OTHER	111		9.0	
Acariformes		27		2.2
Argia		26		2.1
Boyeria		1		0.1
Nigronia		18		1.5
Prostoma		4		0.3
Sialis		2		0.2
Stylogomphus		4		0.3
Veliidae		29		2.4
TOTAL	1,233	1,233	100	100

Table 2.4-26 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 2 in Walker Run on July 15, 2008}

Group Taxon	Total Number		Percent of Total	
	Group	Taxon	Group	Taxon
OLIGOCHAETA	19	19	2.8	2.8
CRUSTACEA	3		0.4	
Cambarus		3		0.4
PLECOPTERA	50		7.3	
Acroneuria		5		0.7
Leuctra		42		6.1
Nemouridae		1		0.1
Sweltsa		2		0.3
EPHEMEROPTERA	137		19.9	
Baetis		86		12.5
Leptophlebiidae		4		0.6
Eurylophella		15		2.2
Serratella		3		0.4
Stenacron		1		0.1
Stenonema		28		4.1
TRICHOPTERA	41		6	
Cheumatopsyche		27		3.9
Chimarra		4		0.6
Hydropsyche		10		1.5
COLEOPTERA	93		13.5	
Optioservus		57		8.3
Oulimnius		24		3.5
Promoresia		6		0.9
Stenelmis		6		0.9
DIPTERA	289		41.9	
Antocha		1		0.1
Chironomidae		272		39.5
Dicranota		4		0.6
Hemerodromia		4		0.6
Probezzia		1		0.1
Simulium		7		1
MOLLUSCA	23		3.3	
Ferrissia		2		0.3
Pisidium		21		3
OTHER	34		4.9	
Acariformes		9		1.3
Nematoda		4		0.6
Nigronia		4		0.6
Stylogomphus		17		2.5
TOTAL	689	689	100	100

Table 2.4-27 {Number and Percent Composition of Benthic Macroinvertebrates collected with a Kick Net at Station 4 in Walker Run on July 14, 2008}

Group Taxon	Total Number		Percent of Total	
	Group	Taxon	Group	Taxon
OLIGOCHAETA	36	36	2	2
CRUSTACEA	57		3.2	
Cambarus		1		0.1
Gammarus		56		3.1
PLECOPTERA	6		0.3	
Acroneuria		1		0.1
Leuctra		5		0.3
EPHEMEROPTERA	118		6.6	
Leptophlebiidae		1		0.1
Baetis		55		3.1
Eurylophella		1		0.1
Stenacron		3		0.2
Stenonema		58		3.2
TRICHOPTERA	846		47.1	
Cheumatopsyche		533		29.7
Chimarra		81		4.5
Hydropsyche		200		11.1
Hydroptila		16		0.9
Psychomyia		16		0.9
COLEOPTERA	292		16.3	
Ectopria		19		1.1
Macronychus		4		0.2
Optioservus		71		4
Oulimnius		9		0.5
Promoresia		46		2.6
Stenelmis		143		8
DIPTERA	408		22.7	
Antocha		15		0.8
Chironomidae		348		19.4
Dicranota		10		0.6
Hemerodromia		2		0.1
Hexatoma		1		0.1
Limonia		3		0.2
Simulium		26		1.4
Tipula		3		0.2
MOLLUSCA	10		0.6	
Ferrissia		5		0.3
Pisidium		5		0.3
OTHER	23		1.3	
Acariformes		8		0.4
Nigronia		2		0.1
Nematoda		1		0.1
Sialis		1		0.1
Veliidae		11		0.6
TOTAL	1,796	1,796	100	100

Table 2.4-28 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 5 in Walker Run on July 14, 2008}

Group Taxon	Total Number		Percent of Total	
	Group	Taxon	Group	Taxon
OLIGOCHAETA	2	2	0.3	0.3
CRUSTACEA	3		0.4	
Cambarus		2		0.3
Gammarus		1		0.1
PLECOPTERA	22		2.8	
Acroneuria		18		2.3
Leuctra		4		0.5
EPHEMEROPTERA	131		16.9	
Baetis		32		4.1
Isonychia		30		3.9
Leptophlebiidae		1		0.1
Leucrocuta		1		0.1
Stenonema		49		6.3
Stenacron		18		2.3
TRICHOPTERA	341		44.1	
Cheumatopsyche		118		15.2
Chimarra		193		24.9
Dolophilodes		8		1
Hydropsyche		13		1.7
Psychomyia		8		1
Rhyacophila		1		0.1
COLEOPTERA	74		9.6	
Ectopria		8		1
Macronychus		1		0.1
Optioservus		18		2.3
Promoresia		2		
Psephenus		21		2.7
Stenelmis		24		3.1
DIPTERA	191		24.7	
Antocha		8		1
Atrichopogon		1		0.1
Chironomidae		178		23
Dicranota		1		0.1
Molophilus		1		0.1
Tipula		2		0.3
MOLLUSCA	3		0.4	
Ferrissia		3		0.4
OTHER	7		0.9	
Argia		1		0.1
Sialis		1		0.1
Veliidae		5		0.6
TOTAL	774	774	100	100

Table 2.4-29 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net at Station 6 in Walker Run on July 15, 2008}

Group Taxon	Total Number		Percent of Total	
	Group	Taxon	Group	Taxon
OLIGOCHAETA	10	10	0.4	0.4
CRUSTACEA	15		0.5	
Cambarus				0
Gammarus		15		0.5
PLECOPTERA	192		7	
Acroneuria		24		0.9
Leuctra		144		5.2
Sweltsa		24		0.9
EPHEMEROPTERA	928		33.7	
Leptophlebiidae		16		0.6
Acentrella		32		1.2
Baetis		656		23.8
Eurylophella		16		0.6
Serratella		112		4.1
Stenonema		96		3.5
TRICHOPTERA	556		20.2	
Cheumatopsyche		280		10.2
Dolophilodes		11		0.4
Hydropsyche		264		9.6
Neophylax		1		0
COLEOPTERA	232		8.4	
Helichus		24		0.9
Optioservus		114		4.1
Oulimnius		63		2.3
Psephenus		6		0.2
Promoresia		3		0.1
Stenelmis		22		0.8
DIPTERA	808		29.3	
Antocha		17		0.6
Chironomidae		656		23.8
Chelifera		8		0.3
Dicranota		82		3
Hemerodromia		17		0.6
Hexatoma		13		0.5
Probezzia		8		0.3
Simulium		5		0.2
Tipula		2		0.1
OTHER	14		0.5	
Acariformes		2		0.1
Boyeria		1		0.0
Nigronia		2		0.1
Stylogomphus		9		0.3
TOTAL	2,755	2,755	100	100

Table 2.4-30 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net in Unnamed Tributary 2 on July 16, 2008}

Group Taxon	Total Number		Percent of Total	
	Group	Taxon	Group	Taxon
OLIGOCHAETA	19	19	0.2	0.2
CRUSTACEA	7,824		95.9	
Cambarus		4		0.0
Gammarus		7,820		95.8
EPHEMEROPTERA	27		0.3	
Baetis		27		0.3
COLEOPTERA	83		1.0	
Optioservus		47		0.6
Oulimnius		34		0.4
Tropisternus		2		0.0
DIPTERA	206		2.5	
Chironomidae		170		2.1
Chrysops		1		0.0
Dicranota		2		0.0
Dixa		10		0.1
Ephydridae		5		0.1
Limonia		9		0.1
Simulium		9		0.1
OTHER	2		0.0	
Dugesia		1		0.0
Nematoda		1		0.0
TOTAL	8,161	8,161	100	100

Table 2.4-31 {Number and Percent Composition of Benthic Macroinvertebrates Collected with a Kick Net in Unnamed Tributary 3 on July 16, 2008}

Group Taxon	Total Number		Percent of Total	
	Group	Taxon	Group	Taxon
OLIGOCHAETA	5	5	1.1	1.1
CRUSTACEA	7		1.6	
Crangonyx		7		1.6
PLECOPTERA	1		0.2	
Leuctra		1		0.2
EPHEMEROPTERA	20		4.5	
Baetis		2		0.5
Leptophlebiidae		13		2.9
Stenonema		5		1.1
TRICHOPTERA	63		14.2	
Cheumatopsyche		1		0.2
Diplectrona		62		14.0
DIPTERA	326		73.4	
Chironomidae		232		52.3
Dicranota		88		19.8
Pseudolimnophila		1		0.2
Tipula		5		1.1
MOLLUSCA	15		3.4	
Corbicula		1		0.2
Pisidium		8		1.8
Physella		6		1.4
OTHER	7		1.6	
Gerridae		4		0.9
Sialis		3		0.7
TOTAL	444	444	100	100

Table 2.4-32 {Occurrence of Butterfly Species of Concern Host Plants at BBNPP}

Host Plants		Butterfly Species of Concern					Observed By		
Scientific Name	Common Name	Northern Pearly Eye	Long Dash	Mulberry Wing	Black Dash	Baltimore Checkerspot	NAI	ECO III	ATLAS
		Enodia anthedon	*Polites mystic*	*Poanes massasoit*	*Euphyes conspicua*	*Euphydryas phaeton*			
Asclepias syriaca	common milkweed		A			A	X		X
Aureolaria spp.	false foxglove					C			X
Betula spp.	birches	A					X	X	X
Brachyelytrum erectum	bearded shorthusk	C							X
Carex stricta	uptight sedge			C	C			X	X
Carex spp.	sedges			C	C		X	X	X
Chelone glabra	turtlehead					C		X	X
Desmodium spp.	tick trefoil		A						X
Echium vulgare	viper's bugloss								X
Erianthus spp.	plumegrass	C							
Fraxinus americana	white ash					C	X		X
Hystrix patula	bottlebrush	C							X
Kalmia latifolia	mountain laurel		A				X		X
Leersia virginica	white grass	C						X	X
Lonicera japonica	japanese honeysuckle					C	X		X
Pedicularis canadensis	common lousewort					C			X
Penstemon hirsutus	beardtongue					C			X
Plantago lanceolata	English plantain					C	X		X
Poa spp.	bluegrasses		C					X	X
Populus spp.	poplars	A					X		X
Prunella vulgaris	selfheal		A						X
Rosa spp.	rose					A	X	X	X
Salix spp.	willows	A						X	X
Uniola latifolia	broadleaf uniola	C							
Vibernum recognitum	arrowwood					A, C	X	X	X
Cephalanthus occidentalis	buttonbush				A				X
Impatiens capensis	jewelweed				A		X	X	X
Cirsium muticum	swampthistle				A				X
Viola fimbriatula	northern downy violet								

Table 2.4-32 {Occurrence of Butterfly Species of Concern Host Plants at BBNPP}

Host Plants		Butterfly Species of Concern					Observed By		
Scientific Name	Common Name	Northern Pearly Eye	Long Dash	Mulberry Wing	Black Dash	Baltimore Checkerspot	NAI	ECO III	ATLAS
		Enodia anthedon	***Polites mystic***	***Poanes massasoit***	***Euphyes conspicua***	***Euphydryas phaeton***			
Viola lanceolata	lance leaved violet								X

A = Adult food
C = Caterpillar hosts
X = Species observation

NAI = observed 2007-2008 by Normandeau Associates
ECO III = observed 1990 - 2007 by Ecology III
ATLAS = documented as occurring in Luzerne County, PA in *The Vascular Flora of Pennsylvania*

Figure 2.4-1 {Topographic Map of the BBNPP Site}

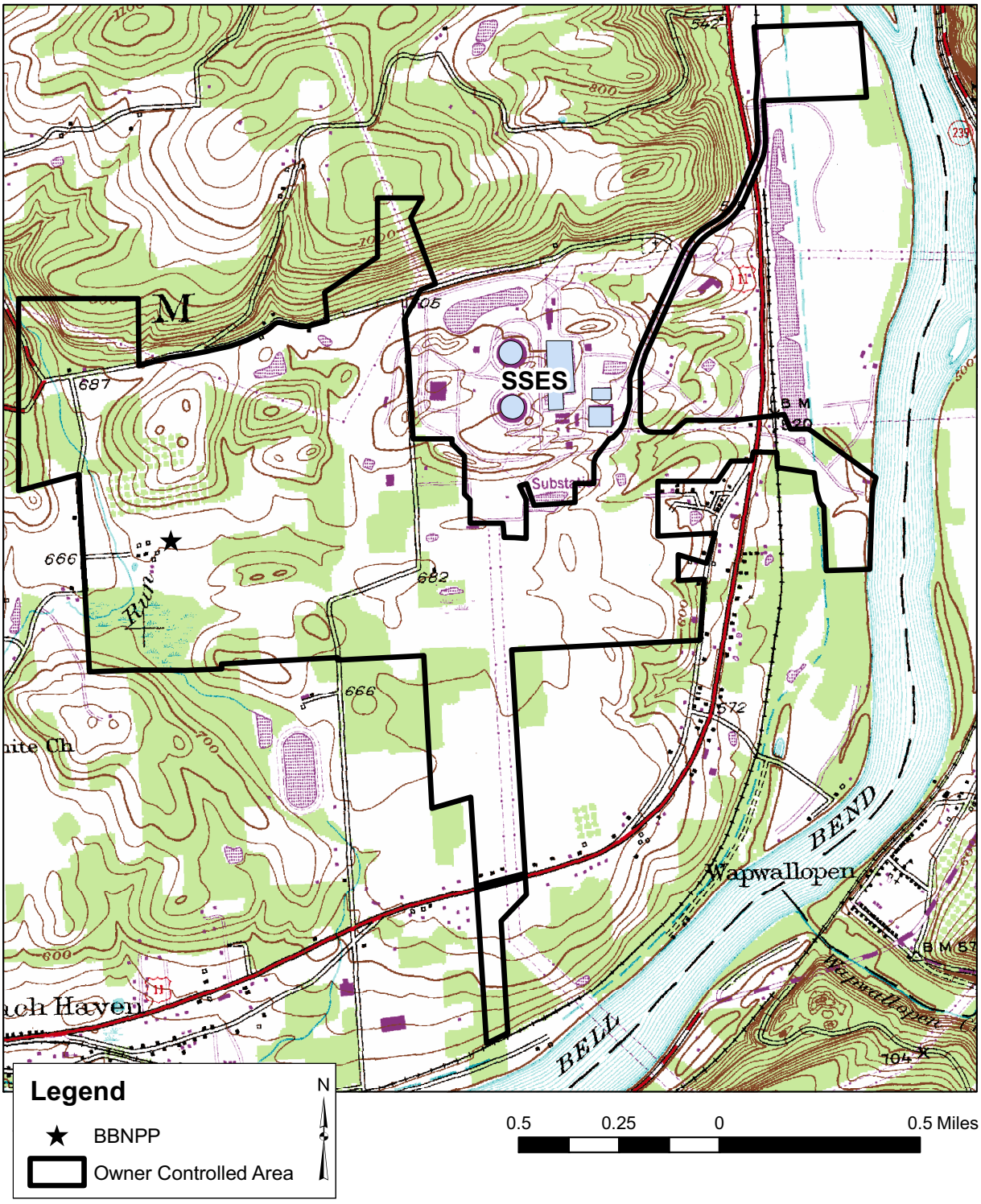

Figure 2.4-2 {Plant Community Map}

Figure 2.4-3 {Location of the Onsite Ponds and Aquatic Biota Collection Stations in Walker Run }

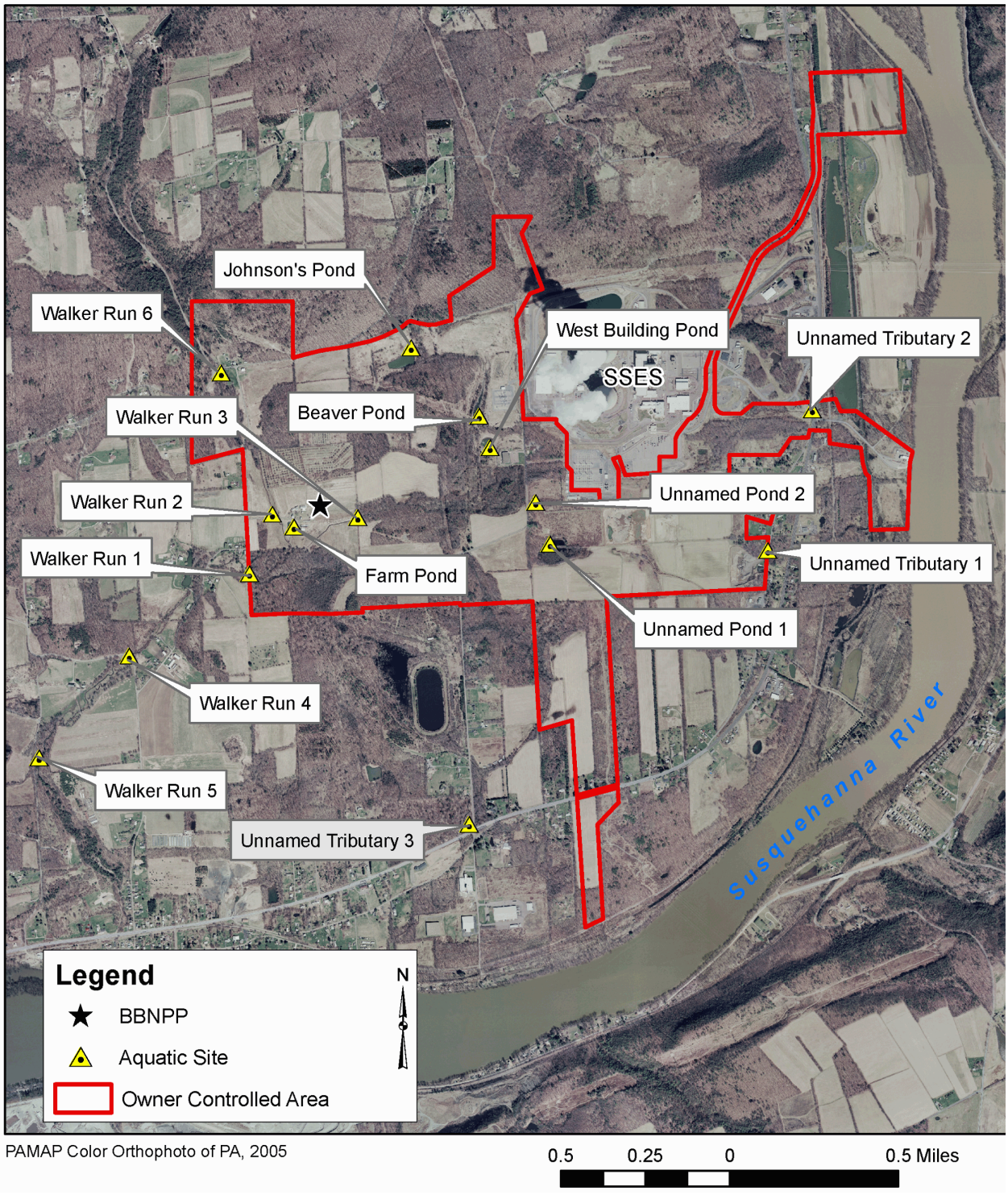

Figure 2.4-4 {Location of Electrofishing (EF) and Seining (SN) Stations in the Susquehanna River}

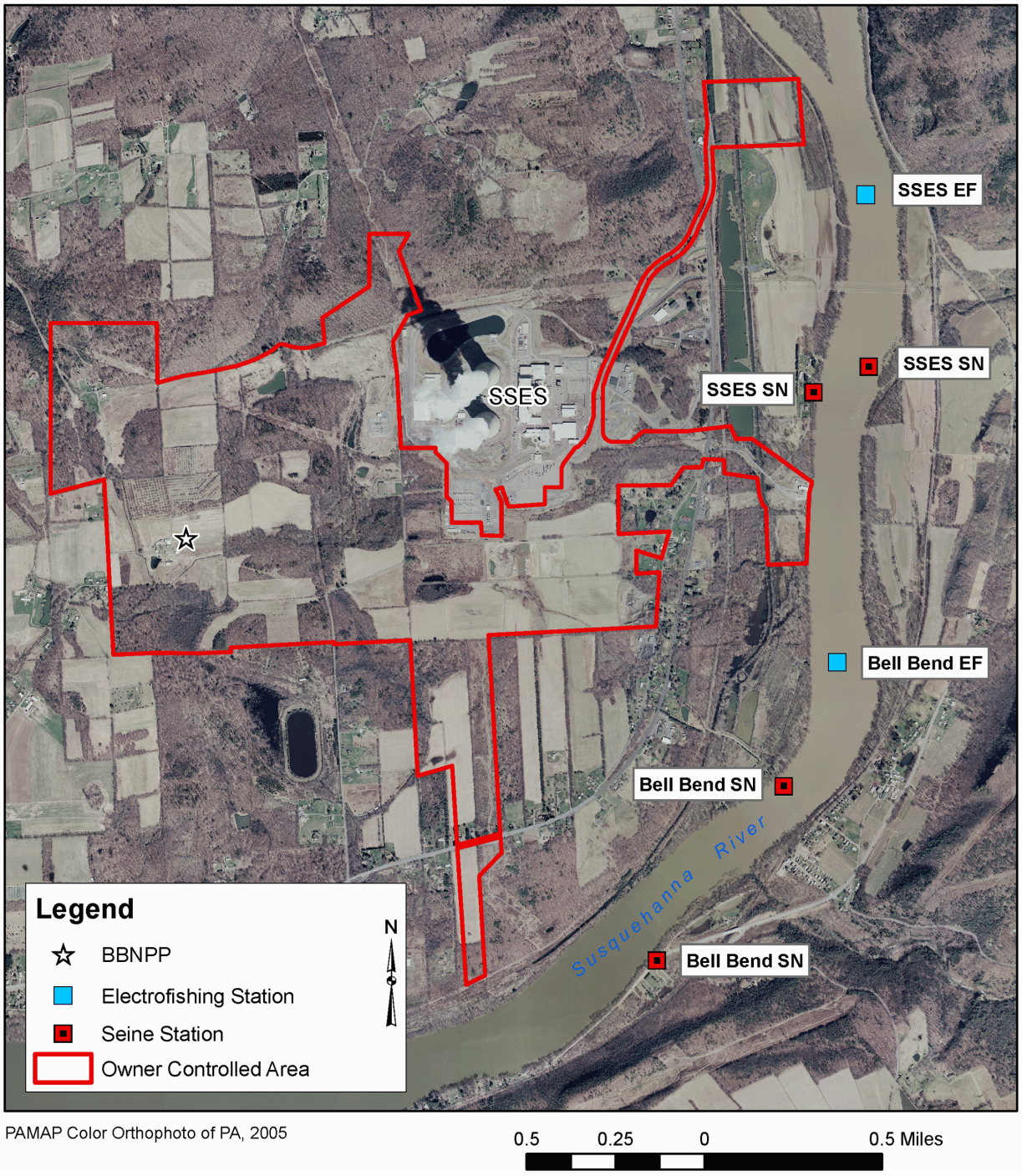

Figure 2.4-5 {Location of Benthic Macroinvertebrate Collection Stations in the Susquehanna River}

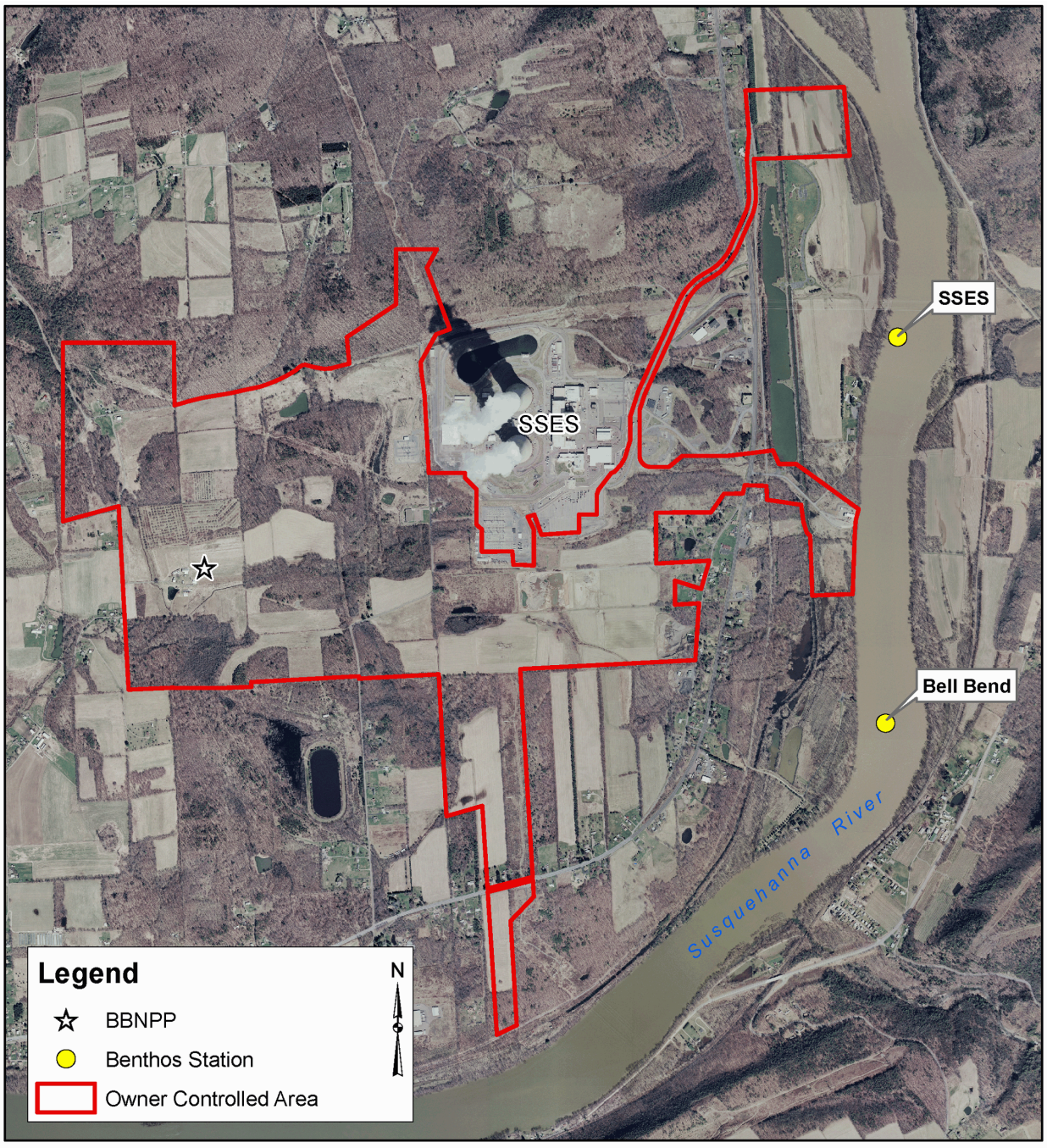

Figure 2.4-6 {Location of Mussel Survey Stations in the Susquehanna River}