

OUTSIDE THE STUDY AREA

Outside the study area in Pennsylvania, the S-R Line could pass through Pike, Monroe, Carbon, Northampton, Wayne, Lackawanna, and Luzerne counties. Although these counties are largely undeveloped, they are some of the fastest growing and developing counties within Pennsylvania, particularly Monroe and Pike counties (Commonwealth of PA 2005a, 2005b, 2005c, 2005d, 2005e, 2005f, 2005g). As more and more land is developed, the park lands will become increasingly important natural areas. Development within the counties in and around the parks is discussed in the “Socioeconomics” section of this chapter. All seven counties contain a combination of private and public lands. More than 20,000 acres of Monroe County have been designated as the Cherry Valley National Wildlife Refuge (NWR), although not all 20,000 acres are under current ownership or management of the USFWS. In Pike County, which contains a large portion of DEWA, wetlands compose between 6% and 7% of the county land (Tiner 1990, 25). Pike County wetlands are mainly forested and forested scrub shrub, and freshwater ponds, lacustrine wetlands (along lakes), and riverine wetlands are also found within the county (USFWS 2010a; Tiner 1990, 73, 80). Northampton County contains less undeveloped land than the other counties (approximately 62%) (Commonwealth of PA 2005f, 1), and only about 1.2% of the land in Northampton County is wetland areas (mainly forested wetlands) (Tiner 1990, 76). Carbon County contains about 1.2% wetlands, the majority of which are forested wetland areas (Tiner 1990, 41). Approximately three-quarters of Carbon County is undeveloped, due in large part to the rugged terrain, and contains both private and public lands and a portion of APPA (Commonwealth of PA 2005g, 1). In Wayne, Lackawanna, and Luzerne counties between 3% and 5% of the land area is covered by wetlands (Tiner 1990, 25). The types of wetlands found within these counties are similar to those found in Pike County, although Luzerne and Wayne counties have more emergent wetland areas (USFWS 2010a; Tiner 1990, 63, 68, 92).

Outside the study area in New Jersey, the S-R Line could pass through Morris, Sussex, and Warren counties. About 14% of the land in Sussex County is wetland areas, with about 9% being forested wetlands and 5% being herbaceous, agricultural, or disturbed wetland areas, including known limestone fen communities (Morris Land Conservancy 2003, 20). In Warren County, roughly 10% of the land is wetland areas (Warren County Planning Board 2008, 53). Lastly, in Morris County, roughly 13% to 14% of the land is wetland areas (Tiner 1985, 21). The wetlands found in these counties are similar to those found within the Pennsylvania counties. Additionally, Morris County includes agricultural wetland areas (USFWS 2010a).

VEGETATION

GENERAL VEGETATION

The 10 counties within the entire S-R Line area (Monroe, Pike, Northampton, Wayne, Carbon, Luzerne, and Lackawanna counties in Pennsylvania and Warren, Sussex, and Morris counties in New Jersey) remain largely undeveloped, with only 14.2% of the land being developed. Over 70% of the S-R Line area is composed of natural landscapes (forests, wetlands, and open water). DEWA is one of the largest public open spaces remaining in the northeastern metropolitan corridor, with nearly 90% of its land remaining undeveloped. Table 9 presents the land use within the project area and within DEWA.

TABLE 9: LAND USE TOTALS FOR THE PROJECT AREA AND WITHIN DEWA

| Land Use Type | Entire Project Area | | DEWA | |
|-------------------|---------------------|--------------------------|--------|--------------------------|
| | Acres | Percentage of Total Area | Acres | Percentage of Total Area |
| Deciduous forest | 1,761,366 | 53.2 | 34,738 | 50.3 |
| Mixed forest | 213,801 | 6.4 | 16,254 | 23.5 |
| Coniferous forest | 101,429 | 3.1 | 2,970 | 4.3 |
| Wetlands | 176,433 | 5.3 | 3,311 | 4.8 |
| Agricultural land | 466,100 | 14.1 | 4,613 | 6.7 |
| Open water | 78,594 | 2.4 | 3,000 | 4.3 |
| Developed area | 469,035 | 14.2 | 4,028 | 5.8 |
| Other | 46,943 | 1.4 | 196 | 0.3 |

Source: USGS 2010.

The variations in topographic, geographic, and hydrologic conditions throughout DEWA support 69 different vegetation associations or plant communities, including 30 that are classified as vulnerable, imperiled, or critically imperiled under state or global conservation rankings (NPS 2007a, 62). The diversity of vegetation associations within DEWA support more than 1,300 vascular plant species, many of which have survived despite past human disturbances within the park (NPS 2008b, 36). For the purposes of this EIS, vegetation associations were divided into the following vegetation types: deciduous, mixed deciduous, and coniferous forests; grasslands; successional areas, including old fields and scrub shrub vegetation communities; and wetland areas dependent on hydrologic conditions that may be seasonal or permanent. These vegetation types are further classified by growing conditions related to elevation and soil moisture and are discussed in more detail below.

Historical and current human activities are apparent in many vegetation communities in DEWA, and the human influence often defines the landscape. The forests in DEWA are typical of second-growth forests in the Appalachian Mountains (NPS 2010j, vi). Much of the forest in DEWA is second growth in areas that were historically logged or farmed (NPS 2008b, 36). Remnants of old farms can still be found in the park, including areas that contain old orchards. One of the orchards that can still be seen today in the park, Roberts Farm Orchard, is widely believed to have the oldest apple trees in any national park, some over 200 years old (NPS 2003b, 1). Agricultural production is not just a practice of the past in DEWA, but is still practiced in some areas of the park today. Agricultural production occurs on roughly 3,000 acres of land within DEWA (NPS 2008b, 36). Cropland areas where agriculture is still practiced are maintained in the park to preserve a feeling of the cultural history and landscape of the area; however, maintenance of agricultural lands within DEWA is carried out through a no-tilling policy. Aside from these agricultural areas, approximately 1,500 acres of land in the parks is maintained as grassland and scrub shrub to provide wildlife habitat, including shrubby hedgerows that separate agricultural croplands (NPS 2008b, 36). The areas maintained by DEWA as grassland and scrub shrub are generally old field areas that are mowed biannually to prevent the growth of a successional forest (NPS 2007a, 61, 271). The NPS may also use prescribed burns to maintain old agricultural fields in the park to protect rare and endangered species, control invasive plants, and maintain historic and scenic vistas and resources, as well as for agricultural purposes (NPS 2004b, 6). Fires are a natural process and DEWA uses prescribed burns to promote natural forest conditions that are resilient to fire, insects, and diseases, while providing for diverse wildlife habitats.

The old field vegetation community requires management to prevent further succession and maintain the plant community. Invasive species, such as autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa*

multiflora), and bush honeysuckles, tend to dominate the successional scrub shrub habitats (NPS 2007a, 61). In some areas formerly used for agriculture, conifer species have been intentionally planted in large plots. These are dominated by pine (*Pinus* spp.) and spruce (*Picea* spp.) in the canopy, and eastern red cedar (*Juniperus virginiana*) in the subcanopy. The understory often contains native northern dewberry (*Rubus flagellaris*) and early low blueberry (*Vaccinium pallidum*) as well as many invasive species, such as Japanese barberry (*Berberis thunbergii*) and multiflora rose (NPS 2007b, 3). Invasive species commonly are found on previously disturbed land, and are often found in old fields and other abandoned agricultural areas (NPS 2007a, 61); the “Invasive Plant Species” section contains more detailed information.

The parks are largely composed of deciduous, low-elevation mesic (moist) Appalachian oak forests dominated by white oak (*Quercus alba*) and northern red oak (*Q. rubra*). Associated species in the Appalachian oak forest include sugar maple (*Acer saccharum*), black birch (*Betula lenta*), bitternut hickory (*Carya cordiformis*), American beech (*Fagus grandifolia*), and tulip poplar (*Liriodendron tulipifera*) (NPS 2007a, 5).

The Eastern Rivers and Mountains Network began monitoring the vegetation communities of DEWA in 2007 to obtain information on the condition of the park’s vegetation and soil resources. This monitoring has discovered several trends in the vegetation communities within DEWA. Within the dry oak forests (which are described below in detail), the predominant seedlings and saplings are not of the same species as the canopy trees. The older trees in the canopy are dominated by oaks, while the seedlings and saplings are mostly white pine (*Pinus strobus*), maples, black birch, and shadbush. This indicates that the species composition of the dry forests within DEWA will change in the future (NPS 2010j, v–vi). Additionally, monitoring has revealed that less than 40% of the survey plots are free of invasive plant species; the spread of invasive species in DEWA is a threat to the native plant communities (NPS 2010j, vi). Invasive plant species are discussed in detail in the “Invasive Plant Species” section of this chapter.

Vegetation communities can vary based on environmental conditions such as geology, topography, soils, and hydrology. The following vegetation associations are classified by elevation and moisture. Habitat types are also described within the overall vegetation classifications.

High-elevation Xeric Forests: Areas with thin and rocky soils commonly result in drier conditions at higher elevations and are commonly composed of xeric, or dry, terrestrial forests. Some areas where these conditions are found in the park include a portion of the Kittatinny Ridge on the New Jersey side of the park and the low glaciated plateau, an area with a matrix of different forests on the Pennsylvania side of the park (NPS 2007a, 57). In both areas, dry conditions create deciduous oak/heath woodlands that are common and generally consist of chestnut oak (*Quercus prinus*), other oak species (*Quercus* spp.), pine species, black birch, and red maple (*Acer rubrum*). Shrub layers generally consist of a dense cover of plants that prefer acidic conditions: mountain laurel (*Kalmia latifolia*), black huckleberry (*Gaylussacia baccata*), sheep laurel (*K. angustifolia*), and early lowbush blueberry (NPS 2007b, 95).

One of the most common terrestrial forest types found in higher elevations is a mixed forest characterized as dry oak/mixed hardwood forest. This forest type is dominated by deciduous oaks but also contains white pine in the understory. The presence of white pine within the shrub layer generally indicates that the area may eventually succeed to a dry white pine/oak forest (NPS 2007b, 89). The dominant oak species can vary and is dependent on the moisture and nutrient condition of the soils (e.g., white oaks thrive on moist soils, while black oaks [*Quercus velutina*] do best in the dry upland slopes). This forest can be found in a variety of areas, including those with varying slope and soil/rock compositions. Oak species dominate the canopy, with red maple and black birch as common canopy associates. The shrubby layer generally includes American witch-hazel (*Hamamelis virginiana*), flowering dogwood (*Cornus florida*), and saplings of canopy species. In some cases, the lower shrub layer consists of great laurel (*Rhododendron*

maximum) and black huckleberry. The herbaceous layer can vary and is dependent on the availability of water in surrounding drainage areas, but generally includes eastern hay-scented fern and Canada mayflower (*Maianthemum canadense*). Vegetation communities distributed in areas of rocky outcroppings are adapted to exposed bedrock, dry conditions, and thin soil.

A mixed forest type dominated by coniferous species and characterized by the presence of pitch pine (*Pinus rigida*) is considered a rare type of dry vegetation association known as a mixed hardwood rocky summit. This forest type is generally found on rocky summits, including Kittatinny Ridge, where sandstone boulders or outcroppings are found. Although most of the vegetation associations found growing in ridgetop bedrock outcroppings are generally sparse and predominantly composed of shrubs and grasses, pitch pine/mixed hardwood rocky summits support trees stunted by the shallow, acidic soil (NPS 2007a, 58). The canopy is dominated by pitch pine, chestnut oak, and black birch. The shrub layer is composed of scrub oak (*Quercus ilicifolia*) and common serviceberry (*Amelanchier arborea*), while the sparse herbaceous layer generally includes hairgrass (*Deschampsia flexuosa*) and little bluestem (*Schizachyrium scoparium*) (NPS 2007b, 185).

One scrub shrub community found in the parks is successional bear oak/heath scrub shrub. This is a dry scrub shrub community found commonly on the Kittatinny Ridge and is dominated by a short shrub layer of black huckleberry, mountain laurel, and lowbush blueberry (*Vaccinium angustifolium*). Bear oak and quaking aspen (*Populus tremuloides*) are occasionally found as a taller shrub layer. Fire is often a determining factor in the location and survival of successional bear oak/heath scrub shrub and other vegetation associations that rely on fire to maintain or promote the correct conditions for the plant community. For example, the bear oak/wavy hairgrass scrub shrub, dominated by bear oak and wavy hairgrass, succeeds dry oak/heath forest after the occurrence of a fire that clears away part of the forest, allowing more light for shrub and grass species (NPS 2007b, 209, 261).

Mid-elevation Mesic Forests: Many areas at middle and low elevations of the parks provide conditions where soils consistently contain moisture and support terrestrial forests requiring damp conditions. These vegetation associations tend to be found in ravines and on lower slopes, although some can be found at higher elevations. Deciduous Appalachian oak forest is dominated by white and northern red oak and is found in the lower elevations of the parks where soil conditions are moist. It is the most common forest type in DEWA. Mixed woodlands found in areas with moist soil conditions include eastern white pine/successional hardwood forests and northern red oak/mixed hardwood forest. Eastern white pine/successional hardwood forest is dominated by a canopy of mature white pine with younger hardwood species, exemplified by red maple and black birch in the subcanopy. This forest type is generally found in the middle to lower elevations. The herbaceous layer contains eastern hay-scented fern and Canada mayflower. The eastern white pine/successional hardwood forest is found on the Walpack Ridge in New Jersey at higher elevations than most mesic terrestrial forests (NPS 2007b, 168).

Northern red oak/mixed hardwood forest is a common vegetation association found in slightly moist areas of the park, and is often used as a broader association to describe many of the mesic forests throughout the park. As a result, the species found within this association are highly variable; however, northern red oak is generally dominant. Northern red oak/mixed hardwood associations are found in ravines, areas with calcareous bedrock, steep slopes, floodplains, or recently disturbed upland drainages (NPS 2007a, 59). Generally, the canopy includes northern red oak but lacks the chestnut oak that is commonly found in higher and drier vegetation communities. There are many codominant species, such as red maple, black oak, hickory (*Carya* sp.), and black birch. The subcanopy layer generally includes American hornbeam, while the shrubby layers are generally composed of northern spicebush, American witch-hazel, Eastern hop-hornbeam (*Ostrya virginiana*), and early lowbush blueberry. The herbaceous layer is generally composed of Christmas fern (*Polystichum acrostichoides*), eastern hay-scented fern, the invasive garlic mustard (*Alliaria petiolata*), Canada mayflower, and club mosses (*Lycopodium* spp.).

Coniferous forests characterized by eastern hemlock (*Tsuga canadensis*) are considered an important indicator for maintaining the health of the park forest ecosystem and as such are important vegetation associations within DEWA. Eastern hemlock forests support many species of wildlife, both terrestrial and aquatic, as well as other plant species. Understory species such as rattlesnake plantain, leatherwood, Canada mayflower, and wood sorrels thrive in hemlock forest stands; several species of birds have been identified as hemlock-obligate species, including black-throated green warbler (*Dendroica virens*), blue-headed vireo (*Vireo solitarius*), and northern goshawk (*Accipiter gentilis*) (Quimby 1996, 4). DEWA contains 141 forest stands that contain eastern hemlock, composing 2,800 acres, or about 5% of DEWA (NPS 2010k). Eastern hemlock forests are found in areas with moist, cool conditions, particularly in low-elevation ravines. Hemlock forests are a climax community that can live for 800 or more years (NPS 2008b, 37). However, hemlock stands are vulnerable to fire, winds, and flooding because of their shallow roots, and have been greatly threatened throughout their range by the hemlock woolly adelgid (*Adelges tsugae*), a nonnative invasive pest species.

Within DEWA, forest stands containing eastern hemlock include eastern hemlock forest and mixed associations of eastern hemlock/northern hardwood forest and eastern hemlock/mixed hardwood palustrine forest vegetation communities (NPS 2007b, 9, 33, 173). Eastern hemlock forest and eastern hemlock/northern hardwood forest are generally found on north-facing, steep ravine slopes. Eastern hemlock/mixed hardwood palustrine forest is found in upland depressions with semipermanent to permanent flooding in higher-elevation drainages, including drainages originating from Kittatinny Ridge. The understory in hemlock/mixed hardwood palustrine forest is predominantly composed of great laurel and sedge species.

Palustrine Forests and Meadows and Scrub Shrub: Wetland vegetation associations may be forested or successional scrub shrub and are generally found in wet lowland areas such as low terrace floodplains of smaller creeks, areas where there is a broad flat with diffuse drainage and poorly drained soil, and upland depressions with poor drainage. Deciduous palustrine forest dominated by red maple is the most common palustrine forest throughout DEWA and can tolerate conditions that range from temporarily to permanently flooded. Common species within these forests include red maple, northern spicebush, jewelweed (*Impatiens capensis*), and skunk cabbage (*Symplocarpus foetidus*) (NPS 2007b, 33, 195).

Riparian areas are found on floodplain terraces or tributaries where flooding and soil conditions are the principal determinants of riparian vegetation associations, which can include grasslands, forests, scrub shrub, or more herbaceous areas (NPS 2007a, 60–61). The most common palustrine scrub shrub is dominated by silky dogwood (*Cornus amomum*) and is generally found in wet areas of formerly used agricultural fields or pastures. Besides silky dogwood, this successional wetland type is dominated by shrubby plants including crack willow (*Salix fragilis*), hairyfruit sedge (*Carex trichocarpa*), reed canarygrass (*Phalaris arundinacea*), and arrow-leaf tearthumb. This vegetation association may succeed to a floodplain forest if woody species survive (NPS 2007b, 235). Other lowland wet-environment vegetation associations, including wet meadows, sedge meadows, marshes, wetlands, bogs, seeps, fens, and vernal pools, are found in areas with specific hydrological conditions. Specific descriptions of wetlands within the study area are described in the “Wetlands” section of this chapter.

The characterization of the vegetation communities along the alternative alignments is based on sources that include the following: *Classification and Mapping of Vegetation and Fire Fuel Models at Delaware Water Gap National Recreation Area* (NPS 2007a, 2007b); *Field Survey Report: Susquehanna to Roseland Transmission Line Proposal and Right-of-Way Request Environmental Impact Statement* (NPS 2011b); *National Biological Information Infrastructure Gap Analysis Program: National Land Cover* (USGS 2010); and applicable county natural area inventories. Detailed descriptions of vegetation along the alignments are based primarily on surveys conducted in 2010 and 2011; however, these surveys were conducted only within the boundaries of DEWA and APPA. Portions of the alignments that fall within the

study area but outside NPS boundaries are characterized with as much detail as possible from existing information. These studies are included in the “References” section of this EIS.

Methodology: The ROW and adjacent habitat within DEWA and APPA were surveyed during vegetation surveys in 2010 and 2011 (NPS 2011b). The land outside the parks but within the study area was characterized mainly using the land cover dataset of the U.S. Geological Survey Gap Analysis Program (USGS 2010). This program uses digital data to create land cover maps that depict major ecological systems, which are categorized by the U.S. Geological Survey National Vegetation Classification Standard. Included in the ecological systems are developed areas, ranging from open space (containing mostly lawn grasses) to high intensity development (containing 80% to 100% impervious surfaces). The following descriptions of the vegetation along the alternative alignments generally discuss vegetation in DEWA, because MDSR and APPA are contained within DEWA.

Alternative 1 (No Action), Alternative 2, and Alternative 2b

In general, the vegetation found along the alignment of alternatives 1, 2, and 2b contains a mix of vegetation communities reflecting wet, moist, and xeric conditions, as described above. The B-K Line ROW crosses through many rare and unique habitats: a calcareous wetland (Arnott Fen), Hogback Ridge, Delaware River riparian corridor, eastern hemlock forests, Van Campen Brook riparian area, Kittatinny Ridge, and talus slope communities; these habitats are described in detail in the “Rare and Unique Communities” section. Hogback Ridge has long been considered the most important area of biodiversity in all of DEWA.

At the time of vegetation surveys for this EIS, the vegetation in the ROW was at varying stages of succession (NPS 2011b). The vegetation in the ROW has not been maintained consistently over the life of the transmission line. The maintenance also differs between Pennsylvania and New Jersey. Since 2007, the vegetation within the ROW in New Jersey has been maintained more consistently and is therefore kept at an earlier stage of succession than the vegetation in Pennsylvania. A large-scale vegetation removal project was conducted prior to the application for this project.

Vegetation within the ROW is identified as that typical of a scrub shrub area, dominated by herbaceous and shrub species. However, tree species found in adjacent woodlands within the habitat adjacent to the ROW are also present. Pioneer species such as eastern red cedar also are present. The habitat on either side of the existing ROW of alternatives 1, 2, and 2b consists of deciduous, coniferous, and mixed forest stands. The woodland vegetation communities along the alignment outside the ROW are consistent with the Appalachian oak forest type and generally include deciduous tree species dominated by oaks, including chestnut oak, northern red oak, and black oak. On lower elevations, the deciduous, oak-dominated mesic forests either contain white, black, or northern red oaks as the dominant species, or a combination of these trees dominate the canopy. On the steep slopes close to APPA, the forests are high elevation and xeric, and chestnut oak tends to be the dominant species. The vegetation in these woodlands is sparse due to the topography.

Several other vegetation types or associations are found along the habitat adjacent to the ROW of alternatives 1, 2, and 2b, including mixed deciduous/coniferous forests dominated by sycamore (*Platanus occidentalis*); mixed deciduous/coniferous forests dominated by sugar maple, American beech, and yellow birch (*Betula alleghaniensis*); and deciduous forests dominated by red maple and red alder (*Alnus rubra*). Red maple and red alder forests are present near wetlands and contain species tolerant of moist conditions. Additionally, the forests along the alignment for alternatives 1, 2, and 2b contain several coniferous species, including eastern red cedar, white pine, and eastern hemlock. Coniferous species are dominant or codominant in several of the woodlands along the alignment for alternatives 1, 2, and 2b and usually have sparse understories. Eastern hemlock, an important component of forest species diversity in

DEWA, is found throughout the habitat adjacent to the ROW of the alignment for alternatives 1, 2, and 2b, including as a codominant species in several forest stands.

The forests adjacent to the existing ROW are mostly continuous. The exceptions are found where roads and a ROW unrelated to this project bisect the forests. In Pennsylvania, the ROW for alternatives 1, 2, and 2b provides grassland habitat. In addition, the alignment crosses a small portion of agricultural cropland and leaves DEWA property several times near the Bushkill Substation (figures 34 and 35). Outside the park boundaries, but inside the study area, the alignment travels through developed area, including a golf course bordered by a deciduous forest.

Alternative 3

Inside the study area, the alternative 3 ROW would stay within the DEWA boundaries and cross both MDSR and APPA (figure 36). The vegetation within the ROW of alternative 3 and adjacent woodlands contains a mix of vegetation communities that reflect wet, moist, and xeric conditions. These include mixed forests, deciduous forests, agriculture, and scrub shrub.

Vegetation within the ROW of alternative 3 contains species typical of scrub shrub; however, at the time of vegetation surveys for this EIS, the vegetation in the ROW was at varying stages of succession. In addition to scrub shrub habitat, the ROW contains several tree species, including eastern hemlock, striped maple (*Acer pensylvanicum*), American beech, and black, yellow, and gray birch.

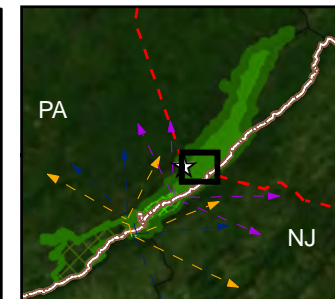
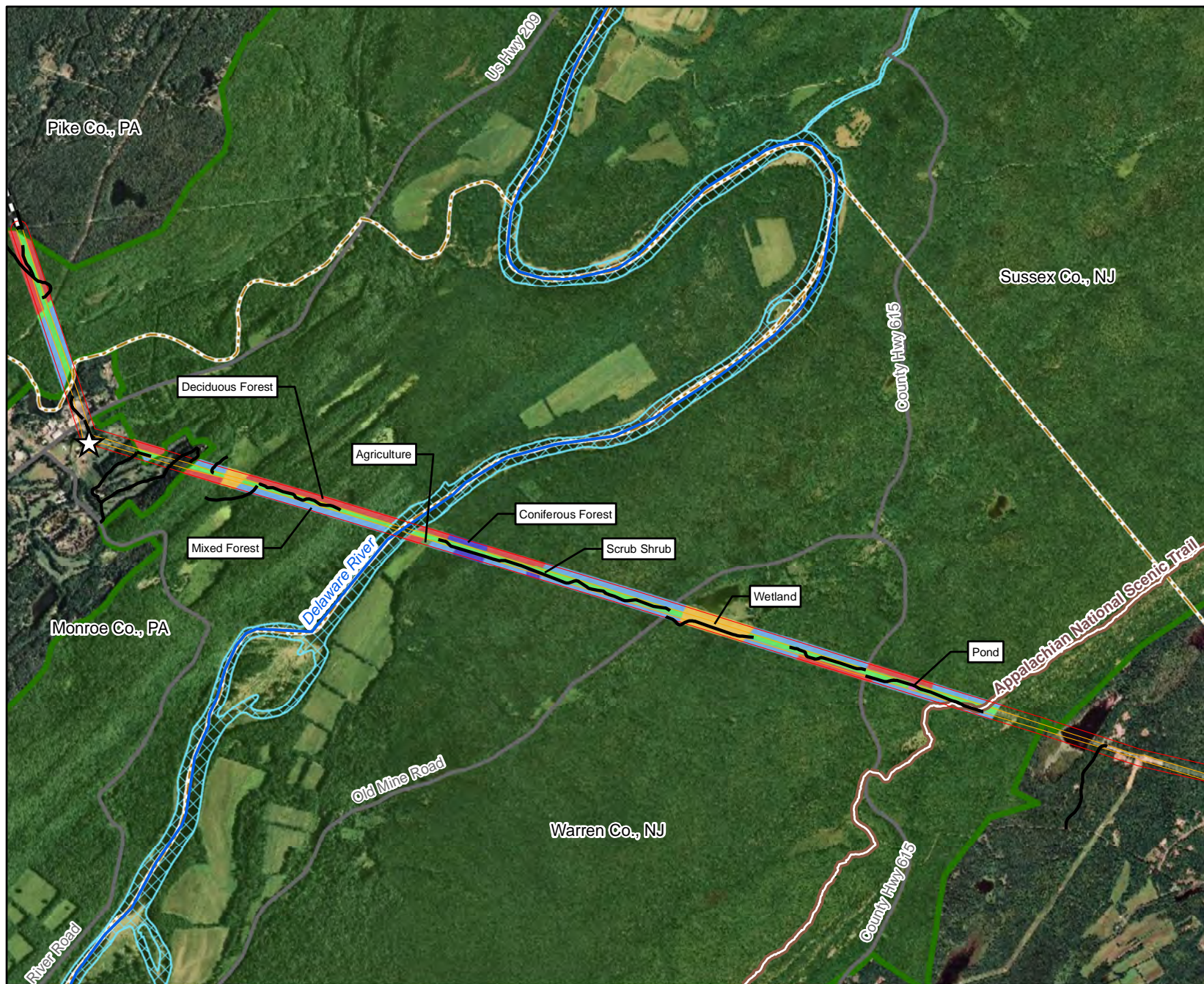
In general, woodland vegetation communities adjacent to the ROW for alternative 3 include primarily deciduous tree species in mixed and deciduous forest stands. These forests are often dominated by tulip poplar, white ash, sugar maple, American beech, red maple, and occasionally eastern hemlock, although few forest stands are dominated by just one species. Invasive plant species are found in the understory of most forest stands and vegetation communities and are discussed in the “Invasive Plant Species” section. The canopy cover is complete or nearly complete at the lower elevations. Both the canopy and groundcover are sparser in the steep topography around APPA.

A small section (approximately 500 linear feet) of the alternative 3 ROW and adjacent habitat contains agricultural land. At the time of the 2010 vegetation surveys, there was evidence of a controlled burn in this area from wildfire suppression completed in Worthington State Forest in the summer of 2010. The NPS uses controlled burns, otherwise known as prescribed fires, to reduce hazardous fuel loads near developed areas, to manage landscapes, and to restore natural woodlands (NPS 2010l).

Outside DEWA boundaries, the following forest types are present within the study area: Appalachian hemlock/hardwood forests, northeastern interior dry–mesic oak forest, central Appalachian pine/oak rocky woodlands, and central Appalachian oak and pine forests. The hemlock/hardwood forests are dominated by sugar maple, yellow birch, and beech in the canopy; hemlocks are frequent as minor canopy associates.

Alternative 4

Inside the study area, alternative 4 would run within or adjacent to the southwest boundary of DEWA and would cross APPA (figure 37). Alternative 4 contains vegetation indicative of high-elevation xeric, mid-elevation mesic, and scrub shrub communities within the ROW and surrounding forests.



Legend

- ☆ Substation
- ▬▬▬ Outside Study Area
- ▬ Existing ROW in Study Area
- ▬ 350 ft Corridor
- ▬ Appalachian National Scenic Trail
- ▬ Delaware River
- ▬ Road
- ▬ Delaware Water Gap National Recreation Area
- ▬ Middle Delaware National Scenic and Recreational River
- ▬ County Line
- Vegetation Types**
 - ▬ Agriculture
 - ▬ Coniferous Forest
 - ▬ Deciduous Forest
 - ▬ Mixed Forest
 - ▬ Pond
 - ▬ Scrub Shrub
 - ▬ Wetland



Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

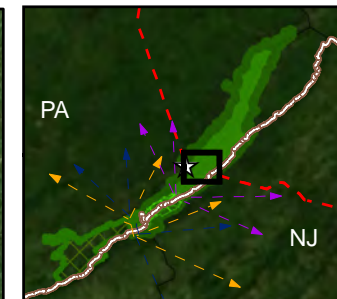
Figure 34
Alternative 2 Vegetation

Source: ESRI Streetmap 2006, Penn State 2010,
ESRI ArcGISonline Map Service 2010,
PennDOT 2011, USGS 2006,
NJ DEP 2008

Projection: NAD 83 UTM Zone 18N
Date: July 2012



0 1,500 3,000
Feet



- Legend**
- ☆ Substation
 - ▬▬▬ Outside Study Area
 - ▬▬▬ Alternative 2b Corridor
 - ▬▬▬ Appalachian National Scenic Trail
 - ▬▬▬ Delaware River
 - ▬▬▬ Road
 - ▬▬▬ Delaware Water Gap National Recreation Area
 - ▬▬▬ Middle Delaware National Scenic and Recreational River
 - ▬▬▬ County Line
- Vegetation Types**
- ▬▬▬ Agriculture
 - ▬▬▬ Coniferous Forest
 - ▬▬▬ Deciduous Forest
 - ▬▬▬ Mixed Forest
 - ▬▬▬ Pond
 - ▬▬▬ Scrub Shrub
 - ▬▬▬ Wetland



Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

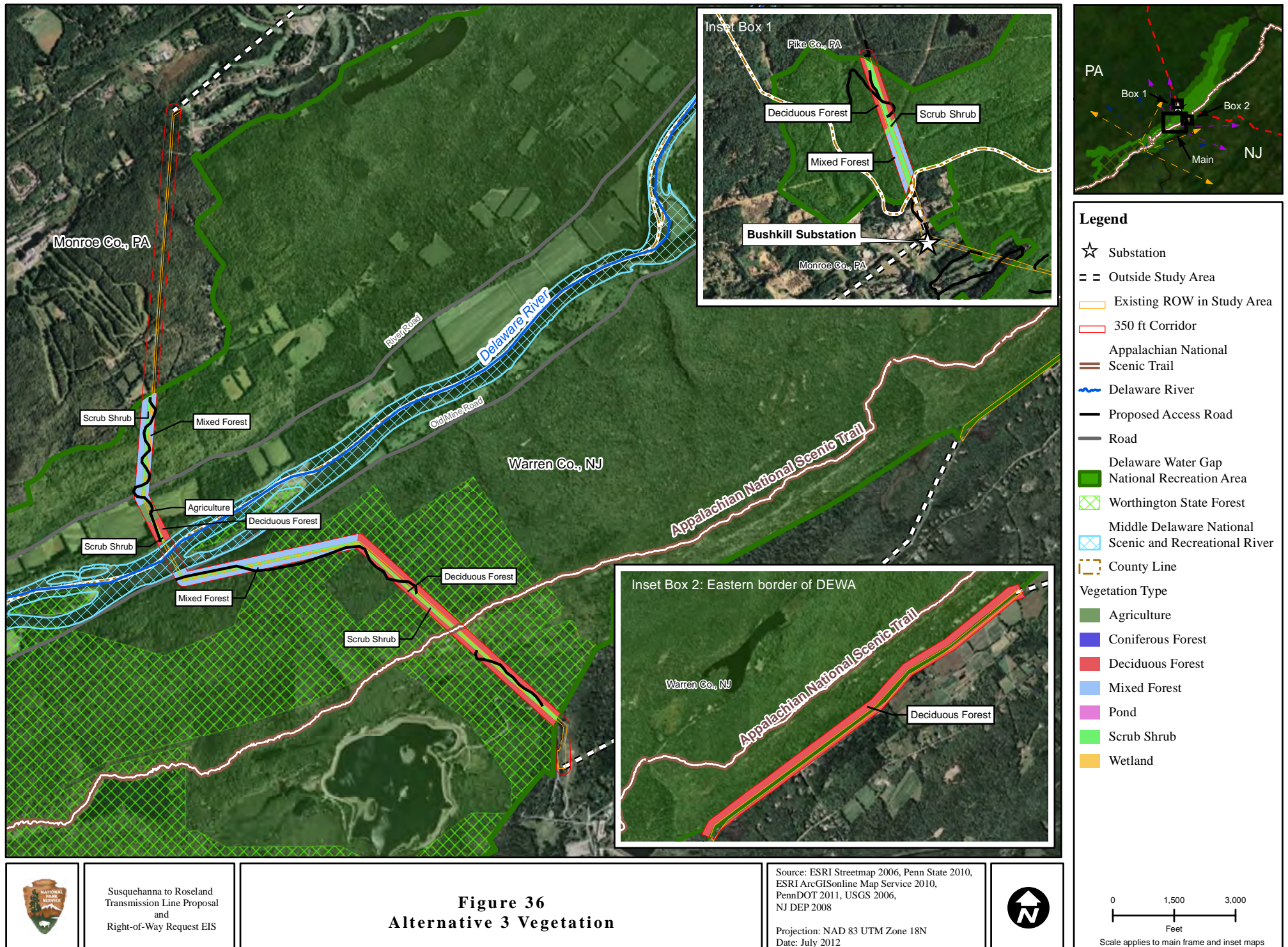
Figure 35
Alternative 2b Vegetation

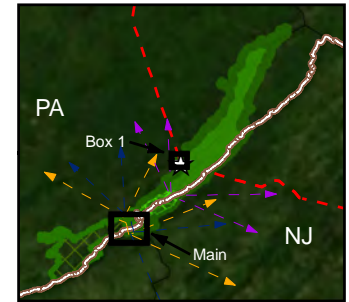
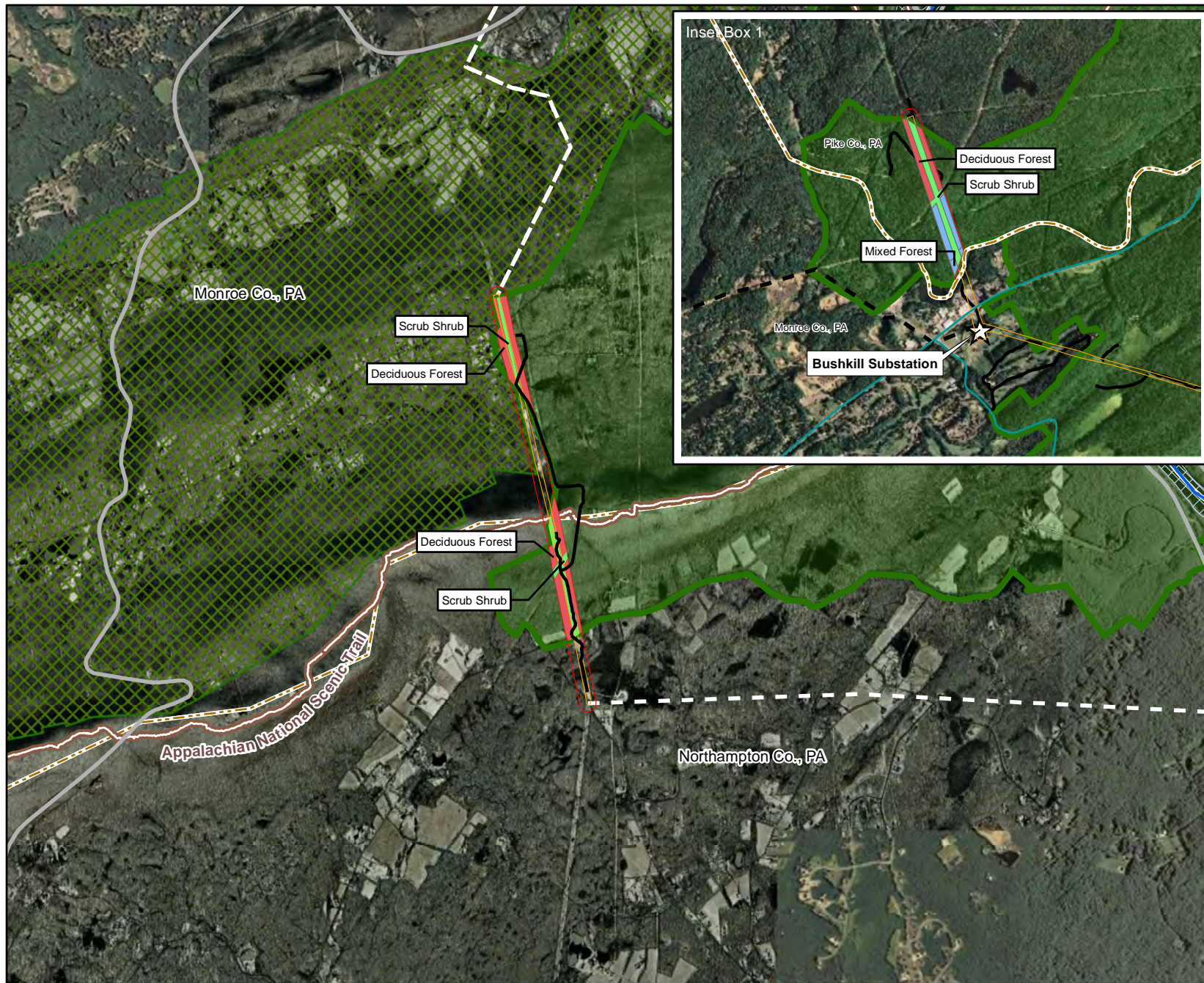
Source: ESRI Streetmap 2006, Penn State 2010,
ESRI ArcGISonline Map Service 2010,
PennDOT 2011, USGS 2006,
NJ DEP 2008

Projection: NAD 83 UTM Zone 18N
Date: July 2012



0 1,500 3,000
Feet





- ☆ Substation
- == Outside Study Area
- Existing ROW in Study Area
- 350 ft Corridor
- Appalachian National Scenic Trail
- Delaware River
- Proposed Access Road
- Roads
- Delaware Water Gap National Recreation Area
- CVNWR Boundary
- County Line
- Vegetation Type
 - Deciduous Forest
 - Mixed Forest
 - Scrub Shrub

Note: Designated boundary of CVNWR is depicted, not all property is owned within the boundary

The alternative 4 ROW vegetation communities are primarily scrub shrub with thick woody shrub species and small specimens of tree species. Nearly half of the alternative 4 alignment is outside the parks' boundaries and the vegetation could not be surveyed; however, the ROW in these areas is expected to be consistent with the above description as it is an existing, maintained transmission line ROW.

In general, vegetation communities adjacent to the ROW of alternative 4 include woodland communities of deciduous tree species; however, the portion of alternative 4 that follows the B-K Line also contains mixed deciduous/coniferous mesic forests. Along the portion of alternative 4 at the southern boundary of DEWA, the woodlands along the habitat adjacent to the ROW are dominated by red maple, black cherry, and tulip poplar, within the lower elevations of the alignment. As the alignment continues south, the dominant species are red maple and tulip poplar. The southern portion of the alignment within the study area crosses APPA within the boundaries of DEWA (figure 37). This portion of the alternative 4 ROW is on steep slopes; these high-elevation xeric forests are characterized by oak species, including northern red oak, chestnut oak, and pin oak, but none of these species dominate the forest.

Outside DEWA boundaries, the following ecological systems are found within the study area: Appalachian hemlock/hardwood forests, northeastern interior dry-mesic oak forest, central Appalachian pine/oak rocky woodlands, and central Appalachian oak and pine forests.

Alternative 5

Alternative 5 would follow the same route through DEWA and APPA as alternative 4, except it would not include the 0.6-mile portion that would connect to the B-K Line (figure 37); therefore, alternative 5 does not contain mixed deciduous/coniferous mesic forests within the study area. The vegetation found along the alternative 5 ROW contains a mix of vegetation communities including high-elevation xeric, mid-elevation mesic, dominated by deciduous species, and scrub shrub communities, as described for alternative 4.

Outside the Study Area

Outside the study area in Pennsylvania, the S-R Line could pass through Carbon, Lackawanna, Luzerne, Monroe, Northampton, Pike, and Wayne counties. These counties are largely undeveloped, with total area of undeveloped land ranging from approximately 62% to 95% (Commonwealth of PA 2005a, 2005b, 2005c, 2005d, 2005e, 2005f, 2005g). Monroe County contains more than 20,000 acres that have been designated as the Cherry Valley NWR; however, not all 20,000 acres are under current ownership or management of the USFWS.

The natural areas of these counties are dominated by two forest types, Appalachian oak forest and northern hardwood forest, which are similar to the type of deciduous woodlands described within DEWA (PATNC 1990, 5–6; 1991a, 7–9; 1991b, 6–8; 1998, 5–7; 2005a, 5–8; 2005b, 6–10; 2006, 5–7). Mixed oak forests are dominated by red oak, white oak, and black oak with some white pine. Common associate species include red maple, sugar maple, American beech, white ash, hickories (*Carya* spp.), and tulip poplar. A shrub layer of blueberries, viburnums, northern spicebush, American witch-hazel, shadbush (*Amelanchier* sp.), and great laurel is common. At higher elevations, the dominant species is chestnut oak. Other ridgetop species include assorted oaks, black gum, gray birch (*Betula populifolia*), red maple, black huckleberry, blueberries, and mountain laurel. Another community that can be found on exposed ridgetops is dominated by pitch pine and scrub oak, with an understory of huckleberry, black chokeberry (*Photinia melanocarpa*), lowbush blueberry, teaberry (*Gaultheria procumbens*), and bracken fern. In the lower mesic areas, forests contain eastern hemlock and white pine with an abundance of great laurel (PATNC 1990, 5–6; 1991a, 7–9; 1991b, 6–8; 1998, 5–7; 2006, 5–7).

Northern hardwood forests of these Pennsylvania counties are dominated by sugar maple, red maple, American beech, yellow birch, eastern hemlock, and/or white pine. The northern hardwood forests are found in areas of past logging, and regeneration in these areas is often slow due to the poor condition of the soils (PATNC 1990, 5–6; 1991a, 7–9; 1991b, 6–8; 1998, 5–7; 2006, 5–7).

These counties also contain an abundance of both nutrient-poor and nutrient-rich wetlands. The dominant vegetation of nutrient-poor wetlands includes a mat of sphagnum moss (*Sphagnum* sp.), sedges, sundews (*Drosera* spp.), pitcher plants (*Sarraceniaceae*), cranberries (*Vaccinium* spp.), and small shrubs surrounded by a bog forest with black spruce (*Picea mariana*), larch (*Larix* sp.), sedges, and moss. In contrast, nutrient-rich wetlands support a vegetation community that includes red maple, eastern hemlock, ash, black gum, and yellow birch with an understory of blueberry and swamp azalea (*Rhododendron viscosum*) (PATNC 1990, 5–6; 1991a, 7–9; 1991b, 6–8; 1998, 5–7; 2006, 5–7). Wetlands are described in more detail in the “Wetlands” section.

Outside the study area in New Jersey, the S-R Line would traverse Sussex, Warren, and Morris counties. These counties are largely undeveloped, with total area of undeveloped land ranging from approximately 41% to 85% (Morris County Planning Board 2007, 3-1–3-4; Sussex County Division of Planning 2009, 18–26; Warren County Planning Board 2005, 33–47). Warren County encompasses all of Worthington State Forest. Sussex County contains Wallkill River NWR. Warren, Sussex, and Morris counties fall within three ecoregions: Northeastern Highlands, Northern Piedmont, and Ridge and Valley. The vegetation of these ecoregions within the undeveloped portions of New Jersey is Appalachian oak forest. This forest type is described in detail above. These New Jersey counties are also rich in wetland habitats (Woods, Omernik, and Moran 2007, 3–11); wetlands are described in more detail in the “Wetlands” section.

INVASIVE PLANT SPECIES

Invasive plant species within DEWA, MDSR, and APPA pose a significant risk to the many vegetation communities that also function as wildlife habitat within the parks, particularly to rare or unique vegetation associations. Invasive species are typically opportunistic and often spread quickly without natural barriers or enemies, resulting in alteration of habitat conditions. These changes can result in adverse impacts on native vegetation and wildlife. The colonization of invasive plants causes major problems, including crowding out native species, contributing to species extinctions, altering the structure of natural plant communities, disrupting ecosystem functions, and degrading recreational opportunities (NJDEP 2004). Within DEWA, 241 invasive plant species have been documented (NPS 1998a, 1). Invasive species are prominent in the groundcover and understory layers of mesic forests and riparian areas within DEWA; however, the xeric forests are largely free of invasive plant species (NPS 2009d, ii-16).

Disturbed and early successional areas such as old agricultural fields provide ideal habitat for invasive species (NPS 2009e, 45) colonization. This is also true for transmission line ROWs, which are routinely disturbed by clearing. The invasive plant species of highest concern are presented in table 10 (NPS 2009e, 18). The two most widespread invasive plants in DEWA, as determined in survey plots, are tree-of-heaven (*Ailanthus altissima*) and Japanese barberry (NPS 2009e, 46). Tree-of-heaven is a particularly difficult invasive species to control, because of its ability to spread by seeds, root suckers, cuttings, and sprouted stumps (NPS 1998a, 2). Another invasive plant species, purple loosestrife (*Lythrum salicaria*), has taken over many wetland areas of the park.

TABLE 10: PREVALENT INVASIVE PLANT SPECIES IN DEWA

| Common Name | Scientific Name |
|---------------------|------------------------------|
| Asian bittersweet | <i>Celastrus orbiculatus</i> |
| Autumn olive | <i>Elaeagnus umbellata</i> |
| Bush honeysuckle | <i>Lonicera</i> spp. |
| Garlic mustard | <i>Alliaria petiolata</i> |
| Japanese barberry | <i>Berberis thunbergii</i> |
| Japanese knotweed | <i>Polygonum cuspidatum</i> |
| Japanese stiltgrass | <i>Microstegium vimineum</i> |
| Multiflora rose | <i>Rosa multiflora</i> |
| Purple loosestrife | <i>Lythrum salicaria</i> |
| Tree-of-heaven | <i>Ailanthus altissima</i> |

Source: NPS 2009e, 18.

Because of the difficulty in controlling many invasive plant species, ongoing management is necessary to keep these species from invading important areas. DEWA uses an early detection program for invasive species that targets multiple species at resource areas that have high value, such as rare natural communities (NPS 2009d, ii-19). DEWA also has several programs that target specific invasive species, such as the biocontrol program for purple loosestrife and the herbicide control program for common reed (*Phragmites australis*) (NPS 2009d, iv-81-iv-96). Additionally, the Northeast Region's Exotic Plant Management Team works to control autumn olive, tree-of-heaven, multiflora rose, Japanese knotweed, purple loosestrife, bush honeysuckle, Japanese hops (*Humulus japonicus*), and tearthumb through cooperative planning efforts (NPS 2009d, iv-99-iv-100). However, despite the use of best management practices (BMPs), it is often impossible to stop the spread of many invasive species.

Vegetation studies conducted throughout DEWA indicated that about 34 % of the survey sites were free of any invasive species, 17 % of the survey sites had only 1 invasive species present, and one survey site contained 10 species (NPS 2009e, 17). These results are consistent with the trends observed through the Eastern Rivers and Mountains Network vegetation and soil monitoring program, where 39 % of the survey plots were found to be free of invasive species (NPS 2010j, vi). Results of the studies indicated that successional and highly disturbed areas within the park provided the optimal conditions for colonization by invasive plant species, whereas cliffs and dry terrestrial communities had the least colonization by invasive plant species (NPS 2009e, 45).

The Eastern Rivers and Mountains Network has an early detection monitoring program to provide early identification and elimination of invasive species before they become widespread within a park. First, a short list of generally 10 to 20 potential likely invasive species is created for each park. Park staff members become familiar with the listed invasive species and monitor for new invasive species. Rapid response of identification, extent, and removal of the invasive species is employed. In DEWA this early detection program has successfully led to the quick discovery of three invasive plant species—narrowleaf bittercress (*Cardamine impatiens*), linden arrowwood (*Viburnum dilatatum*), and Amur corktree (*Phellodendron amurense*) (NPS 2010m, 3-11).

Alternative 1 (No Action), Alternative 2, and Alternative 2b

Nearly all invasive species observed inside the study area along alternatives 1, 2, and 2b during the 2010 vegetation surveys were found within the existing ROW (NPS 2011b). Ten invasive species were

observed over the length of the alignment for alternatives 1, 2, and 2b. These include tree-of-heaven, winged euonymus (*Euonymus alatus*), Japanese barberry, autumn olive, multiflora rose, Japanese stiltgrass, Canada thistle (*Cirsium arvense*), garlic mustard, purple loosestrife, and Asian bittersweet (a vine). The ROW contains invasive species throughout its length, likely because of the periodic but historically inconsistent disturbance resulting from the clearing required to maintain the area beneath the transmission lines.

Alternative 3

Inside the study area, nine species of invasive plants were identified within the proposed alignment of alternative 3 during the 2010 and 2011 vegetation surveys (NPS 2011b). Species that are found along the alternative 3 ROW include tree-of-heaven, black locust (*Robinia pseudoacacia*), and shrubs of Japanese barberry, autumn olive, multiflora rose, Japanese honeysuckle, and wineberry. The herbaceous species Japanese knotweed and garlic mustard are also present. Most of these species are found in the ROW of alternative 3 and habitat adjacent to the ROW. Portions of the habitat adjacent to the ROW are free of invasive species, whereas others contain a high abundance of invasive species. The ROW contains invasive species throughout its length, primarily because of the periodic disturbance resulting from the clearing required to maintain the area beneath the transmission lines.

Alternative 4

Inside the study area, 11 invasive plant species were found along the proposed alignment of alternative 4 during the 2010 and 2011 vegetation study (NPS 2011b). The following species are found within the ROW and adjacent habitat: Canada thistle, Japanese barberry, autumn olive, garlic mustard, and multiflora rose. The ROW also contains Japanese stiltgrass, Asian bittersweet, common privet, spotted knapweed (*Centaurea stoebe*), winged euonymus, and Japanese honeysuckle. The habitat areas adjacent to alternative 4 south of APPA within the boundaries of DEWA are free of invasive species, and the ROW contains one invasive species, Japanese stiltgrass.

Alternative 5

The alternative 5 alignment would follow the same route through DEWA and APPA as alternative 4, except it would not include the 0.6-mile portion of the B-K Line. Therefore, the invasive species along the alternative 5 ROW include Canada thistle, Japanese barberry, autumn olive, Japanese stiltgrass, Asian bittersweet, common privet, spotted knapweed, Japanese honeysuckle, and multiflora rose.

Outside the Study Area

Outside the study area in Pennsylvania, the S-R Line could pass through Carbon, Lackawanna, Luzerne, Monroe, Northampton, Pike, and Wayne counties. Invasive species are found throughout Pennsylvania, including these counties. Nonnative plants such as tree-of-heaven, Asian bittersweet, Japanese barberry, multiflora rose, Japanese honeysuckle, autumn olive, and garlic mustard have become commonplace in disturbed woodlands, often to the point of excluding some of the native plants. In wetlands and along streams, purple loosestrife, Japanese hops, and Japanese knotweed are aggressive, weedy species that follow in the wake of disturbance and crowd out native species. The species with the greatest impact on these communities tend to be robust herbs such as purple loosestrife and Japanese knotweed, but vines such as Japanese hops are also serious problems. Aquatic habitats of the rivers, streams, and lakes are also vulnerable to invasion by exotics (PATNC 1998, 7–8; 2006, 7–8).

Outside the study area in New Jersey, the S-R Line would traverse Sussex, Warren, and Morris counties. More than 1,000 nonnative plant species have become established in New Jersey (NJDEP 2004). Some

nonnative, invasive species common to Sussex and Morris counties are Japanese barberry, spotted knapweed, Canada thistle, Japanese honeysuckle, Tatarian honeysuckle (*Lonicera tatarica*), Morrow's honeysuckle (*Lonicera morrowii*), curly pondweed (*Potamogeton crispus*), and black locust. Purple loosestrife, Japanese stiltgrass, tree-of-heaven, garlic mustard, lesser celandine (*Ranunculus ficaria*), multiflora rose, and Asian bittersweet are also found in one or more of these counties.

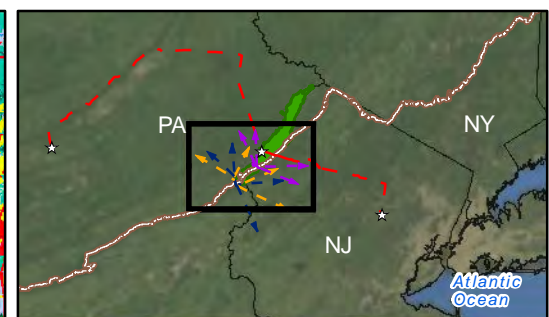
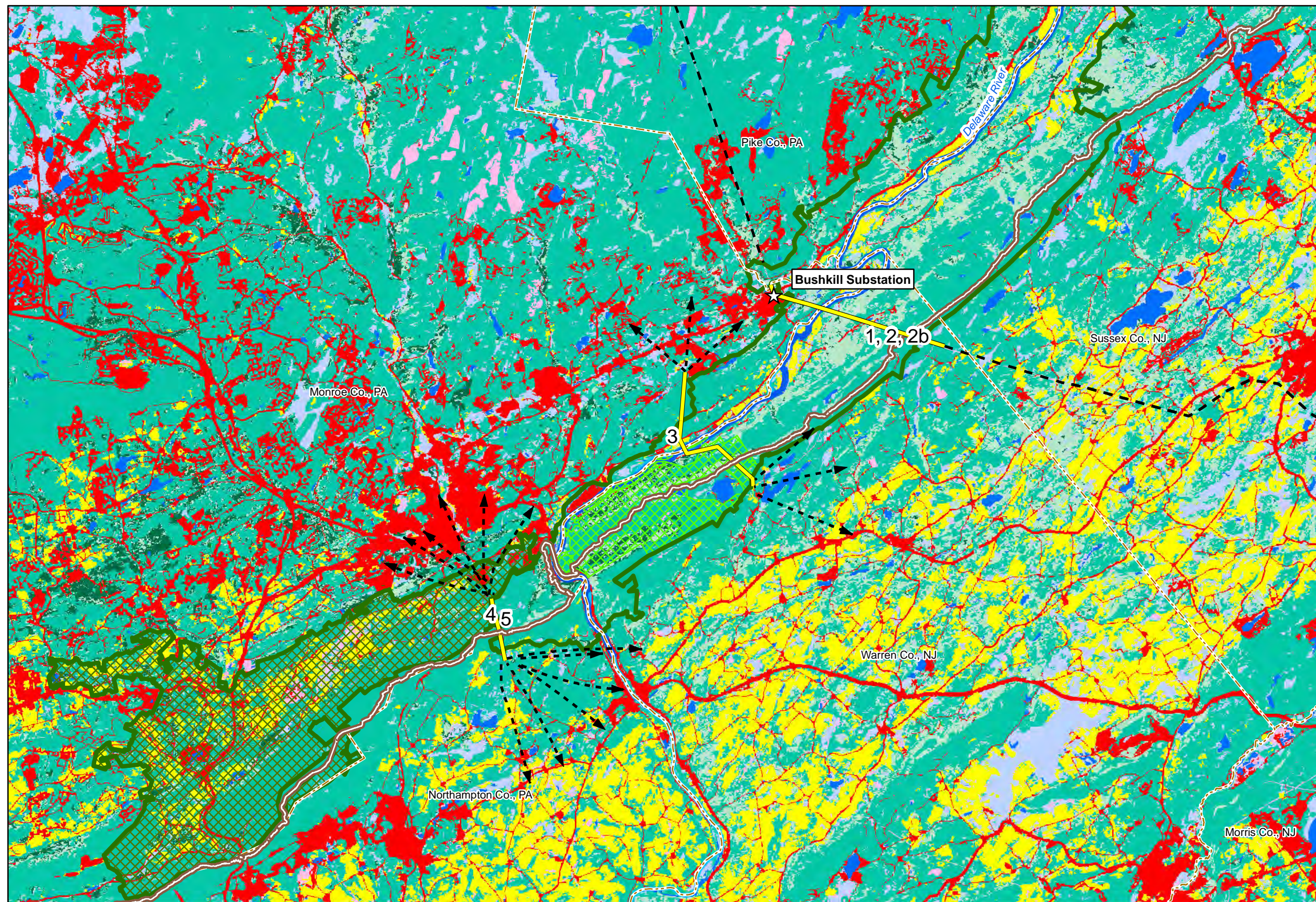
LANDSCAPE CONNECTIVITY, WILDLIFE HABITAT, AND WILDLIFE

LANDSCAPE CONNECTIVITY

Landscape connectivity is the degree to which the landscape facilitates or impedes movement between resource patches (Taylor et al. 1993, 571). It is a generally accepted principle that larger contiguous land areas provide more ecological services and fragmentation disrupts these services and diminishes the value of fragmented lands. A primary goal of land managers is to achieve a high degree of connectivity within the landscape. For lands in the eastern United States, the preservation of large tracts of undisturbed, contiguous tracts of forests, wetlands, surface waters, and floodplains is a priority. Many native species are dependent on the interior forests and the connection of these undisturbed forests to wetlands, riparian corridors, and surface waters. Land management to maintain large forest patch sizes and smaller inter-patch distances supports landscape connectivity. National parks and other large tracts of public land often serve as hubs for colonization of other patches within the regional landscape and as refuges for wildlife populations within the highly populated eastern states.

The NPS aims to conserve large, contiguous areas of undisturbed forest, wetlands, surface waters, and floodplains for native species; these areas represent the habitats described in this document. DEWA, MDSR, and APPA play an important role in preserving undisturbed contiguous natural habitats, not only within park boundaries but regionally. DEWA provides 67,000 acres of national park within a mixed landscape in western New Jersey and eastern Pennsylvania. Regional land cover types are shown in figure 38. Large tracts of hardwood forests dominated by oaks and coniferous forests dominated by eastern hemlock are prevalent within DEWA. The forests of DEWA, including those surrounding APPA, provide some of the increasingly rare forest interior of the mid-Atlantic region. Additionally, the Delaware River is the last and largest free-flowing river in the eastern United States (NPS 2003a, 6), devoid of dams along its length, allowing unimpeded migration for many fish species.

Habitat fragmentation is the alteration of habitat resulting in spatial separation of habitat patches, which reduces the connectivity of habitats on a landscape scale (Hogan 2011). Habitat fragmentation occurs naturally through geological forces, climate change, floods, and earthquakes. However, human alteration of habitat through processes such as creation of agricultural land and construction of infrastructure has dramatically altered and fragmented natural landscapes (Lavery et al. n.d.). Infrastructure projects such as roads, trails, natural gas pipelines, and electric transmission lines have the potential to fragment the large tracts of contiguous forest within DEWA. Habitat fragmentation within the parks can be managed through careful consideration of projects that would remove tracts of habitat, particularly forests, or create substantial amounts of habitat edge. In general, openings in the forest, such as for roads and power lines, should be avoided, and concentrated in already disturbed areas away from contiguous, undisturbed forested lands (Faaborg et al. 1993, 336). Habitat edge, while promoting local species diversity, encourages the establishment of invasive species and reduces the quality of interior forest habitat (Rosenberg et al. 1999, 9). For example, creating habitat edge through a forest will reduce the size of interior forest patches. If interior forest or core forest is defined by mature forest that is at least 300 feet from a forest edge (NJ Highlands Council 2008a, 2), creating or expanding a ROW through forest will further reduce interior forest habitat. Invasive and opportunistic plant and animal species will have an increased potential to affect or displace native species. Increasing edge habitat can potentially subject forest-interior bird species to increased nest predation and parasitism (Rosenberg et al. 1999, 9).



Legend

- ☆ Substation
- Inside Study Area
- - Outside Study Area
- Appalachian National Scenic Trail
- Middle Delaware National Scenic and Recreational River
- Delaware River
- Delaware Water Gap National Recreation Area
- Worthington State Forest
- CVNWR Boundary
- County Line

Land Use/Land Cover

- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Agriculture
- Developed
- Open Water
- Wetlands
- Other

Note: Designated boundary of CVNWR is depicted, not all property is owned within the boundary

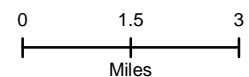


Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

Figure 38
Alternatives Overview Map
Regional Land Cover

Source: ESRI Streetmap 2006, Penn State 2010,
ESRI ArcGISonline Map Service 2010,
PennDOT 2011, USGS 2006,
NJ DEP 2008,

Projection: NAD 83 UTM Zone 18N
Date: July, 2012



All the alternatives being considered use existing utility ROWs within the park and continue outside the park to Susquehanna Substation in Pennsylvania and Roseland Substation in New Jersey, where possible. The ROWs being considered for the alternatives are various widths and have varying frequencies of vegetation maintenance. Therefore, these alternatives and the associated ROWs already represent edge habitat within the forest blocks that surround them. However, the magnitude of the disruption not only in vegetation but in activity and other areas can seriously alter the existing condition.

Alternative 1 (No Action), Alternative 2, and Alternative 2b

Inside the study area, the B-K Line ROW ranges from 80 to 100 feet wide and creates a linear tract from east to west across one of the widest portions of DEWA. The ROW also bisects MDSR and APPA. The specific vegetation cover, both within the existing ROW and adjacent to the ROW, is described in detail in the “Vegetation” section. The parks contain large areas of contiguous habitat that include ROWs, major and minor roads, and trails (figure 39). From the DEWA boundary heading east to Community Drive in Pennsylvania, alternatives 1, 2, and 2b would pass through forest that includes relatively innocuous breaks by other utility ROWs and roads, such as Creek Road. Moving southeastward off the ridge, the ROW would cross Big Bushkill Creek and exit the park while crossing the developed Route 209 corridor in Pennsylvania outside the park. The habitat patches adjacent to the ROW in this area range from approximately 1 acre to 507 acres. Once crossing the Delaware River from the west, the ROW would continue into New Jersey, where the portion of DEWA near the ROW consists of steep ridges that are mostly forested. The ROW would cross APPA at the crest of a forested ridge. From Community Drive to the eastern boundary of DEWA, the habitat patches are larger, ranging from 47 to 5,301 acres. In Pennsylvania, the habitats adjacent to the existing ROW are crossed by two existing ROWs, major and minor roads (US 209, Community Drive, Freeman Tract Road, and Creek Road), McDade Trail, and development at the Bushkill Substation and Fernwood Hotel and Resort. Habitat adjacent to the existing ROW in New Jersey is fragmented by major and minor roads (Millbrook, Old Mine, and Nobebosco roads) and development at the Watergate Recreation Site and Camp No-Be-Bo-Sco. The park provides a mosaic of different habitat types that include roads and utility ROW without fragmenting the nature of the ecosystem.

Alternative 3

Inside the study area, the proposed transmission line expansion route under alternative 3 would cross DEWA, MDSR, and APPA using an existing ROW that is approximately 40 to 125 feet wide. The alternative 3 alignment would also cross Worthington State Forest in New Jersey (figure 40).

Proceeding into DEWA from the western boundary in Pennsylvania, the ROW of alternative 3 would leave the fragmented forest area of the Great Bear Golf and Country Club along the Route 209 corridor. Within the park boundary, the ROW would pass over a forested ridge before descending the ridge to a floodplain that contains agricultural fields. The ROW would cross a forest buffer of the Delaware River before making the crossing just downstream from Tocks Island. The contiguous habitat patches adjacent to this portion of the alternative 3 alignment range from approximately 57 acres to 693 acres and are fragmented by major and minor roads (River Road, Mosiers Knob Road, and Hidden Lake Road) and McDade Trail. Crossing into New Jersey, the existing ROW along alternative 3 crosses through largely unbroken forests of the Worthington State Forest. The habitat patches in New Jersey range from 695 to 4,332 acres and is fragmented by Old Mine Road along the Delaware River. The ROW for alternative 3 would proceed eastward midway up Raccoon Ridge before turning southeast to the crest of the ridge and APPA. The ROW would then head northeast and down the eastern slope of the ridge through the Yards Creek Power Plant and parallel the park boundary to the study area. The portion of the ROW that heads northeast to the study area would pass through mixed-use areas of Yards Creek and agricultural/residential lands with large forest patches that are less contiguous than those inside the parks.

The alternative 3 alignment would follow the DEWA boundary in New Jersey, paralleling APPA. The forests within the DEWA boundary are contiguous in this area; however, the lands adjacent to DEWA in this area contain large portions of agriculture fields and are bisected by small roads.

Alternative 4

Inside the study area, the alternative 4 alignment would cross through APPA, the southern portion of DEWA, and the Cherry Valley NWR established boundary, but not on Federal property, along an existing ROW in Pennsylvania that is approximately 70 to 120 feet wide. The forests along the existing ROW of alternative 4 within the study area are dominated by deciduous forests and contain shrub-dominated rocky summit outcrop areas and several wetlands. Totts Gap Road runs along the alternative 4 alignment and two existing ROWs run parallel to the alignment within 0.5 mile. These features, as well as other roads (Mountain Road and NPS Drive) fragment the habitats along the alternative 4 alignment (figure 41). The habitat patches adjacent to the alignment range from approximately 1 acre to 945 acres, with the smallest patches found between the alternative 4 alignment and the other existing ROWs. Outside the parks, residential lots also fragment the contiguous forest near this alternative.

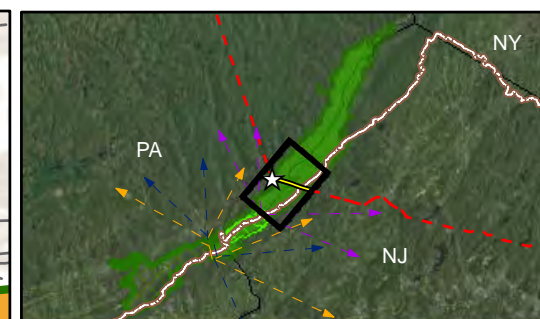
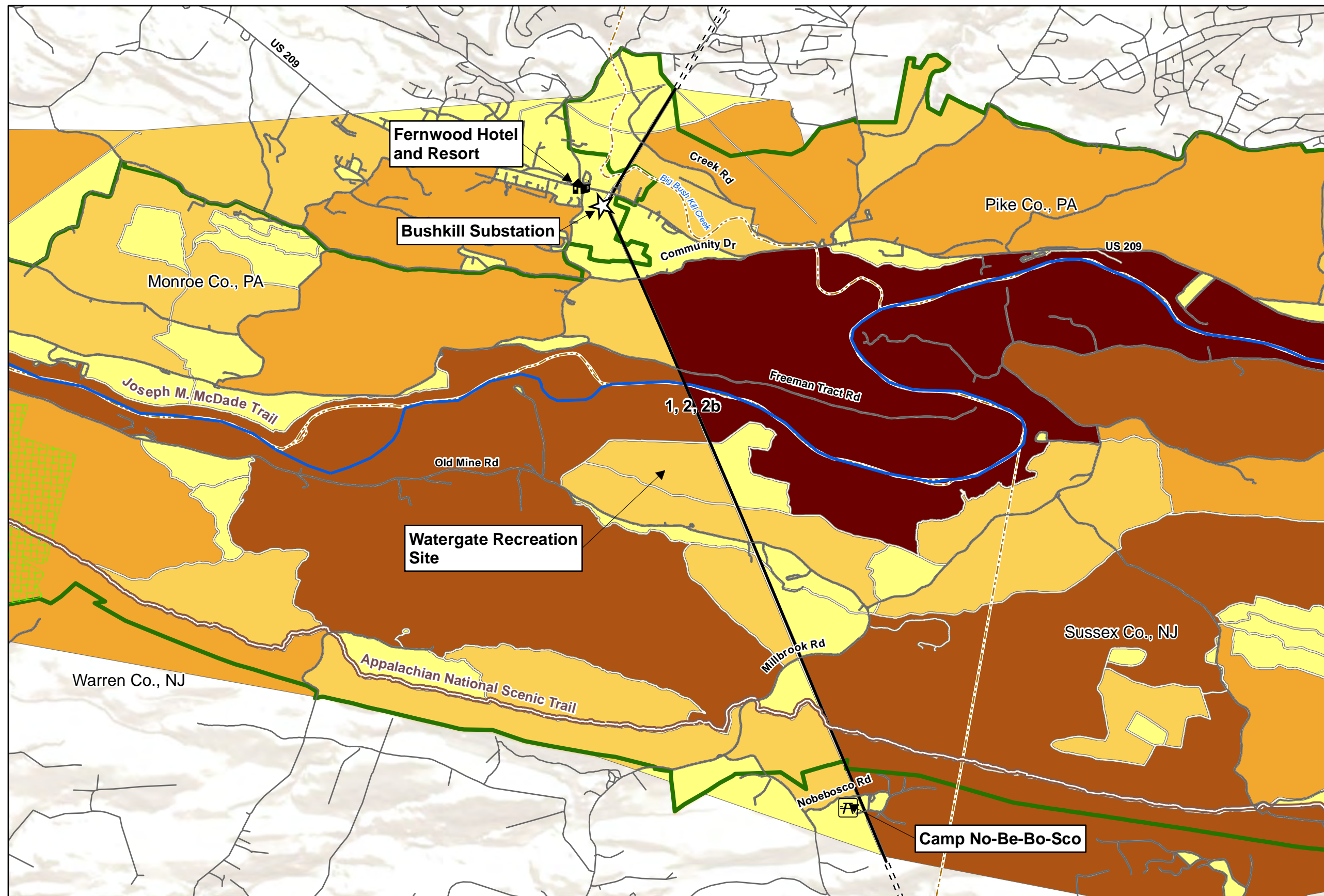
The alternative 4 alignment would connect with the alternative 2 alignment at the Bushkill Substation and travel west through another portion of DEWA. As described for alternatives 1 and 2, the ROW in this portion of DEWA passes through forest that is broken up by other utility ROWs (e.g., Columbia Gas Transmission Company pipeline) and roads (such as Creek Road).

Alternative 5

Inside the study area, alternative 5 would follow the same route as alternative 4 inside the study area, with the exception of the portion from the Bushkill Substation to the western boundary of DEWA; therefore, the information for habitat fragmentation under alternative 5 is the same as discussed for alternative 4.

Outside the Study Area

Outside DEWA in New Jersey, Sussex and Warren counties contain approximately 97,000 acres of state land. In Pennsylvania, Pike, Monroe, and Northampton counties contain approximately 166,000 acres of state lands (Donahue and Morlock 2009, slide 3). In addition to the public lands, numerous hunting clubs near the park contain forest cover. Maintaining connectivity between DEWA and other large tracts of forested lands outside the park is an initiative promoted by DEWA (Donahue and Morlock 2009, slide 3). Approximately 40% of New Jersey is developed (Environment New Jersey 2011). However, approximately 75% of the Highlands Region, which encompasses most of Sussex, Warren, and Morris counties, remains undeveloped (NJ Highlands Council 2008b, 25). Appendix G-5 presents the state game lands, wildlife management areas, state parks, state forests, important mammal areas (IMAs), important bird areas (IBAs), federal lands, NWRs, and The Nature Conservancy (TNC) Preserves that could be crossed in Carbon, Lackawanna, Luzerne, Monroe, Northampton, Pike, and Wayne counties in Pennsylvania and Morris, Sussex, and Warren counties in New Jersey. IMAs and IBAs are designated for the critical habitat they provide; therefore development in these lands should be limited.



Legend

- ☆ Substation
- Alternative 2,2b
- = = = Outside Study Area
- Appalachian National Scenic Trail
- Middle Delaware National Scenic & Recreational River
- River/Stream
- Roads
- ▭ Delaware Water Gap National Recreation Area
- ▨ Worthington State Forest
- - - County Line
- Habitat Patch Acreages**
- 0 - 150 acres
- 150 - 500 acres
- 500 - 1,200 acres
- 1,200 - 3,200 acres
- 3,200 - 8,000 acres



Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

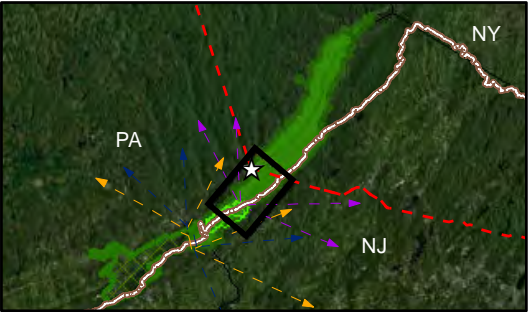
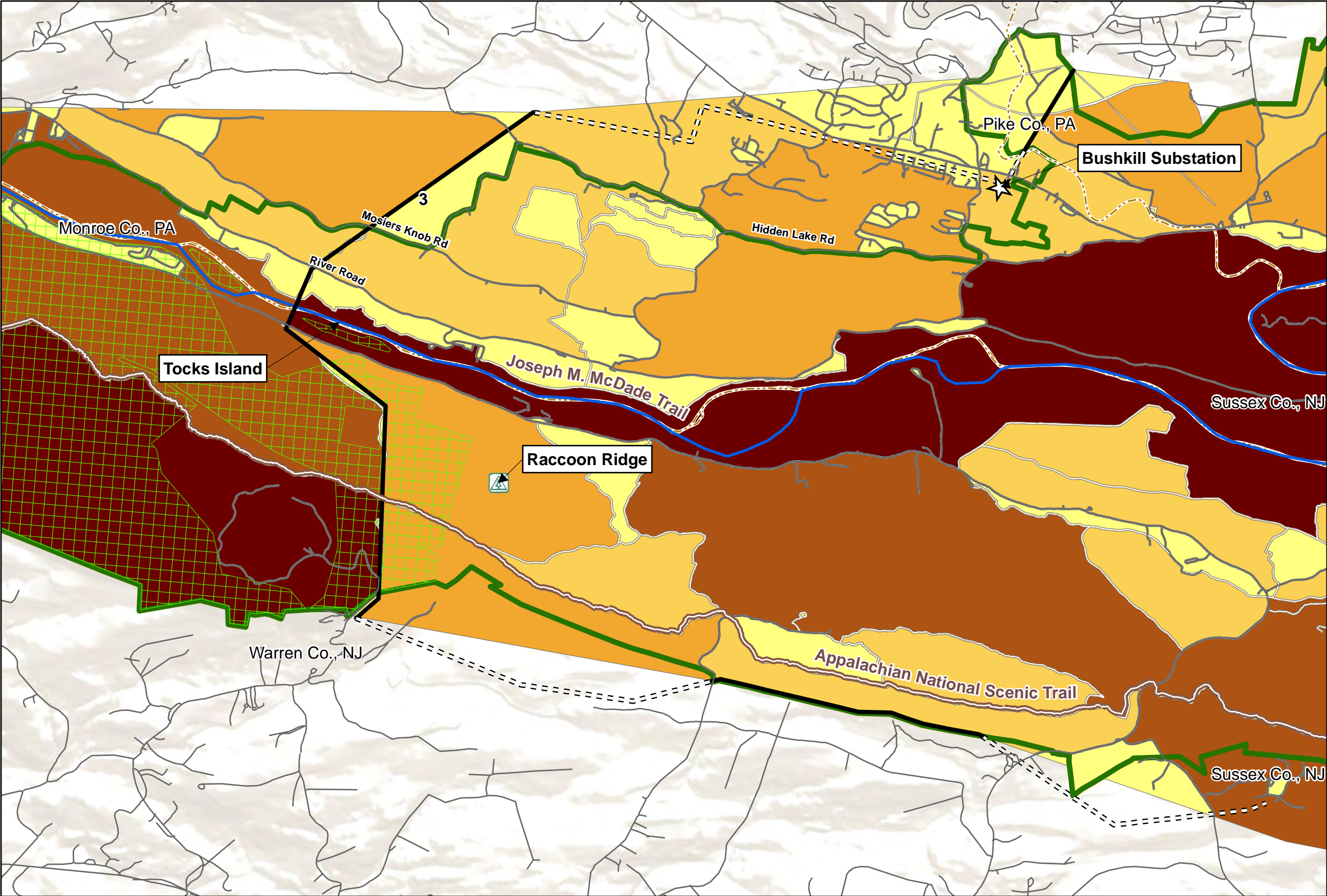
Figure 39
Alternative 2/2b Habitat Patches

Source: ESRI Streetmap 2009;
NPS 2011;
ArcGIS Map Service 2010;

Projection: NAD 83 UTM Zone 18N
Date: July, 2012



0 0.5 1
Miles



- Legend**
- ☆ Substation
 - Alternative 3
 - - - Outside Study Area
 - Appalachian National Scenic Trail
 - Middle Delaware National Scenic & Recreational River
 - Roads
 - Delaware Water Gap
 - National Recreation Area
 - Worthington State Forest
 - County Line
- Habitat Patch Acreages**
- 0 - 150 acres
 - 150 - 500 acres
 - 500 - 1,200 acres
 - 1,200 - 3,200 acres
 - 3,200 - 8,000 acres

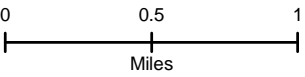
Figure 40
Alternative 3 Habitat Patches

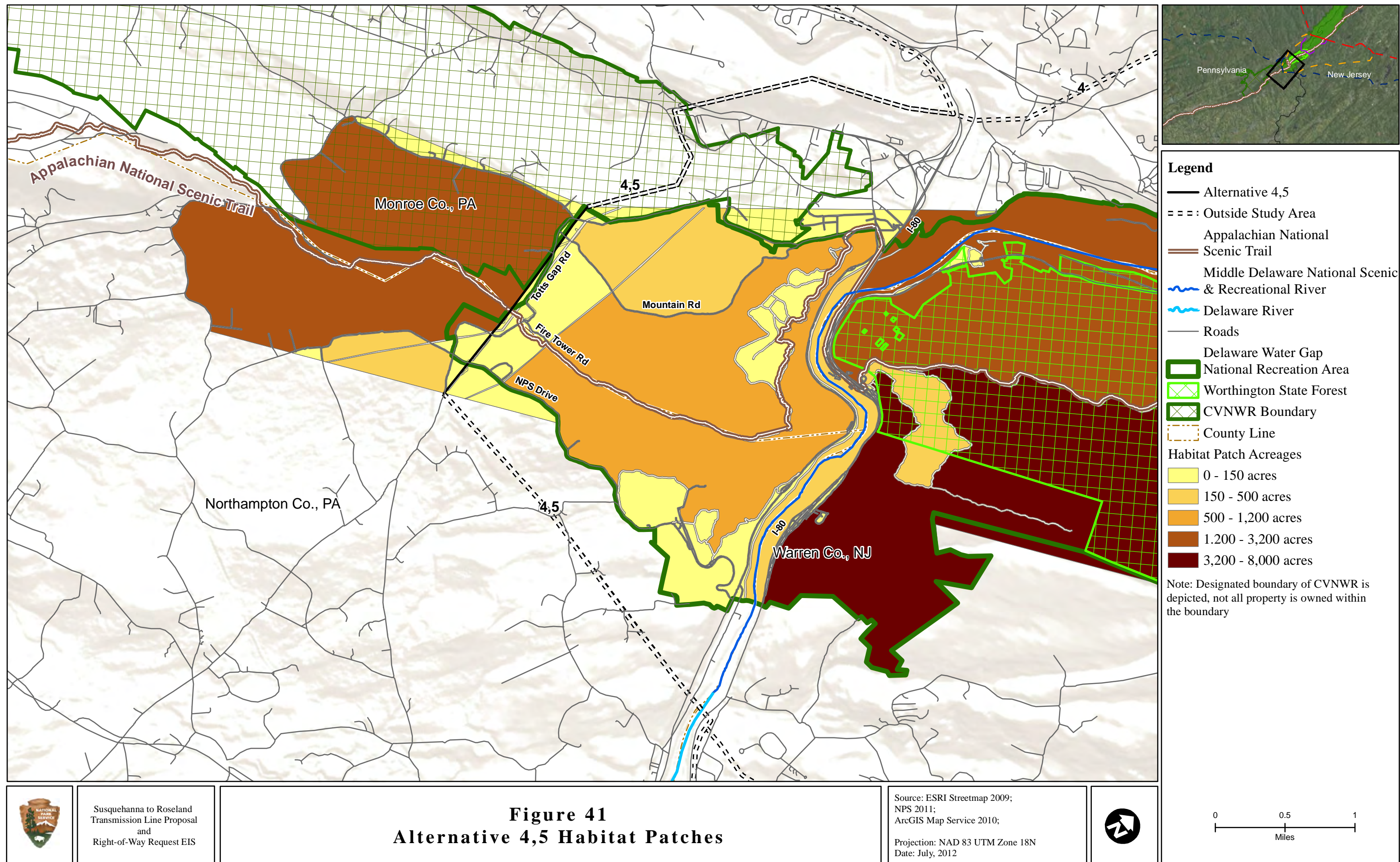


Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

Source: ESRI Streetmap 2009;
NPS 2011;
ArcGIS Map Service 2010;

Projection: NAD 83 UTM Zone 18N
Date: July, 2012





Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

**Figure 41
Alternative 4,5 Habitat Patches**

Source: ESRI Streetmap 2009;
NPS 2011;
ArcGIS Map Service 2010;
Projection: NAD 83 UTM Zone 18N
Date: July, 2012



WILDLIFE AND WILDLIFE HABITAT

DEWA, MDSR, and APPA provide a high diversity of contiguous undeveloped wildlife habitat that allows for a diversity of wildlife species. The available expanse of undeveloped and varied habitat within the parks becomes more crucial to wildlife as the availability of large areas of undeveloped contiguous habitat outside the parks becomes limited by habitat fragmentation from development or agriculture. As a result of conservation and protection of park lands, the parks support thousands of species, including many that are rare, endangered, or of special concern.

Wildlife presence determinations discussed are based on observations from park-specific inventories, including incidental observations during vegetation surveys during summer and fall of 2010 and spring of 2011 designed to characterize and identify vegetation communities and the potential for the presence of species of special concern (NPS 2011b). Due to the brief duration of the vegetation surveys, the wildlife species documented provide a “snapshot” of species presence and do not provide certainty as to whether all species observed reside in the habitats or whether they are temporarily using these habitats for foraging, migration, or other activities. When combined with other known presence determinations information, such as checklists and park information, these observational data can reasonably be used to describe species composition within the characterized habitats. Sources for the following sections include previous studies and surveys, websites, county planning departments, and nongovernmental organizations, as well as consultation with state and federal resource agencies.

The NPS has an ongoing program to inventory and monitor wildlife species within DEWA, including species of special concern and their habitats. Outside DEWA, MDSR, and APPA, lands owned by the states of New Jersey and Pennsylvania, USFWS, and organizations such as TNC protect additional wildlife habitat within the study area. Both New Jersey and Pennsylvania have prepared and implemented comprehensive wildlife conservation strategies that provide goals for conserving species at risk as well as maintaining sustainable and diverse wildlife populations (PGC and PFBC 2005, 1; NJDEP 2008a, 1). In Pennsylvania, the National Wildlife Federation, Pennsylvania Wildlife Federation, Pennsylvania Federation of Sportsman’s Clubs, Mammal Technical Committee/Pennsylvania Biological Survey, and the Carnegie Museum of Natural History have formed a partnership to identify and designate IMAs. IMAs that traverse or could be traversed by each alternative are discussed below. The National Audubon Society’s program of designated IBAs recognizes sites within the study area that provide resident and migratory birds with essential habitat for food, shelter, and/or nesting as IBAs. The IBA Program is a global effort to recognize and conserve habitat that is vital to birds and biodiversity (Audubon PA 2010, 1). Inside the study area, all the alternatives cross Kittatinny Ridge, and alternatives 1, 2, 2b, and 3 cross the Delaware Riparian River Corridor, which are considered important migratory bird routes. IBAs are discussed primarily within the “Migratory Birds” section.

Alternatives 1 through 5

Several broad categories are used to define wildlife habitat: deciduous, coniferous, and mixed woodlands, wetlands, scrub shrub, and developed/maintained areas. Wildlife species that are known to be present or that may be found within these areas as resident or seasonally present individuals are discussed below. Migratory bird species, species of special concern, and invasive animal species are presented in separate sections following the general wildlife discussion.

Wildlife species that live in forested areas often broadly use all three types of woodlands (deciduous, coniferous, and mixed). Wildlife documented within the parks that use all woodland habitats include mammal species such as black bear (*Ursus americanus*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and eastern gray squirrel (*Sciurus carolinensis*) as well as other small mammal species that may include eastern chipmunk (*Tamias striatus*)

and a variety of mouse, shrew, mole, and bat species. Black bear, white-tailed deer, porcupine, gray squirrel, eastern chipmunk, American crow, and red-bellied woodpecker were observed within woodland habitats during vegetation surveys (NPS 2011b).

Bird species considered permanent residents that are often found within deciduous woods include ruffed grouse (*Bonasa umbellus*), downy and hairy woodpeckers (*Picoides pubescens* and *P. villosus*), black-capped chickadee (*Poecile atricapilla*), tufted titmouse (*Baeolophus bicolor*), white-breasted nuthatch (*Sitta carolinensis*), and blue jay (*Cyanocitta cristata*). A number of raptor species are found in deciduous woodlands as permanent residents: eastern screech owl (*Megascops asio*), great horned owl (*Bubo virginianus*), northern goshawk, and red-tailed hawk (*Buteo jamaicensis*). Other raptors may use deciduous woodlands seasonally or in migration and are discussed in “Migratory Birds.” Seasonally, the bird species found within deciduous woodlands would be supplemented by summer resident species, many of which are Neotropical migrants and are described below. Bird species that were observed during vegetation surveys include black-capped chickadee, blue jay, downy woodpecker, great crested flycatcher, barred owl, red-eyed vireo, red shouldered hawk (*Buteo lineatus*), red-tailed hawk, tufted titmouse, and white-breasted nuthatch (NPS 2011b). Reptiles such as eastern garter snake (*Thamnophis sirtalis sirtalis*), northern black racer (*Coluber constrictor constrictor*), and black rat snake (*Elaphe obsoleta*) are representative of reptile species that use deciduous habitat; where deciduous woodlands and moist conditions are present, salamanders, northern gray treefrog (*Hyla versicolor*), and American toad (*Bufo americanus*) may also be found. Garter snake, timber rattlesnake, American toad, and northern gray treefrog were some of the species observed during vegetation surveys (NPS 2011b).

Several wildlife species are more frequently found within coniferous forests, such as red squirrel (*Tamiasciurus hudsonicus*) and winter resident bird species, including golden-crowned kinglet (*Regulus satrapa*), ruby-crowned kinglet (*R. calendula*), purple finch (*Carpodacus purpureus*), and red-breasted nuthatch (*Sitta canadensis*).

Wetlands typically have water present seasonally or year-round. Wildlife species are generally attracted to wetlands as a source of water, and some species are wetland specialists, including beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*). Bird species that use wetland or riparian areas include wading birds and waterfowl. Wetland bird species include green heron (*Butorides virescens*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), and passerine species such as willow flycatcher (*Empidonax traillii*), common yellowthroat (*Geothlypis trichas*), and swamp sparrow (*Melospiza georgiana*). Aquatic insects are more common in wetland areas because they require water sources as habitat during a portion of their life cycles. Amphibians, including northern spring peeper (*Pseudacris crucifer crucifer*), bullfrog (*Rana catesbeiana*), and green frog (*R. clamitans melanota*) as well as toads and salamanders, are all reliant on water/wetland habitats for their reproductive cycles and have been observed during vegetation surveys. Reptile species such as common snapping turtle (*Chelydra serpentina serpentina*), eastern painted turtle (*Chrysemys picta picta*), and northern water snake (*Nerodia sipedon sipedon*) are commonly found in wetland and riparian areas.

Scrub shrub habitat in areas of previous disturbance and along the existing ROWs may be used by wildlife species found within adjacent woodlands that use the ROWs as foraging and travel corridors. White-tailed deer and opportunistic scavengers such as opossum (*Didelphis virginiana*), skunk, and red fox can be found within the ROWs along with summer resident bird species, especially flycatchers and insectivorous Neotropical migrants. In addition, bird species preferring thickets and edges, such as song sparrow (*Melospiza melodia*), eastern towhee (*Pipilo erythrophthalmus*), and eastern bluebird (*Sialia sialis*), are often present as well as aerial foragers that include prairie warbler (*Dendroica discolor*) and several species of flycatchers and swallows. During the vegetation studies, the following bird species were observed within scrub shrub habitat: American goldfinch (*Carduelis tristis*), blue-gray gnatcatcher, Carolina wren (*Thryothorus ludovicianus*), common yellowthroat, gray catbird (*Dumetella carolinensis*),

northern cardinal, and indigo bunting (NPS 2011b). Open areas within this habitat provide basking areas for many of the snake species mentioned above, for eastern box turtle (*Terrapene carolina carolina*), and for five-lined skink (*Eumeces fasciatus*). Eastern box and wood turtles were observed within scrub shrub habitat during vegetation surveys (NPS 2011b). Herbaceous vegetation in this more open habitat creates habitat for butterfly and other pollinator insect species and dragonflies. An invertebrate survey conducted along the existing ROW identified 32 butterfly and 29 dragonfly and damselfly species (including 2 unknown species) (EcolSciences 2009a, 8).

Agriculture and developed lands were grouped together because they are the result of disturbance to a previously existing natural habitat. Species that occupy these areas are generally tolerant of human activity and are generalists in their requirements for food, shelter, and other necessities. Species that are known to use these habitats include mourning dove (*Zenaida macroura*), rock pigeon (*Columba livia*), European starling (*Sturnus vulgaris*), common grackle (*Quiscalus quiscula*), house finch (*Carpodacus mexicanus*), and house sparrow (*Passer domesticus*) as well as other common bird species such as the American robin (*Turdus migratorius*), blue jay, and American crow (*Corvus brachyrhynchos*). White-tailed deer, raccoon, opossum, and eastern gray squirrel can also become adapted to human activity surrounding developed areas. Raptors may use the open areas of agricultural fields and developed areas to forage for small mammals. Reptiles and amphibians that are found as opportunistic species that forage within agricultural lands and developed areas include garter snakes, toads, and, where there is adequate moisture, frogs such as the northern cricket frog (*Acris crepitans*); reptiles also use agricultural fields for nesting habitat. In addition to the open habitat offered by agricultural and developed areas, open grasslands offer similar habitat for insects and aerial foragers, such as raptors and swallows, as well as foraging corridors for opportunistic scavengers and carnivores such as raccoon and red fox. Open grasslands also provide habitat for grassland bird species including grasshopper sparrow (*Ammodramus savannarum*), field sparrow (*Spizella pusilla*), and wild turkey (*Meleagris gallopavo*) (McNaught 2004, 4).

One IBA is found within the study area, the Delaware Water Gap and Valley macro-site IBA, designated as such by the New Jersey Audubon Society (NJ Audubon 2010a, 1). This macro-site IBA would be crossed by all the alternative alignments. It encompasses the Delaware River from the New York state line south 40 miles along the Delaware River. Species that are known to be present within this macro-site IBA include bald eagle, northern goshawk, red shouldered hawk, barred owl, sharp-shinned hawk, red-headed woodpecker, savannah sparrow, grasshopper sparrow, bobolink, gold-winged warbler, veery, and cerulean warbler.

Three IMAs are found within the study area: the Delaware State Forest/Bushkill Creek Area IMA (crossed by alternatives 1, 2, 2b, and 3), the Delaware Water Gap/Pocono Environmental Education Center IMA (crossed by all alternatives), and the Cherry Valley Watershed IMA (crossed by alternatives 4 and 5). Together, the Delaware State Forest/Bushkill Creek Area and the Delaware Water Gap/Pocono Environmental Education Center IMAs support black bear, bobcat, northern river otter, beaver, Allegheny woodrat, little brown myotis, big brown myotis, fisher (*Martes pennanti*), and northern water shrew. The Cherry Valley Watershed IMA supports northern river otter, northern myotis, small-footed bat, snowshoe hare, black bear, and bobcat.

A full list of wildlife species known to be present within DEWA is presented in appendix G. Observations of these species during vegetation, invertebrate, and other studies are also indicated in this appendix.

Outside the Study Area

Outside the study area in Pennsylvania, the S-R Line could pass through Carbon, Lackawanna, Luzerne, Monroe, Northampton, Pike, and Wayne counties. In New Jersey, the S-R Line could cross Sussex, Warren, and Morris counties. The habitat in these counties consists mostly of deciduous forest, interspersed with smaller areas of developed/agricultural, wetlands, scrub shrub, and mixed and coniferous habitat types. Species that are known to be present within these habitats inside the study area, as described above, are likely to also be present outside the study area in similar habitats. White-tailed deer, squirrels, raccoons, opossums, cottontail rabbits (*Sylvilagus floridanus*), and skunks are likely to be present, as well as bird species listed above. Other likely species may include permanent resident bird species such as turkey vulture (*Cathartes aura*), northern flicker (*Colaptes auratus*), and northern cardinal (*Cardinalis cardinalis*), as well as Neotropical species of flycatchers, tanagers, orioles, and warblers as described in the section “Migratory Birds” below.

Appendix G-5 presents the state game lands, wildlife management areas, state parks, state forests, IBAs, IMAs, federal lands, NWRs, and TNC preserves that could be crossed in Carbon, Lackawanna, Luzerne, Monroe, Northampton, Pike, and Wayne counties in Pennsylvania and Morris, Sussex, and Warren counties in New Jersey. As previously discussed, these private, state, and federally owned lands protect crucial wildlife habitat; therefore, a variety of wildlife is expected to be present in these lands.

MIGRATORY BIRDS

The north-to-south orientation of the Delaware River Riparian Corridor and the surrounding topography, including Kittatinny Ridge, provide an ideal corridor for the seasonal migration of birds (McNaught 2004, 2). Kittatinny Ridge through Pennsylvania and New Jersey is part of the Appalachian Raptor Migration Flyway and is considered a globally significant flyway for fall and spring migration. Approximately 14,000 to 20,000 migratory raptors funnel through the area between August and December each year (Heintzelman 2009, i). Kittatinny Ridge is also important to migrating passerines that use the topographic feature for orientation during northbound (spring) and southbound (fall) migrations. The surrounding forests serve as stopover areas for resting and feeding. Passerines are birds of the order Passeriformes, which is the most diverse order of birds, containing over 5,000 identified species. This group includes all perching birds, such as warblers, sparrows, jays, and pigeons. The Kittatinny Ridge is recognized worldwide for its importance to migrating birds, particularly raptors. The ridge is part of the larger flyway that has been petitioned for designation by the USFWS as the “Kittatinny-Shawangunk National Raptor Corridor” by over 275 national and international organizations and concerned citizens and scientists (Heintzelman 2009). Additionally, the Delaware River Riparian Corridor is a part of the Atlantic Flyway, and provides important breeding and foraging habitat for migratory species, particularly migratory waterfowl.

As stated in the “Wildlife and Wildlife Habitat” section, the National Audubon Society has designated several IBAs within the parks. Kittatinny Ridge is incorporated into several IBAs within DEWA, including Upper Delaware Scenic River and Hawk Mountain Sanctuary–Kittatinny Ridge in Pennsylvania. These IBAs support migrating raptors including bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), osprey (*Pandion haliaetus*), northern goshawk, and northern harrier (*Circus cyaneus*). Over 140 bird species have been recorded during fall migration, including at least 27 warbler species (McNaught 2004, 2–3; Audubon PA 1999a, 1). Appendix G presents a list of birds that use the habitats of DEWA and could therefore be expected to migrate along Kittatinny Ridge. Because of the number of birds that use the ridge during migrations, Kittatinny Ridge is a considered globally important flyway in the spring and fall (Audubon PA 2006, 6). A portion of the Dutch Mountain Wetland/State Game Lands 57 IBA lies within Luzerne County. This IBA contains the only confirmed breeding site of the blackpoll warbler in Pennsylvania (Audubon PA 1999a, 1).

In New Jersey, a macro-site IBA, Delaware Water Gap and Valley, encompasses several other IBAs including Clove Brook Road Corridor, Kittatinny Camp/Van Ness Road, Stokes State Forest/High Point State Park, Walpack Valley, Bear Swamp Wildlife Management Area–Sussex, Old Mine Road, and Mount Tammany Cliffs. The Delaware Water Gap and Valley macro-site supports the migration of and provides breeding habitat for raptors such as bald eagle, northern goshawk, and red shouldered hawk. It also provides breeding and stopover habitat suitable for Acadian flycatcher (*Empidonax virescens*), veery (*Catharus fuscescens*), blue-winged warbler (*Vermivora cyanoptera*), golden-winged warbler (*Vermivora chrysoptera*), prairie warbler (*Dendroica discolor*), black-throated green warbler (*Dendroica virens*), cerulean warbler (*Dendroica cerulea*), black-and-white warbler (*Mniotilta varia*), hooded warbler (*Wilsonia citrina*), Louisiana waterthrush (*Seiurus motacilla*), worm-eating warbler (*Helmitheros vermivorum*), eastern towhee (*Pipilo erythrophthalmus*), scarlet tanager (*Piranga olivacea*), Baltimore oriole (*Icterus galbula*), and yellow-breasted chat (*Icteria virens*) (NJ Audubon 2010a). Pennsylvania and New Jersey counties contain many IBAs that could be crossed by the Susquehanna to Roseland transmission line. The IBAs within each county are presented in appendix G-5.

The USFWS Division of Migratory Bird Management has identified birds of conservation concern. These species are those that are not listed as threatened or endangered under the Endangered Species Act, but that represent the highest conservation priority. Without conservation efforts, these species are likely to become candidates for listing under the Endangered Species Act. Table 11 presents the species identified for USFWS Region 5 (Northeast Region) and Bird Conservation Region 28 (Appalachian Mountains). These species are all migratory and could be present within the study area during migration seasons.

Pennsylvania and New Jersey contain protected federal, state, and private lands that provide habitat for migratory birds within the project area. Throughout this discussion of migratory birds, the habitats identified along the proposed alternative alignments are only discussed as they are used by migrant species. Other bird species that use these habitats are discussed in the “Wildlife and Wildlife Habitat” section. Any undeveloped habitat or habitat that provides food and shelter will likely be used by migrating birds during stopovers anywhere along the routes for all alternatives. In general, migrating species will seek out similar habitats in migration to those used for nesting (i.e., wetland species will use wetland habitats for resting and feeding, if available).

Migrating Passerines: DEWA is home to over 260 species of permanent resident, seasonally present (breeding or wintering), or migratory birds (McNaught 2004, 4). Approximately 55% of birds within DEWA are considered Neotropical migrant species and may be found as summer resident (breeding species) or transient species traveling through the study area on northbound (spring) and southbound (fall) migrations (PEEC 2008; USFWS 2009a). As defined by Rappole, Neotropical migrants are “Western Hemisphere bird species all or part of whose populations breed north of the Tropic of Cancer and winter south of that line” (DeGraaf and Rappole 1995, 9). In general, many of these species can be said to breed in North America and travel to South and Central America or the Caribbean for the winter; however, at least 30 species of Neotropical migrants have overlapping distributions of year-round resident populations and winter resident populations, including great blue heron (*Ardea herodias*), turkey vulture (*Cathartes aura*), killdeer (*Charadrius vociferus*), and mourning dove (*Zenaida macroura*) (DeGraaf and Rappole 1995, 10).

TABLE 11: BIRDS OF CONSERVATION CONCERN FOR USFWS REGION 5 AND BIRD CONSERVATION REGION 28

| Common Name | Scientific Name | USFWS Region 5 | Bird Conservation Region 28 |
|---|-----------------------------------|----------------|-----------------------------|
| Red-throated loon (nb) | <i>Gavia stellata</i> | X | |
| Pied-billed grebe | <i>Podilymbus podiceps</i> | X | |
| Horned grebe (nb) | <i>Podiceps auritus</i> | X | |
| Greater shearwater (nb) | <i>Puffinus gravis</i> | X | |
| Audubon's shearwater (nb) | <i>Puffinus lherminieri</i> | X | |
| American bittern | <i>Botaurus lentiginosus</i> | X | |
| Least bittern | <i>Ixobrychus exilis</i> | X | |
| Snowy egret | <i>Egretta thula</i> | X | |
| Bald eagle ^a | <i>Haliaeetus leucocephalus</i> | X | X |
| Peregrine falcon ^a | <i>Falco peregrinus</i> | X | X |
| Yellow rail | <i>Coturnicops noveboracensis</i> | X | |
| Black rail | <i>Laterallus jamaicensis</i> | X | |
| Wilson's plover | <i>Charadrius wilsonia</i> | X | |
| American oystercatcher | <i>Haematopus palliatus</i> | X | |
| Solitary sandpiper (nb) | <i>Tringa solitaria</i> | X | |
| Lesser yellowlegs (nb) | <i>Tringa flavipes</i> | X | |
| Upland sandpiper | <i>Bartramia longicauda</i> | X | X |
| Whimbrel (nb) | <i>Numenius phaeopus</i> | X | |
| Hudsonian godwit (nb) | <i>Limosa haemastica</i> | X | |
| Marbled godwit (nb) | <i>Limosa fedoa</i> | X | |
| Red knot (<i>rufa</i> ssp.) ^b (nb) | <i>Calidris canutus</i> | X | |
| Semipalmated sandpiper (Eastern) (nb) | <i>Calidris pusilla</i> | X | |
| Purple sandpiper (nb) | <i>Calidris maritima</i> | X | |
| Buff-breasted sandpiper (nb) | <i>Tryngites subruficollis</i> | X | |
| Short-billed dowitcher (nb) | <i>Limnodromus griseus</i> | X | |
| Least tern ^c | <i>Sternula antillarum</i> | X | |
| Gull-billed tern | <i>Gelochelidon nilotica</i> | X | |
| Arctic tern | <i>Sterna paradisaea</i> | X | |
| Black skimmer | <i>Rynchops niger</i> | X | |
| Short-eared owl (nb) | <i>Asio flammeus</i> | X | |
| Northern saw-whet owl (S. Appalachian breeding pop.) | <i>Aegolius acadicus</i> | | X |
| Whip-poor-will | <i>Caprimulgus vociferus</i> | X | X |
| Red-headed woodpecker | <i>Melanerpes erythrocephalus</i> | X | X |
| Yellow-bellied sapsucker (S. Appalachian breeding pop.) | <i>Sphyrapicus varius</i> | | X |
| Olive-sided flycatcher | <i>Contopus cooperi</i> | X | X |
| Loggerhead shrike | <i>Lanius ludovicianus</i> | X | X |
| Black-capped chickadee (S. Appalachian pop.) | <i>Poecile atricapillus</i> | | X |
| Bewick's wren (<i>bewickii</i> ssp.) | <i>Thryomanes bewickii</i> | X | X |

| Common Name | Scientific Name | USFWS Region 5 | Bird Conservation Region 28 |
|-------------------------------------|--------------------------------|----------------|-----------------------------|
| Sedge wren (nb*) | <i>Cistothorus platensis</i> | X | X |
| Bicknell's thrush | <i>Catharus bicknelli</i> | X | |
| Wood thrush | <i>Hylocichla mustelina</i> | X | X |
| Blue-winged warbler | <i>Vermivora cyanoptera</i> | X | X |
| Golden-winged warbler | <i>Vermivora chrysoptera</i> | X | X |
| Prairie warbler | <i>Dendroica discolor</i> | X | X |
| Bay-breasted warbler | <i>Dendroica castanea</i> | X | |
| Cerulean warbler | <i>Dendroica cerulea</i> | X | X |
| Worm-eating warbler | <i>Helmitheros vermivorum</i> | X | X |
| Swainson's warbler | <i>Limnithlypis swainsonii</i> | X | X |
| Louisiana waterthrush | <i>Seiurus motacilla</i> | | X |
| Kentucky warbler | <i>Oporornis formosus</i> | X | X |
| Canada warbler | <i>Wilsonia canadensis</i> | X | X |
| Henslow's sparrow | <i>Ammodramus henslowii</i> | X | X |
| Nelson's sharp-tailed sparrow | <i>Ammodramus nelsoni</i> | X | |
| Saltmarsh sharp-tailed sparrow | <i>Ammodramus caudacutus</i> | X | |
| Seaside sparrow ^c | <i>Ammodramus maritimus</i> | X | |
| Rusty blackbird (nb*) | <i>Euphagus carolinus</i> | X | X |
| Red crossbill (S. Appalachian pop.) | <i>Loxia curvirostra</i> | | X |

a. Endangered Species Act delisted.

b. Endangered Species Act candidate.

c. Nonlisted subspecies or population of threatened or endangered species

nb = nonbreeding in this region.

nb* = nonbreeding in Bird Conservation Region 28, but not USFWS Region 5.

Migratory behavior has evolved from the need for reliable food resources and to reduce competition and predation (DeGraaf and Rappole 1995, 10). Migration of Neotropical species is primarily nocturnal, traveling from one stopover to another between sunset and pre-dawn, when they stop again to rest and forage. As a result, during spring and fall, habitats within the parks provide critical food resources and shelter for migrant passerines and the number of species that may be found within the parks increases beyond the number of species that are found as year-round, wintering, or seasonal residents.

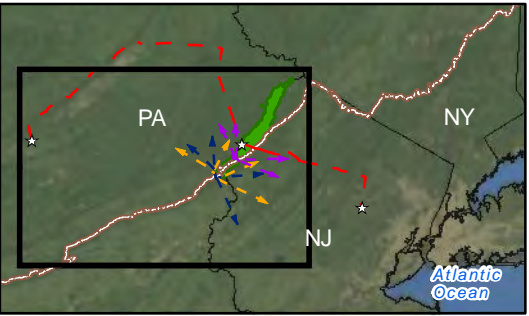
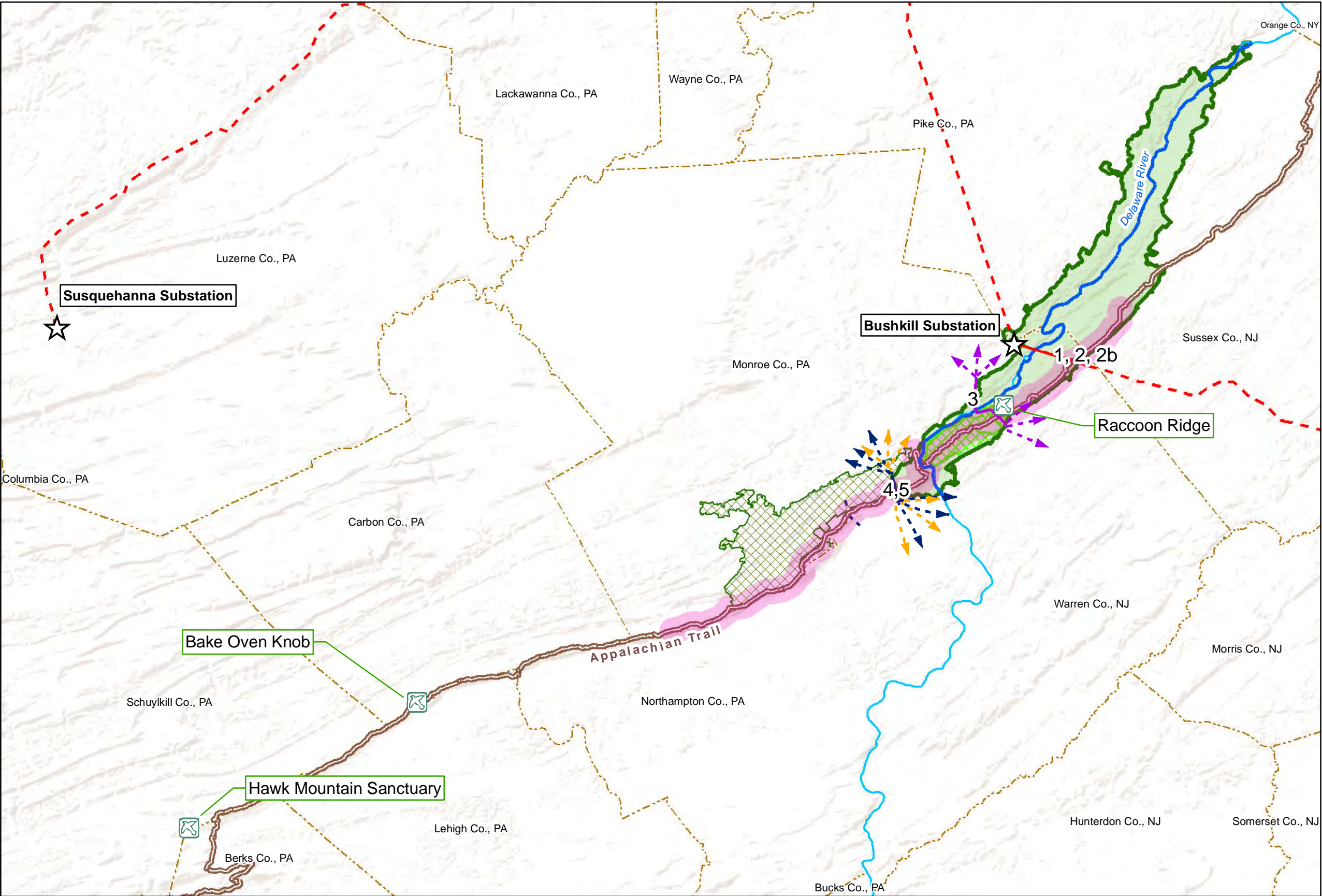
Kittatinny Ridge is the backbone of the Northern Ridge and Valley ecoregion, and this area provides a variety of habitats that suit a wide variety of bird species (figure 42). The dominant habitat types include scrub shrub, deciduous, coniferous (including eastern hemlock stands), and mixed forests, agricultural/developed areas and grasslands, and freshwater wetlands. Because of the wide variety of habitats in the parks and specifically along Kittatinny Ridge, the ridge is attractive for many passerines; when birds descend from migratory flights, they tend to be attracted to the highest topography and concentrate at these points (Audubon PA 2006, 7).

Many sensitive Neotropical migratory bird species are recorded as spring and fall transients, because they do not remain in the area for an extended period but use the habitats along Kittatinny Ridge and in the parks for resting and feeding during migration. Almost any Neotropical migrant species that breeds in the northeastern forests of North America may be found during migration in habitats found at the parks. These species may include blackpoll warbler (*Dendroica striata*), bay-breasted warbler (*Dendroica castanea*), Cape May warbler (*Dendroica tigrina*), and palm warbler (*Dendroica palmarum*), all of which

have breeding ranges in northern New England and Canada. Some individuals of these species may remain to nest; examples include golden-winged warbler in scrub shrub, cerulean warbler and worm-eating warbler in deciduous forests, and wood thrush (*Hylocichla mustelina*) and eastern wood-pewee (*Contopus virens*) in deciduous and mixed forests (Rosenberg and Robinson 2003, 4–5). The eastern hemlock forests of the Northern Ridge and Valley ecoregion provide breeding habitat for Acadian flycatcher, Blackburnian warbler (*Dendroica virens*), and black-throated green warbler (McNaught 2004, 4). Other species have been observed in DEWA during breeding season, but nesting has not been confirmed. They may be considered potential nesting species and would also be among the species that use the area for feeding during migration. Examples include Nashville warbler (*Vermivora ruficapilla*), yellow-breasted chat, and prothonotary warbler (*Protonotaria citrea*). DEWA supports migrant species that breed farther north and may overwinter in the park, including ruby-crowned kinglet (*Regulus calendula*), dark-eyed junco (*Junco hyemalis*), and purple finch. Appendix G presents the bird species known to be present within DEWA, including migratory species, and was developed from the *Delaware Water Gap National Recreational Bird Checklist* (PEEC 2008).

Migrating Raptors: Kittatinny Ridge is one of the most important raptor migration corridors in the world. Each fall, thousands of raptors are observed traveling south along the ridge. The ridge is used to a lesser degree as a travel corridor for northward migration in the spring (Audubon PA 1999b, 1). Raptors are primarily daytime migrants that use visual cues such as Kittatinny Ridge as a travel guide for migration. The birds are also able to conserve energy by gaining lift from updrafts and thermals along the cliffs (NJ Audubon 2010a). A case study by Kerlinger determined that at Kittatinny Ridge, raptors tend to fly at a constant height in relation to the ridge, from a few feet to several hundred feet above the ridge. The birds fly at a speed of 20 to 35 miles per hour, depending on the strength of the updrafts. By changing flight speed and altitude, raptors are able to maximize the distance traveled while minimizing the amount of energy expended (Kerlinger 1995, 136–137). Depending on the strength of the updrafts at any given time, the proposed towers could be directly in the flight path of the raptor migration. DEWA supports many raptor species as permanent residents and these species may also be observed as seasonal migrants through the area, especially along Kittatinny Ridge. Other migrating raptors that are only observed as true migrants include golden eagle (*Aquila chrysaetos*), rough-legged hawk (*Buteo lagopus*), merlin (*Falco columbarius*), short-eared owl (*Asio flammeus*), and northern saw-whet owl (*Aegolius acadicus*). Hawk migration along Kittatinny Ridge is closely monitored through visual surveys at Raccoon Ridge within Worthington State Forest north of Upper Yards Creek Reservoir in New Jersey; at Bake Oven Knob north of Allentown, Pennsylvania, approximately 43 miles southwest from DEWA Headquarters in Bushkill, Pennsylvania; and at Hawk Mountain Sanctuary farther west in Kempton, Pennsylvania, about 15 miles farther southwest along Kittatinny Ridge. Raptor migration counts have been ongoing at Raccoon Ridge since the 1930s, at Bake Oven Knob since 1961, and at Hawk Mountain since 1934 (HMANA 2010; Hawk Mountain Sanctuary 2007; Lehigh Gap Nature Center 2010). At Raccoon Ridge an average of 6,528 raptors were recorded each year from 2002 to 2010 (HMANA 2011). An average of 15,806 raptors per year were counted at Bake Oven Knob from 1998 to 2007; during the same time period at Hawk Mountain Sanctuary, the average number of raptors was 20,311 (Bake Oven Knob 2008; Hawk Mountain Sanctuary 2010). The most abundant species at all sites were broad-winged hawk (*Buteo platypterus*), sharp-shinned hawk (*Accipiter striatus*), and red-tailed hawk. Peak migration for these birds occurs between September and November (HMANA 2010).

Migrating Waterfowl: Many species of waterfowl (ducks, geese, swans) use the Delaware River for resting and foraging during their seasonal migrations in the spring and fall. Migratory species such as the common merganser (*Mergus merganser*), ring-neck duck (*Aythya collaris*) and common goldeneye (*Bucephala clangula*) may also winter along the Delaware River and other areas of open water within the study area. Other waterfowl species may be year round or summer residents that use the corridor for nesting and breeding, including the common merganser, mallard duck (*Anas platyrhynchos*), and Canada goose (*Branta canadensis*) (PEEC 2008).



- Legend**
- ☆ Substation
 - Hawk Watch Site
 - Alternative 1, 2, 2b
 - Alternative 3
 - Alternative 4
 - Alternative 5
 - Appalachian National Scenic Trail
 - Kittatinny Ridge
 - Middle Delaware National Scenic and Recreation River
 - Delaware River
 - Delaware Water Gap National Recreation Area
 - Worthington State Forest
 - CVNWR Boundary
 - County Line

Note: Designated boundary of CVNWR is depicted, not all property is owned within the boundary

Alternative 1 (No Action), Alternative 2, and Alternative 2b

Inside the study area, the alignment for alternatives 1, 2, and 2b would cross Kittatinny Ridge and pass through the Upper Delaware Scenic River IBA in Pennsylvania and the Old Mine Road IBA in New Jersey. As previously stated, the diverse habitats within the IBAs support many species of Neotropical migrants during spring and fall migration (McNaught 2004, 2), and numerous raptors use the migration corridor along Kittatinny Ridge. In addition, many Neotropical migrants and raptors use the habitats along the ridge for breeding, feeding, and wintering. The alignment for alternatives 1, 2, and 2b would cross an area that contains a known bald eagle winter roost. The existing transmission lines are in the flight path between the roost and foraging areas (Ambler 1996, 1–6); however, the transmission lines are barely above the tree canopy and upon leaving the roost, the eagles fly over the lines to foraging areas. The alignments for alternatives 1, 2, and 2b would also cross the Delaware River and riparian corridor, which are both within the Atlantic flyway route used by migratory waterfowl such as ducks, geese, and swans as discussed in the paragraph above. Waterfowl use the Delaware River and other areas of open water in the study area during migration for resting and foraging; some species also use this corridor for nesting and breeding as well.

Generally, the alternative 1, 2, and 2b alignment contains deciduous, coniferous, and mixed forests, wetlands, and scrub shrub within the study area, providing a wide range of habitats. Passerines observed during 2010 summer vegetation surveys include species that would be found around forest edges and the scrub shrub of the ROW: eastern wood-pewee, which uses any of the forested areas; Carolina wren (*Thryothorus ludovicianus*) and red-eyed vireo (*Vireo olivaceus*), which prefer open woodlands; and common yellowthroat (*Geothlypis trichas*) and northern waterthrush (*Seiurus noveboracensis*) within wetland areas (NPS 2011b). These observations should be considered cursory because they were incidental sightings during vegetation surveys; however, the species observed are representative of the habitats along the alignment. Although not observed during vegetation surveys, Blackburnian warbler, a hemlock/conifer specialist, and blue-winged warbler, which uses scrub shrub habitat, are known to be found within DEWA (PEEC 2008). A raptor survey along the alignment for alternatives 1, 2, and 2b revealed red-tailed hawk, northern goshawk, and barred owl (EcolSciences 2010b, 11–12), and red shouldered hawk and barred owl were observed during raptor nest surveys (NPS 2011b). A red-tailed hawk was also seen during a bald eagle survey (Mellon 2009, 3). The raptors observed in these three studies could be either migratory species or resident species. All bird species observed along the route of alternatives 1, 2, and 2b during vegetation surveys between 2008 and 2010 are presented in appendix G.

Alternative 3

Inside the study area the proposed transmission line expansion route under alternative 3 would cross DEWA, MDSR, and APPA. The alternative 3 alignment would also cross the Kittatinny Ridge in the Upper Delaware Scenic River IBA in Pennsylvania and the Old Mine Road IBA in New Jersey as discussed under alternatives 1, 2, and 2b. The alternative 3 ROW would cross Raccoon Ridge along APPA near Yards Creek. The alignment for alternative 3 would also cross the Delaware River and riparian corridor, which are both within the Atlantic flyway route used by waterfowl. Waterfowl use the Delaware River and other areas of open water in the study area during migration for resting and foraging. Some species also use this corridor for nesting and breeding, as discussed under alternatives 1, 2, and 2b. The alternative 3 alignment would traverse a variety of habitats, including deciduous woodlands, wetlands, agricultural fields, and forested areas of talus. Expected species include least flycatcher (*Empidonax minimus*) and black-and-white warbler in deciduous forests; black-throated blue warbler (*Dendroica caerulescens*) and northern parula (*Parula americana*) in mixed forests; and yellow warbler (*Dendroica petechia*) and common yellowthroat in wetland habitats. In addition, black-throated green warbler and blue-headed vireo, hemlock-obligate species known to be present within DEWA, are expected to use the hemlock stands within the alternative 3 alignment (Quimby 1996, 4; PEEC 2008). A

Cooper's hawk was observed along alternative 3 during raptor nest surveys (NPS 2011b). Species such as sharp-shinned hawk, bald eagle, and broad-winged hawk are expected to use Kittatinny Ridge during fall migration. Bald eagles, golden eagles, and other raptor species have been observed during counts at Raccoon Ridge. All the birds observed along the alternative 3 alignment during vegetation surveys for this project are presented in appendix G.

Alternative 4

Inside the study area, the alternative 4 transmission line route would cross through DEWA and APPA. As a result, the alternative 4 alignment would cross Kittatinny Ridge in the Upper Delaware Scenic River IBA in Pennsylvania and the Old Mine Road IBA in New Jersey. The forests along the alternative 4 ROW within the study area are dominated by deciduous forests and also contain shrub-dominated rocky summit outcrop areas and several wetlands. These habitats could provide resting and foraging areas for many migratory bird species. A few examples of expected species include ovenbird (*Seiurus aurocapilla*) and scarlet tanager within the forests and yellow warbler and hooded warbler in wetland habitats. Wetlands are found within 0.25 mile of the alternative 4 alignment. Bird species identified during the wetlands survey included the following Neotropical migrants: American redstart (*Setophaga ruticilla*), blue-gray gnatcatcher (*Poliophtila caerulea*), hooded warbler, ovenbird, veery, and Louisiana waterthrush; this survey was conducted after spring migration in June and July of 2004 and 2005 (Sheehan and Master 2008, 68). During raptor nest surveys, red shouldered hawks were observed near Bushkill Creek along the portion of the alternative 4 alignment that follows the B-K Line. Additionally, individuals of the migratory raptor species documented along Kittatinny Ridge at Bake Oven Knob and Hawk Mountain would be expected to use Kittatinny Ridge during fall migration. All the birds observed along the alternative 4 alignment during vegetation surveys for this project are presented in appendix G.

Alternative 5

Inside the study area, alternative 5 would follow the same path as alternative 4, except for the portion that follows the B-K Line. Therefore, the information for migratory birds is the same as discussed for alternative 4 with the exception of the red shouldered hawk observation. All the birds observed along the alternative 5 alignment during vegetation surveys for this project are presented in appendix G.

Outside the Study Area

Outside the study area in Pennsylvania, the S-R Line could pass through Carbon, Lackawanna, Luzerne, Monroe, Northampton, Pike, and Wayne counties. The amount of undeveloped area ranges from approximately 79% to 95% in these counties. The S-R Line could also cross nine designated IBAs outside the study area. These undeveloped areas, IBAs, and the rare and unique communities discussed later in this chapter contain a variety of habitats including wetlands, scrub shrub, artificial lakes, and deciduous and coniferous woodlands, including riparian woodlands. These areas provide habitat suitable for breeding populations of passerines, waterfowl, wading birds, and raptors, as well as habitat suitable for passerines during spring and fall migration. Raptors using a route along Kittatinny Ridge are not likely to deviate from their route, but may on occasion rest and forage within habitats along the route; as daytime migrants, raptors would also roost for the night along the ridge. However, several of the IBAs support resident populations of raptors such as barred owl, sharp-shinned hawk, and osprey (Audubon PA 1999b). Although birds tend to be found in higher numbers along Kittatinny Ridge during spring and fall migration, they could be found throughout the region wherever suitable habitat is present.

Outside the study area in New Jersey, the S-R Line would traverse Sussex, Warren, and Morris counties. Depending on the final route selected for the S-R Line, the alignment could cross any of the 32 IBAs in these counties. In general, Warren, Sussex, and Morris counties remain largely undeveloped and contain a

variety of natural habitats ranging from grasslands to wetlands to old-growth forests. Several of the IBAs in New Jersey, including Wantage Grasslands and Delaware Water Gap and Valley, provide essential habitat for passerine species during spring and fall migration and are heavily used by migrants. The Kittatinny Camp/Van Ness Road IBA provides valuable scrub shrub habitat for golden-winged warbler, which is state listed as threatened in New Jersey (NJ Audubon 2010b, 1). The Stokes State Forest and High Point State Park IBA also support golden-winged warbler as well as cerulean and black-throated green warblers, both of which are species of concern in New Jersey (NJ Audubon 2010c, 1). IBAs also provide breeding and wintering habitat for raptor species, such as bald eagles, red shouldered hawks, northern goshawks, barred owls, sharp-shinned hawks, and broad-winged hawks. In addition to habitat, IBAs contain features that aid raptors with migration, such as ridges and cliffs where the birds can use thermals to reduce the amount of energy used for migration.

INVASIVE WILDLIFE SPECIES

An invasive species is defined as “an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health” by Executive Order 13112, “Invasive Species.” Alien or nonnative species are those that have been either accidentally or purposely introduced into an area in which they do not naturally live. These species generally lack natural predators in their new environment and can aggressively compete with native species for life requirements within habitats. Other invasive wildlife species can alter a population or habitat through direct predation. The National Invasive Species Council was established by Executive Order 13112, “Invasive Species,” in 1999 to ensure that federal programs and activities to prevent and control invasive species are coordinated, effective, and efficient; as an agency of the Department of the Interior, the NPS manages invasive species within park lands, including APPA, MDSR, and DEWA. Within DEWA, 28 invasive animal species have been documented (NPS 1998a, 1).

Terrestrial invasive wildlife species are known to be present in the parks and are primarily invertebrate species that adversely affect terrestrial vegetation within the parks: the hemlock woolly adelgid (*Adelges tsugae*), elongate hemlock scale (*Fiorinia externa*), and European gypsy moth (*Lymantria dispar*) (NPS 2010n, 8–9). More recently described invasive insect species, the emerald ash borer (*Agrilus planipennis*) and the brown marmorated stink bug (*Halyomorpha halys*), may also affect park vegetation. Lastly, white-nose syndrome in bats is likely caused by a fungus (*Geomyces destructans*) that is aggressively spreading throughout the northeast and mid-Atlantic bat populations (NPS 2009f, 1).

The hemlock woolly adelgid, an Asian species believed to have arrived in shipments from Asia, was first reported in the western United States in 1924 and in the eastern United States in 1952. All stages of the hemlock woolly adelgid feed on young twig tissue to obtain nutrients from stored starches. Dispersal and movement can occur primarily as a result of transportation of infected nursery stock; however, the more natural dispersion occurs during the first larval stage as a result of wind, birds, and other animals that may come into contact with the naturally sticky larvae. Natural predators on hemlock woolly adelgid are not effective at reducing populations enough to prevent mortality of trees (USFS 2005, 1).

The elongate hemlock scale was first observed in New York in 1908 and is believed to have been unintentionally introduced in the United States from Japan (Penn State 2011). Scale insects feed on the fluid within the hemlock needles, starting from the bottom limbs and working toward the crown of the tree. Hemlock scale is dispersed by wind and birds and can be carried large distances. Effects of the elongate hemlock scale are worse on trees that are stressed by drought or parasitism by hemlock woolly adelgid (Penn State 2011; University of Kentucky 2003). Natural predators of the elongate hemlock scale include two small wasp parasitoids, the twice-stabbed ladybeetle (*Chilocorus stigma*), and several species of lacewings (Penn State 2011).

The European gypsy moth was accidentally introduced in Massachusetts in 1869 and has spread west to Ohio, north to Quebec, Canada, and south to North Carolina. Periodic outbreaks of gypsy moth caterpillars can cause extensive defoliation of deciduous forests, frequently along the boundaries between forests and urban areas. Infestations often occur along dry ridges and steep slopes that have shallow soils. Caterpillars are known to eat the leaves of more than 500 species of trees and generally attack trees that are already stressed (by drought or human-caused disturbance). Outbreaks, which result in extensive defoliation, tend to occur in cycles and last for 1 to 2 years. As with other invasive insects, natural predators are not capable of reducing or controlling population levels during outbreaks (NPS 2010n, 1).

Emerald ash borer was introduced into the United States in 2002 and probably entered in wooden packing material from Asia. The emerald ash borer attacks only ash trees (*Fraxinus* spp.), and as larvae burrow into the tree after hatching and feed on the phloem layer within the tree; adults emerge through D-shaped holes after overwintering as mature pupae. In forested areas, the emerald ash borer tends to attack upper trunks and limbs of larger trees, slowly weakening the trees and facilitating mass attack by emerald ash borers on the main trunks, which can result in tree death within 5 years (USFS 2010, 1). Pennsylvania and New Jersey are actively participating in emerald ash borer surveys under the Emerald Ash Borer National Management Program. This survey will monitor known emerald ash borer infestations and try to locate other unknown beetle populations (USDA 2011).

Brown marmorated stink bugs were first identified in Allentown, Pennsylvania in 1998. This species was most likely introduced accidentally to Pennsylvania from its native range in eastern Asia. The brown marmorated stinkbug is primarily an agricultural plant pest that pierces fruit and leaves of host plants to feed. In Pennsylvania, it has been observed feeding on ornamental plants, weeds, and trees, including black cherry (*Prunus serotina*). It is currently unknown whether the species will become a widespread pest (PADCNr 2010a, 1).

White-nose syndrome was first identified in bats near Albany, New York, in 2007 and has spread rapidly. Bats with white-nose syndrome exhibit abnormal behaviors, such as leaving their hibernacula during the winter months or clustering near the mouth of their hibernacula (a hibernaculum is a site where bats hibernate over the winter and generally includes caves or abandoned mines). These behaviors, which cause the bats to lose fat reserves that they need to survive the winter, usually result in death (USFWS 2009b). Infections in winter hibernacula in Pennsylvania have resulted in nearly 95% mortality to the bat populations in winter hibernacula 2 years after initial infection (PGC 2010a). DEWA was the first national park system unit to document the presence of white-nose syndrome. To date, there are four national park system units that have documented the presence of the syndrome. DEWA and the NPS are providing guidance on management of white-nose syndrome, including recommendations to close wild caves or requiring decontamination of caving gear following the USFWS Cave Advisory dated March 26, 2009, as well as providing educational information and support of research (NPS 2009f, 1).

Alternatives 1 through 5

Hemlock woolly adelgid and elongate hemlock scale were observed during field reconnaissance surveys (inside the study area for alternatives 1, 2, and 2b). The spread of and defoliation from hemlock woolly adelgid and elongate hemlock scale, as well as gypsy moths, are monitored throughout DEWA as part of the Eastern Rivers and Mountains Network program to monitor the condition of vegetation communities within the park (NPS 2010j, 8–9). White-nose syndrome has been documented in bats in DEWA. It is likely that outbreaks of these invasive wildlife species may occur in deciduous woodlands in the parks as well as outside the study area to Susquehanna and/or Roseland; such outbreaks are therefore considered likely to occur under the appropriate conditions in appropriate habitats under all alternatives.

SPECIAL-STATUS SPECIES

Special-status species are plants and animals that are legally protected under state regulations and the federal Endangered Species Act of 1973 or other regulations, and that are considered sufficiently rare by the scientific community to qualify for such status. In this section, the presence of federally and state-listed threatened and endangered species and potential habitat to support these species, as well as candidate species and any designated critical habitat (although no critical habitat has been designated within the study area at this time), is described by alternative. Presence data were compiled as a result of agency consultation, the collection of existing electronic data layers, the review of natural resource reports, and the results of field surveys conducted within the project area.

Consultation History: Consultation with the National Oceanic and Atmospheric Administration (NOAA) Fisheries was formally initiated with a letter sent to request information on the potential for the presence of federally listed aquatic species that are endangered, threatened, candidate, or species of concern. Additional information on the presence of designated critical habitat for listed aquatic species was also requested in the consultation letter. NOAA Fisheries responded in a letter dated July 22, 2010, that shortnose sturgeon (*Acipenser brevirostrum*), a federally listed endangered fish species, is the only species known to be present in the project vicinity. NOAA Fisheries further noted that the shortnose sturgeon is present in the Delaware River below Lambertville, New Jersey, more than 90 river miles below DEWA. NOAA Fisheries concluded that because there were no federally listed species within the project area, no further consultation with NOAA Fisheries would be necessary unless project plans or new information became available (NOAA Fisheries 2010).

Responding to initial consultation correspondence, the USFWS provided a list of federally listed species that included Indiana bat (*Myotis sodalis*), bog turtle (*Glyptemys muhlenbergii*), and the freshwater mussel dwarf wedgemussel (*Alasmidonta heterodon*). The plant swamp pink (*Helonias bullata*) was also identified as a federally listed species that could grow in the eastern portions of some of the alternatives outside the study area. USFWS also requested that the bald eagle continue to be considered because of the existence of active bald eagle nests and wintering and foraging habitat within the project area (USFWS 2010b). Responding to follow-up consultation correspondence, the USFWS provided a list of protected species by alternative that may be present within the study area.

Consultations with the Pennsylvania Fish and Boat Commission (PFBC) and the NJDEP Division of Fish and Wildlife were initiated concurrently with NOAA Fisheries and USFWS consultation. PFBC provided information that indicated bog turtle, timber rattlesnake (*Crotalus horridus*), and several state-listed fish and freshwater mussel species are known to be present in portions of the project area. The freshwater mussel and fish species may be in portions of the Middle Delaware River and adjacent drainages within proposed alternative alignments; however, no details on specific species of fish or freshwater mussels were provided. Information on special-status aquatic species that may be present along the alternative alignments in Pennsylvania was developed from county lists provided on the Pennsylvania Natural Heritage Program (PNHP) website. The Pennsylvania Department of Conservation and Natural Resources (PADCNR) responded with a letter listing a total of 16 plant species and four natural communities (PADCNR 2010b).

New Jersey Endangered and Nongame Species Program (NJENSP) responded with information limited to New Jersey and NPS-owned lands from their species presence area database. Because the proposed routes of the alternative alignments have not been finalized outside the study area, consultation and discussion of species of special status that are present or have the potential to be found outside the study area in New Jersey is limited to state-owned and NPS-owned lands and a database search of species presence in areas that intersect with the proposed ROWs. As a result, special-status species known to be present or having

the potential to be found along the proposed transmission line routes in New Jersey include 3 freshwater mussel, 3 butterfly, 7 reptile and amphibian, 14 bird, and 3 mammal species (NJENSP 2010a).

Initial consultation with federal and state agencies resulted in a compiled list of species known to be present or that have the potential to be found within the project area. Because of the limited ability to develop a special-status species list for areas outside the study area in New Jersey and Pennsylvania, it would be incumbent on the applicant to coordinate with state and federal agencies when a final alternative is chosen.

The following discussion of all special-status species known to be present within the study area is subdivided into aquatic and terrestrial wildlife and terrestrial vegetation. All species that are present or have the potential to be found are listed in the following sections in tables 12 through 20 and are based on existing data from consultation as well as previous surveys and reports. For species that have the potential to be present and have not been observed or otherwise documented, brief descriptions of the life requirements for those species are provided in appendix G.

AQUATIC FEDERALLY AND STATE-LISTED SPECIES

Based on information from DEWA, freshwater mussels within DEWA include eight species, six of which are endangered, threatened, or of special concern in New Jersey or Pennsylvania, including the dwarf wedgemussel, triangle floater (*Alasmidonta undulata*), brook floater (*A. varicosa*), alewife floater (*Anodonta implicata*), creeper (*Strophitus undulatus*), and yellow lampmussel (*Lampsilis cariosa*). All six species are known to be found within DEWA (NPS 2007c). In addition, four fish species that are endangered, threatened, or of special concern in New Jersey or Pennsylvania could also be present within DEWA and/or MDSR. These listed species include bridled shiner (*Notropis bifrenatus*), ironcolor shiner (*Notropis chalybaeus*), eastern mudminnow (*Umbra pygmaea*), and banded sunfish (*Enneacanthus obesus*). No critical habitat for aquatic species has been proposed or designated within the project area.

No other special-status aquatic species have the potential to be found or are known to be present within the proposed alternative alignments based on consultation information provided. The names and designated conservation status of special-status aquatic species that are known to be present or have potential to be found within the study area are presented in table 12. In addition to the species in table 12, sheepsnose mussel (*Plethobasus cyphus*) and rabbitsfoot (*Quadrula cylindrica cylindrica*) are candidate species for federal listing; however, because these species occur in the Allegheny River Basin and not the Delaware River drainage (USFWS 2011a), they are not discussed further.

Dwarf Wedgemussel (*Alasmidonta heterodon*): The dwarf wedgemussel is considered critically imperiled and listed as federally and state (New Jersey and Pennsylvania) endangered. The dwarf wedgemussel is a small freshwater mussel that requires muddy sand, sand, and gravel/pebble substrates in rivers and creeks with slow to moderate currents, good water quality, and little silt deposition (USFWS 1993, 1). Glochidial (larval) host fish include tessellated darter (*Etheostoma olmstedi*), mottled sculpin (*Cottus bairdi*), and juvenile Atlantic salmon (*Salmo salar*) (NJDEP 2002a, 3). The dwarf wedgemussel once lived in 15 major drainage basins along the Atlantic slope, including 3 in New Jersey: the Delaware, Hackensack, and Passaic rivers (NatureServe 2009). There are only four known active dwarf wedgemussel areas remaining in Sussex and Warren counties, New Jersey: Paulins Kill, Pequest River, Flat Brook, and Little Flat Brook (NJDEP 2002a, 2). During consultation, PFBC indicated that several rare mussel species live in the Delaware River within the alignments for alternatives 1, 2, 2b, and 3; however, the species were not identified (PFBC 2010a, 1).

TABLE 12: SPECIAL-STATUS AQUATIC SPECIES IDENTIFIED THROUGH AGENCY CONSULTATION

| Species | Federal Status | PA State Status | NJ State Status |
|--|----------------|-----------------|-----------------|
| Freshwater Mussels | | | |
| Dwarf wedgemussel (<i>Alasmidonta heterodon</i>) | E | E | E |
| Triangle floater (<i>Alasmidonta undulata</i>) | | N | T |
| Brook floater (<i>Alasmidonta varicosa</i>) | SC | E | E |
| Alewife floater (<i>Anodonta implicata</i>) | | CU | |
| Yellow lampmussel (<i>Lampsilis cariosa</i>) | SC | CU | T |
| Creeper (<i>Strophitus undulatus</i>) | | | SC |
| Fish | | | |
| Eastern mudminnow (<i>Umbra pygmaea</i>) | | C | |
| Ironcolor shiner (<i>Notropis chalybaeus</i>) | | E | |
| Bridle shiner (<i>Notropis bifrenatus</i>) | | E | |
| Banded sunfish (<i>Enneacanthus obesus</i>) | | E | |

Source: USFWS 2010b, 1; 2010c, 1; PNHP 2010a, 1.

Status Codes: E = endangered, T = threatened, C = candidate; CU = condition undetermined—insufficient data; N = no status—under study for future listing; CP = potential that species is present but no records exist; SC = species of special concern.

Triangle Floater (*Alasmidonta undulata*): The triangle floater is considered vulnerable in Pennsylvania (NatureServe 2009) and has been listed by the state of New Jersey as threatened. This mussel is small with a roughly triangular shape. The triangle floater is a geographically widespread species found from Nova Scotia to Florida. Considered a habitat generalist, the triangle floater can be found in a variety of aquatic habitats and is more tolerant of standing water conditions found in ponds, lakes, and canals than other *Alasmidonta* species. However, it prefers low-gradient rivers with sand and gravel substrates (PNHP 2010a, 1). Triangle floater has a variety of larval host fish species, including blacknose dace (*Rhinichthys atratulus*), longnose dace (*R. cataractae*), fantail darter (*Etheostoma flabellare*), fallfish (*Semotilus corporalis*), common shiner (*Notropis cornutus*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), slimy sculpin (*Cottus cognatus*), and white sucker (*Ameiurus catus*) (PADCNr 2010c). During consultation, PFBC indicated that several rare mussel species live in the Delaware River within the alignments for alternatives 1, 2, 2b, and 3; however, the species were not identified (PFBC 2010a, 1).

Brook Floater (*Alasmidonta varicosa*): The brook floater is listed as endangered in both Pennsylvania and New Jersey. The brook floater is a small mussel found only in streams and rivers with consistently flowing clean water, where it prefers areas of riffles and substrates with gravel or a mix of sand and gravel. Potential hosts for the brook floater include blacknose dace, longnose dace, golden shiner (*Notemigonus crysoleucas*), pumpkinseed, slimy sculpin, yellow perch (*Perca flavescens*), and margined madtom (*Noturus insignis*) (PADCNr 2010d). In Pennsylvania, this species is known to live in the Middle Delaware River-Mongaup-Brodhead River Watershed and is considered imperiled; in New Jersey it is found in the Delaware River watershed in Morris, Sussex, Somerset, and Warren counties. During consultation, PFBC indicated that several rare mussel species live in the Delaware River within the alignments for alternatives 1, 2, 2b, and 3; however, the species were not identified (PFBC 2010a, 1).

Alewife Floater (*Anodonta implicata*): The status of the alewife floater is under review in Pennsylvania and the species is secure in New Jersey (NatureServe 2009). The alewife floater is an elongate freshwater mussel that is variable in color and may grow up to 7 inches in length. It is found in streams, rivers, ponds, and lakes with a variety of substrates and migratory spawning runs of anadromous clupeids

(herring), especially alewife, a host fish species. The presence of alewife generally determines the range for alewife floater; however, other documented host fish species include white sucker, threespine stickleback (*Gasterosteus aculeatus*), pumpkinseed, and white perch (*Morone americana*) (NatureServe 2009). In Pennsylvania, the alewife floater is known to be present in Luzerne, Monroe, Pike, and Wayne counties. During consultation, PFBC indicated that several rare mussel species live in the Delaware River within the alignments for alternatives 1, 2, 2b, and 3; however, the species were not identified (PFBC 2010a, 1).

Yellow Lampmussel (*Lampsilis cariosa*): The yellow lampmussel, a bright yellow, medium-sized freshwater mussel, is a federal species of special concern. It is considered vulnerable in Pennsylvania (NatureServe 2009) and listed as threatened in New Jersey (NJDEP 2002a, 4). Benthic substrates preferred by the yellow lampmussel consist of sand/silt. The host species for this mussel has not been identified; however, alewife (*Alosa pseudoharengus*) is the suspected host (NJDEP 2002a, 4). The yellow lampmussel prefers large rivers with large watersheds and ranges from Canada to Georgia. In New Jersey, the yellow lampmussel is restricted to the Delaware River (NJDEP 2002a, 4). The NJENSP identified the yellow lampmussel as potentially present along the alignment for alternatives 1, 2, and 2b (NJENSP 2010a, 2). During consultation, PFBC indicated that several rare mussel species live in the Delaware River within the alignments for alternatives 1, 2, 2b, and 3; however, the species were not identified (PFBC 2010a, 1).

Creeper (*Strophitus undulatus*): The creeper is apparently secure in Pennsylvania (NatureServe 2009) and listed as a species of special concern in New Jersey. As a habitat generalist with a wide-ranging distribution, the creeper is found in all drainages of the Delaware River Basin, preferring sand and gravel substrates in low-gradient rivers with low to moderate water flows but tolerating a wide range of habitat conditions. The creeper has a wide range of host fish species. It is often found in association with triangle floater, dwarf wedgemussel, and brook floater. NJENSP identified the creeper as potentially present along the alignment for alternatives 1, 2, and 2b (NJENSP 2010a, 2). During consultation, PFBC indicated that several rare mussel species live in the Delaware River within the alignments for alternatives 1, 2, 2b, and 3; however, the species were not identified (PFBC 2010a, 1).

Eastern Mudminnow (*Umbra pygmaea*): The eastern mudminnow is considered vulnerable in Pennsylvania and considered secure in New Jersey. The eastern mudminnow is known to be present in Luzerne, Pike, and Wayne counties in Pennsylvania; it has been documented in the Middle-Delaware-Mongaup-Brodhead watershed (NatureServe 2009; PNHP 2010b). The eastern mudminnow is found in quiet, mud-bottomed, often heavily vegetated streams, sloughs, swamps, and ponds, where it prefers the margins of sand, mud, and debris where soft substrate is available for burrowing to escape predators. The species is also able to tolerate low levels of oxygen (NatureServe 2009; PNHP 2010b). Fish surveys of the Delaware River and tributaries along the alternative 3 alignment within DEWA from 2004 to 2006 included collection of eastern mudminnow (NPS 2008c).

Bridle Shiner (*Notropis bifrenatus*): In Pennsylvania, bridle shiner is listed as endangered and in New Jersey, it is listed as apparently secure (NatureServe 2009); however, this status is expected to change to imperiled or vulnerable (PNHP 2010c). The bridle shiner is found in mud or detritus bottom pools of vegetated warmwater streams or lakes (PNHP 2010c). A historical record of several bridle shiners shows collections occurred from the Delaware River near the mouth of Van Campen Brook in DEWA (NPS 2008c); however, new specimens were not captured in recent surveys. In Pennsylvania, bridle shiner is known to be present in Monroe County; it has been documented in the Middle-Delaware-Mongaup-Brodhead watershed (NatureServe 2009). Fish inventories conducted in 2004–2006 included collection of bridle shiner in or near the Upper Delaware River and in tributaries and a pond near Flat Brook in DEWA, near the alignment for alternatives 1, 2, and 2b (NPS 2008c, 75). The ironcolor shiner and bridle

shiner have historically been documented in the Cherry Creek watershed near the alignments for alternatives 4 and 5 (USFWS 2008).

Special-status aquatic species analysis are shown in table 13.

TABLE 13: SPECIAL-STATUS AQUATIC SPECIES ANALYSIS BY ALTERNATIVE WITHIN THE STUDY AREA

| Special-status Species | Alternatives | | | | | |
|------------------------|--------------|---|----|---|---|---|
| | 1 | 2 | 2b | 3 | 4 | 5 |
| Aquatic Species | | | | | | |
| Freshwater mussels | X | X | X | X | — | — |
| Bridle shiner | X | X | X | — | — | — |

X = species is known to be present or could be found based on presence of habitat.

— = species is not likely to be present based on absence of habitat.

Outside the study area in Pennsylvania, the proposed S-R Line could pass through Carbon, Lackawanna, Luzerne, Monroe, Pike, Northampton, and Wayne counties and could cross several tributaries to the Delaware River and Susquehanna River. PFBC did not specify the location of any known presence of special-status aquatic species but noted that state-listed species of freshwater mussels have been found in the Delaware River and a state-endangered fish in Marshalls Creek (PFBC 2010a, 1). The USFWS indicated that the dwarf wedgemussel has been recorded in the Delaware River outside the proposed study area (USFWS 2010b, 4).

Outside the study area in New Jersey, the S-R Line could traverse Warren, Sussex, and Morris counties and could cross several tributaries to the Delaware and Passaic rivers. NJENSP identified the presence of yellow lampmussel, creeper, and triangle floater within state land (NJENSP 2010a, 3). Consultation with the USFWS indicated that the dwarf wedgemussel is known to be present in the Pequest River, which could be intersected by the proposed S-R Line (USFWS 2010b, 4). Paulins Kill is also known to provide habitat for the dwarf wedgemussel. NOAA Fisheries identified a population of endangered shortnose sturgeon in the Delaware River downstream of Lambertville, New Jersey (NOAA Fisheries 2010, 1).

FEDERALLY AND STATE-LISTED TERRESTRIAL WILDLIFE SPECIES

The study area provides a diversity of topography and habitat that in turn provides life requirements for a diversity of terrestrial wildlife species, including special-status species. Special-status terrestrial wildlife species that are known to be present or have the potential to be present as determined through agency consultation are discussed in this section and listed in table 14. In addition to the species listed in table 14, red knot (*Calidris canutus rufa*) and eastern Massasauga rattlesnake (*Sistrurus catenatus catenatus*) are candidate species for federal listing. However, the eastern Massasauga rattlesnake is only known to occur in Butler, Crawford, Mercer and Venango Counties, Pennsylvania (USFWS 2011a) and the red knot is not known to occur in the study area and was not observed during surveys in 2010 and 2011. Therefore, the eastern Massasauga rattlesnake and the red knot are not discussed further.

TABLE 14: SPECIAL-STATUS WILDLIFE SPECIES IDENTIFIED THROUGH AGENCY CONSULTATION

| Species | Federal Status | PA State Status | NJ State Status |
|---|----------------|-----------------|---------------------------------|
| Invertebrates | | | |
| Arogos skipper (<i>Atrytone arogos arogos</i>) | SC | | E |
| Mitchell's satyr (<i>Neonympha mitchellii mitchellii</i>) | E | | E |
| Cobblestone tiger beetle (<i>Cicindela marginipennis</i>) | SC | | |
| Superb jewelwing (<i>Calopteryx amata</i>) | | | T |
| Harpoon clubtail (<i>Gomphus descryptus</i>) | | | T |
| Kennedy's Emerald (<i>Somatochlora kennedyi</i>) | | | T |
| Gray petaltail (<i>Tachopteryx thoreyi</i>) | | | E |
| Brook snaketail (<i>Ohpiogomphus asperses</i>) | | | T |
| Birds | | | |
| Great blue heron (<i>Ardea herodias</i>) | | | SC ^a |
| Osprey (<i>Pandion haliaetus</i>) | | T | T ^a |
| Bald eagle (<i>Haliaeetus leucocephalus</i>) | | T | E ^a /T ^b |
| Northern harrier (<i>Circus cyaneus</i>) | | | E ^a |
| Cooper's hawk (<i>Accipiter cooperii</i>) | | | SC ^a |
| Northern goshawk (<i>Accipiter gentilis</i>) | | | E ^a |
| Red shouldered hawk (<i>Buteo lineatus</i>) | | | E ^a |
| Peregrine falcon (<i>Falco peregrinus</i>) | | E | E ^a |
| American kestrel (<i>Falco sparverius</i>) | | | T |
| Barred owl (<i>Strix varia</i>) | | | T |
| Short-eared owl (<i>Asio flammeus</i>) | | | E ^a |
| Long-eared owl (<i>Asio otus</i>) | | | T |
| Cliff swallow (<i>Petrochelidon pyrrhonota</i>) | | | SC ^a |
| Veery (<i>Catharus fuscescens</i>) | | | SC ^a |
| Golden-winged warbler (<i>Vermivora chrysoptera</i>) | SC | | E ^a /SC ^b |
| Black-throated green warbler (<i>Dendroica virens</i>) | | | SC ^a |
| Cerulean warbler (<i>Dendroica cerulea</i>) | | | SC |
| Vesper sparrow (<i>Pooecetes gramineus</i>) | | | E ^a |
| Horned lark (<i>Eremophila alpestris</i>) | | | T ^a |
| Reptiles and Amphibians | | | |
| Bog turtle (<i>Glyptemys muhlenbergii</i>) | T | E | E |
| Wood turtle (<i>Clemmys insculpta</i>) | | | T |
| Eastern box turtle (<i>Terrapene carolina carolina</i>) | | | SC |
| Northern copperhead (<i>Agkistrodon contortrix mokasen</i>) | | | SC |
| Timber rattlesnake (<i>Crotalus horridus horridus</i>) | | C | E |
| Northern fence lizard (<i>Sceloporus undulatus</i>) | | SC | |
| Blue-spotted salamander (<i>Ambystoma laterale</i>) | | E | E |

| Species | Federal Status | PA State Status | NJ State Status |
|---|----------------|-----------------|-----------------|
| Longtail salamander (<i>Eurycea longicauda</i>) | | | T |
| Mammals | | | |
| Bobcat (<i>Lynx rufus</i>) | | | E |
| Indiana bat (<i>Myotis sodalis</i>) | E | E | E |
| Small-footed bat (<i>Myotis leibii</i>) | SC | T | |
| Northern myotis (<i>Myotis septentrionalis</i>) | SC | SC | |

Status Codes: E = endangered; T = threatened; C = candidate; SC = species of special concern.

^a Breeding population

^b Non-Breeding population

Invertebrate Species

Arogos skipper (*Atrytone arogos arogos*): The Arogos skipper is state listed by New Jersey as endangered and is a federally listed as a species of special concern. This butterfly species inhabits xeric to dry–mesic grasslands containing its host plant, little bluestem (*Schizachyrium scoparius*), in the northern portion of New Jersey. The Arogos skipper can be difficult to identify due to its resemblance to the more abundant Delaware skipper (*Anatrytone logan*) (NJDFW 2010a). The habitat requirements for Arogos skipper include fallow agricultural fields and little bluestem communities, which are typically found in power line ROWs. There are no fallow agricultural fields in the study area, but actively farmed agricultural fields that could support this species are found along all of the alternative alignments. The specific community described as Northern Appalachian acidic rocky summit/little bluestem/Pennsylvania sedge opening, which could support the arogos skipper, does not exist within DEWA along the alignment for alternatives 1, 2, and 2b (Mellon 2010a). In contrast, vegetation mapping of DEWA presents sparsely forested lands that includes a community of little bluestem beyond APPA along the alignment for alternatives 1, 2, and 2b (PNHP 2006) that could support the Arogos skipper. An invertebrate survey of the alignment for alternatives 1, 2, and 2b did not note observations of the Arogos skipper but stated that the alternative 1, 2, and 2b alignment may serve as a migratory and movement corridor for invertebrates, including butterflies, due to the linear nature of the clearing along the ROW (EcolSciences 2009a). Therefore, alternatives 1, 2, and 2b could potentially provide habitat for the Arogos skipper. Suitable habitat is not found along the alignments for alternatives 3, 4, and 5; however, the ROWs could serve as migratory corridors for Arogos skipper. Even so, Arogos skipper is unlikely to occur along the alignments for alternatives 3, 4, and 5.

Mitchell's satyr (*Neonympha mitchellii mitchellii*): Mitchell's satyr is a federally endangered and New Jersey State listed butterfly that has historically been found from New Jersey to Michigan and Indiana. Habitat loss and pesticides have contributed to the decline of Mitchell's satyr (USFWS 2010d). Today, Mitchell's satyr is extirpated from New Jersey and is currently restricted to a few locations in Michigan and Indiana. Suitable fen habitat exists in Pennsylvania and New Jersey, but Mitchell's satyr is not known to be present in these states (USFWS 2010d). Specifically, suitable habitat exists along the alignment for alternatives 1, 2, and 2b. An invertebrate survey of the corridor for alternatives 1, 2, and 2b did not note observations of Mitchell's satyr but stated that the alignment for alternatives 1, 2, and 2b may serve as a migratory and movement corridor for invertebrates, including butterflies, due to the linear nature of the clearing along the ROW (EcolSciences 2009a). Therefore, alternatives 1, 2, and 2b could potentially provide habitat for the Mitchell's satyr. Suitable habitat is not found along the alignments for alternatives 3, 4, and 5; however, the ROWs could serve as migratory corridors for Mitchell's satyr. Even so, Mitchell's satyr is unlikely to occur along the alignments for alternatives 3, 4, and 5. Special-status invertebrate species analyses are shown in table 15.

TABLE 15: SPECIAL-STATUS INVERTEBRATE SPECIES ANALYSIS BY ALTERNATIVE WITHIN THE STUDY AREA

| Special-status Species | Alternatives | | | | | |
|------------------------|--------------|---|----|---|---|---|
| | 1 | 2 | 2b | 3 | 4 | 5 |
| Invertebrate Species | | | | | | |
| Arogos skipper | X | X | X | — | — | — |
| Mitchell's satyr | X | X | X | — | — | — |

X = species is known to be present or could be found based on presence of potential habitat.

— = species is not likely to be present based on absence of potential habitat, even though ROWs in general can serve as migratory corridors.

Bird Species

Great Blue Heron (*Ardea herodias*): The great blue heron is listed by New Jersey as a species of concern but only for the breeding population. The great blue heron is the most widespread heron species in North America and relies on both freshwater and saltwater environments, where it can be found along the edge of inland bodies of water and along seacoasts. This species generally nests in colonies but occasionally nests in lone pairs and constructs stick nests in trees and occasionally on the ground. Foraging occurs mainly in water and food items consist mostly of fish and other invertebrates; peak activity occurs before dawn and at dusk (Terres 1991, 499). The great blue heron could be found almost anywhere in the study area where preferred habitat is found. Wetlands within the ROW for alternatives 1, 2, and 2b provide breeding and nesting habitat for the great blue heron. Forested and emergent wetland areas as well as riparian areas adjacent to the Delaware River are present along the alignments for alternatives 1, 2, 2b, and 3 and provide breeding and nesting habitat for the great blue heron. A great blue heron rookery is on Hogback Ridge near the alternative 1, 2, and 2b alignment. This species was observed along the alignments for alternatives 1, 2, 2b, and 3 (NPS 2011b, PSE&G 2010a), and, during consultation, NJENSP indicated that the great blue heron is known to be present along the alignments for alternatives 1, 2, 2b, and 3 (NJENSP 2010a, 2).

Osprey (*Pandion haliaetus*): The osprey is currently listed in New Jersey as a threatened species (the breeding population only) and is listed in Pennsylvania as threatened. The species was listed in New Jersey in 1974 when dichlorodiphenyltrichloroethane (DDT) and habitat loss caused population declines. In 1979, biologists in New Jersey began an osprey reintroduction program. Populations have slowly increased since then, and in 1985, the osprey was downlisted from endangered to threatened (NJDFW 2010b). The osprey feeds solely on fish and is found near bodies of water that support adequate fish populations, usually rivers, marshes, bays, and lakes. Nesting can occur on almost any structure near available fish foraging areas. Potential habitat for the osprey is found along the alignments for alternatives 1, 2, 2b, and 3, and osprey were observed along the alignment for alternatives 1, 2, and 2b in New Jersey (PSE&G 2010a).

Bald Eagle (*Haliaeetus leucocephalus*): The bald eagle is currently state-listed by Pennsylvania as threatened, by New Jersey as endangered for the breeding population, and threatened for the non-breeding population. The bald eagle was originally listed as endangered in New Jersey in 1974, in Pennsylvania in 1978, and was listed federally in the lower 48 states in 1978. The decline in bald eagle populations was mostly due to the use of DDT, which was assimilated by bald eagles during feeding. DDT ultimately caused eggshell thinning, resulting in poor reproductive success, and subsequent population decline. The federal government banned DDT several years before listing the bald eagle, and since then bald eagle numbers have increased. The bald eagle was removed from federal listing in 2007, although it is still protected by the Migratory Bird Treaty Act and Bald Eagle and Golden Eagle Protection Act. The number

of nests and fledglings has grown steadily in New Jersey and Pennsylvania since its listing. Protection, restrictions on pesticide use, and recovery efforts have been successful.

The bald eagle is found throughout North America. Ideal habitat includes areas with clean water and undisturbed land with large trees in which individuals roost, perch, and nest. This species prefers undisturbed areas near large lakes and reservoirs, marshes and swamps, or stretches along rivers where it can find open water for foraging. The bald eagle generally nests near coastlines, rivers, and large lakes where there is an adequate food supply. This species nests in mature or old growth trees, snags (dead trees), cliffs, and rock promontories. In forested areas, the bald eagle often selects the tallest trees with limbs strong enough to support a nest. Nest sites typically include at least one perch with a clear view of the water where individuals forage, because they are visual hunters. Recently, and with increasing frequency, this species has been nesting on artificial structures, such as power poles and communication towers (USFWS 2010e). The bald eagle begins migrating southward in the fall to areas where water remains open and food resources are typically reliable. This species is territorial during breeding season, but wintering individuals often congregate at communal roost trees at night. The same roost trees are often used for several years. Roost locations are often protected from the wind by vegetation or terrain and communal roosting may help eagles find food in the winter (USFWS 2010e).

The bald eagle is known to nest, roost, and forage along the Delaware River. Individuals have been using the Delaware River in DEWA as a wintering area since the late 1970s. Studies indicate that 15 to 20 bald eagles spend the winter in DEWA with additional migrants bolstering their numbers during periods of harsh winter weather. Over 50 individual bald eagles were recorded in DEWA during the 2010 Annual Midwinter Bald Eagle Survey. Research in the 1980s and early 1990s identified two communal winter night roosts within DEWA. Individuals are known to roost in riparian habitat along the Delaware River, and the alignment for alternatives 1, 2, and 2b bisects an important communal wintering eagle roost (USFWS 2010b). No other communal winter roost sites for bald eagles have been documented in the southern portion of DEWA. Surveys conducted in 2010 indicated that this night roost was still being used by large numbers of eagles. The first observations of bald eagles attempting to nest in DEWA were in 1999, and the first successful nesting was recorded in 2002. One successful nest was recorded in 2003 and 2004, approximately 2 miles upstream of the alignment for alternatives 1, 2, and 2b. The nest tree was felled by a winter storm in 2005, and the new nest site for this pair has not been found (NPS 2006b, 41). The USFWS stated in a 2010 letter that several active bald eagle nests exist along the alignment for alternatives 1, 2, and 2b (USFWS 2010b, 5). In addition, there is the potential for inactive or alternate nests (not used for breeding by eagles in a given breeding season) (USFWS 2007a, 17). USFWS also indicated that an active bald eagle nest is within 0.2 mile of the alternative 3 alignment (USFWS 2010b, 5). NJENSP indicated during consultation that bald eagles are known to be found along the alignment for alternatives 1, 2, and 2b (NJENSP 2010a, 2). All the alternatives cross foraging habitat mapped by the NJDEP Landscape Project (USFWS 2010b, 5). A bald eagle was observed along the alignment for alternatives 1, 2, and 2b in New Jersey (PSE&G 2010a).

Northern Harrier (*Circus cyaneus*): The breeding population of the northern harrier is listed in New Jersey as an endangered species. The northern harrier inhabits tidal marshes, emergent wetlands, fallow fields, grasslands, meadows, airports, and agricultural areas. Nesting occurs in brackish or saline marshes among the high marsh in salt hay (*Spartina patens*), marsh elder (*Iva frutescens*), or reed grass (*Phragmites australis*) or in freshwater tidal marshes that contain phragmites, sedges (*Carex* spp.), or other emergent wetland plants. Foraging occurs over much the same habitat, with males venturing out farther in search of food (NJDFW 2010c). Foraging habitat for migratory and resident northern harriers may be present in or along the alignments for alternatives 1, 2, 2b, and 3.

Cooper's Hawk (*Accipiter cooperii*): The Cooper's hawk is listed in New Jersey as a species of special concern. This species is considered an uncommon hawk from southern Canada over most of the United

States south to Florida and Texas. The Cooper's hawk inhabits a wide variety of woodland types, favoring extensive deciduous, coniferous, and mixed forests, and conifer plantations for nesting; this species is also found in suburban and urban habitats. In northern New Jersey, pine plantations appear to be favored nesting sites. Forest edge habitat is an important component of their home range for breeding pairs and may serve as primary hunting sites. In the breeding season, the home range of the Cooper's hawk is estimated at 990 to 4,450 acres (400 to 1,800 hectares). Cooper's hawks have been observed along the alignments for alternatives 1, 2, 2b, and 3 (NPS 2011b; PSE&G 2010a); in addition, potential habitat for the Cooper's hawk has been identified along the alignments for alternatives 3, 4, and 5. NJENSP indicated during consultation that the Cooper's hawk is present along the alignment for alternative 3 in New Jersey (NJENSP 2010a, 2).

Northern Goshawk (*Accipiter gentilis*): The northern goshawk is listed as endangered for the breeding population in New Jersey. The northern goshawk nests in mature, contiguous forests that may be dominated by coniferous, deciduous, or mixed canopy tree species and that include large trees, a closed canopy, and an open understory. Nests may be in either deciduous or coniferous trees, although deciduous trees are used more frequently by goshawks nesting in New Jersey. Breeding territories are preferentially selected in areas where individuals are protected from human activity and development. In the Highlands region of New Jersey and New York, northern goshawk nests were, on average, more than 3,280 feet (1,000 meters) from paved roads or areas of human habitation (NJDFW 2010d). Nests are constructed in a crotch in the lower canopy layer of a large, canopy-sized tree, such as an American beech, black birch, oak, maple, white pine, red pine, or hemlock (EcolSciences 2010b, 1–3). Individuals have been observed along the alignment and/or access roads for alternatives 1, 2, and 2b in New Jersey (PSE&G 2010a); in addition, potential habitat for the northern goshawk has been identified along the alignments for alternatives 3, 4, and 5. The New Jersey Landscape Project identified potential habitat along the alignments for alternatives 1, 2, 2b, and 3 (Niles et al. 2008).

Red shouldered Hawk (*Buteo lineatus*): The red shouldered hawk is listed as endangered for breeding populations in New Jersey. This species inhabits moist woodlands, swamps, and wooded riparian areas. Individuals generally avoid human influences, nesting away from residences, roads, and development. The red shouldered hawk prefers large tracts of forest, between 250 acres and 620 acres. During the nonbreeding season, this species occupies smaller forested tracts (NJDFW 2010e). Pairs maintain the same nesting territory for many years (Terres 1991, 483–484). This species has been observed within the alignments for alternatives 1, 2, 2b, 4, and 5 (NPS 2011b; PSE&G 2010a); in addition, potential habitat for red shouldered hawk has been identified along the alignments for alternatives 3, 4, and 5. The red shouldered hawk is listed in New Jersey as endangered, and NJENSP indicated during consultation that the red shouldered hawk is present along the alignment for alternative 3 in New Jersey (NJENSP 2010a, 2). The New Jersey Landscape Project identified potential habitat along the alignments for alternatives 1, 2, 2b, and 3 (Niles et al. 2008).

Peregrine falcon (*Falco peregrinus*): The peregrine falcon is listed in both New Jersey (only breeding populations) and Pennsylvania as an endangered species. This species prefers open areas such as marshes, beaches, and open water for foraging, and cliffs and rock outcrops for nesting. The peregrine falcon was listed as endangered federally in 1970, in Pennsylvania in 1972, and in New Jersey in 1974 (NJDEP n.d.; PGC 2009). The decline of the peregrine falcon in North America is attributed to egg collectors, falconers, loss of habitat, and the use of DDT. This species was removed from the federal endangered species list in 1999 (NJDEP n.d.). Recent nesting attempts have been recorded near the alignments for alternatives 4 and 5 and suitable foraging habitat exists along all alignments.

American kestrel (*Falco sparverius*): The American kestrel is currently listed as state threatened in New Jersey. The American kestrel is the smallest falcon in North America occupying large open areas with short vegetation. The kestrel is often attracted to human altered or managed areas such as farmland,

parkland, and livestock pastures. Females tend to use similar habitats during the non-breeding and overwintering season; however, male kestrels typically occupy more forested areas during this period. Kestrels hunt for insects and small vertebrates from perches including branches and utility lines. American kestrels use cavities in trees facing open areas that are either naturally occurring or excavated by woodpeckers for nests. Lack of suitable nesting is one reason for the decline of American kestrels (NJDFW n.d.a, 1-3). American kestrels are breeding summer residents within the parks; however, they were not observed along the alignments for the proposed alternatives during field surveys. Potential habitat for this species occurs within alternatives 1, 2, 2b, and 3.

Barred Owl (*Strix varia*): New Jersey listed barred owls as threatened in 1979. The barred owl is typically found in remote wetland forests with an open understory. In northern New Jersey, this species inhabits hemlock ravines, mixed deciduous wetlands, and oak hardwood forests. Resident individuals establish territories that they defend year-round. Populations of barred owls are currently declining due to development and fragmentation of forests (NJDFW 2010f). The barred owl is known to use a nest site for many years and maintain a territory of approximately 1 square mile throughout the year, relocating when food resources become scarce (Terres 1991, 664–665). This species has been observed in the alignment for alternatives 1, 2, and 2b (NPS 2011b; PSE&G 2010a); in addition, potential habitat for the barred owl has been identified along the alignments for alternatives 3, 4, and 5. NJENSP indicated during consultation that the barred owl is present along the alignments for alternatives 1, 2, 2b, and 3 in New Jersey (NJENSP 2010a, 2). The New Jersey Landscape Project identified potential habitat along the alignments for alternatives 1, 2, 2b, and 3 (Niles et al. 2008).

Short-eared owl (*Asio flammeus*): The breeding population of short-eared owls is listed as an endangered species in New Jersey. The short-eared owl is typically found in large open areas including fallow fields, hay fields, grasslands, and sedge meadows. The short-eared owl occupies similar habitats year round. Wintering roosts are formed on the ground within open areas and are occasionally shared with long-eared owls (*Asio otus*). Short-eared owls are also found to inhabit coastal tidal and brackish marsh areas where they roost, forage, or nest in the drier portions of the marsh (NJDFW n.d.b, 1-2). This species is often found sharing foraging and roosting habitat with Northern harriers during the winter. The short-eared owl was not observed during field surveys along the alignments for the proposed alternatives; however, short-eared owls are likely winter residents or transient throughout the park. Potential habitat for this species occurs along the alignments for alternatives 1, 2, 2b, and 3.

Veery (*Catharus fuscescens*): The veery breeding population is listed in New Jersey as a species of special concern. The veery is a species in the thrush family that inhabits damp, deciduous forests and riparian habitats, where it forages for insects on the forest floor. Nesting occurs on the ground or in shrubs close to the ground (Cornell 2009). This species has been observed within the alignment and/or access roads for alternatives 1, 2, and 2b in New Jersey (PSE&G 2010a); in addition, potential habitat for the veery has been identified along the alignments for all alternatives. During consultation, NJENSP identified the veery as present along the alignment for alternatives 1, 2, and 2b (NJENSP 2010a, 2). The New Jersey Landscape Project identified potential habitat along the alignments for alternatives 1, 2, 2b, and 3 (Niles et al. 2008).

Golden-winged Warbler (*Vermivora chrysoptera*): The USFWS is conducting a status review of the golden-winged warbler in response to a petition to list this species under the Endangered Species Act. The golden-winged warbler is also state listed in New Jersey as a species of special concern for the non-breeding population. The breeding population in New Jersey is listed as endangered. The golden-winged warbler prefers early successional habitats of patchy scrub shrub or along the forest edge, constructing nests near the ground or on the ground. Foraging occurs in a similar habitat but in the upper half of nearby trees and shrubs. It is believed that populations are declining because of loss of early successional habitat due to reforestation and hybridization with the blue-winged warbler (Cornell 2009). The golden-winged

warbler has been identified by NJENSP as potentially present along the alignment for alternatives 1, 2, and 2b (NJENSP 2010a, 2) and the New Jersey Landscape Project has identified potential habitat for the golden-winged warbler along the alignments for alternatives 1, 2, 2b, and 3 (Niles et al. 2008); potential habitat could also be present along the alignments for alternatives 4 and 5.

Black-throated Green Warbler (*Dendroica virens*): The black-throated green warbler breeding population is listed in New Jersey as a species of special concern. The black-throated green warbler breeds from east-central British Columbia and Manitoba to central Ontario and Newfoundland south to Pennsylvania and northern New Jersey, as well as along the Appalachians to Georgia. General habitat includes large stands of mature open mixed woodlands (especially northern hardwood/hemlock stands), northern coniferous forests, and larch bogs (DeGraaf and Rappole 1995, 428–429). Overall populations appear to be stable; however, logging of coniferous forests negatively affects the species (Cornell 2009). This species has been observed in the alignment and/or access roads for alternatives 1, 2, and 2b in New Jersey (PSE&G 2010a); in addition, potential habitat for the black-throated green warbler has been identified along the alignments for alternatives 1, 2, 2b, and 3 by the New Jersey Landscape Project (Niles et al. 2008), and potential habitat could also be present along the alignments for alternatives 4 and 5. During consultation, NJENSP identified the presence of this species along the alignment for alternatives 1, 2, and 2b (NJENSP 2010a, 2).

Cerulean Warbler (*Dendroica cerulea*): The cerulean warbler is listed in New Jersey as a species of special concern. This species prefers extensive (generally at least 620 acres) mature floodplain and bottomland forests and shaded, mature upland woods with sparse understories and tall trees (DeGraaf and Rappole 1995, 442–443). Within the Delaware River area, this species tends to use mature deciduous stands of oaks, tulip poplar, and sycamores as its prime habitat. An extension of the Delaware River population has colonized the Stokes State Forest, High Point State Park, the Flatbrook-Roy Wildlife Management Area, and the Walpack Wildlife Management Area. The cerulean warbler is also found in isolated spots in forested dry ridgetops, often associated with forest openings, although use is infrequent and singing males are more scattered from each other than in habitat used along riparian corridors (Rosenberg, Barker, and Rohrbaugh 2000, 30–32, 38–39). This warbler is sensitive to habitat fragmentation and is declining throughout its range (DeGraaf and Rappole 1995, 442–443). The cerulean warbler is a common breeder along the riparian corridor of the Delaware River on both Pennsylvania and New Jersey sides of the river from the Delaware Gap north to Port Jervis, New York (Rosenberg, Barker, and Rohrbaugh 2000, 30). As a result, the cerulean warbler has the potential to be present within the alignments for all alternatives near the Delaware River and along upland ridges for all proposed alternatives. This species has been observed in the alignment and/or access roads for alternatives 1, 2, and 2b in New Jersey (PSE&G 2010a); in addition, potential habitat for the cerulean warbler has been identified along the alignments for all alternatives. During consultation, NJENSP identified the presence of cerulean warbler along the alignment for alternatives 1, 2, and 2b (NJENSP 2010a, 2).

Vesper sparrow (*Pooecetes gramineus*): The breeding population of the vesper sparrow is state-listed as endangered in New Jersey. Vesper sparrow habitats are typically sparsely vegetated with patches of bare ground, low vegetation, and scattered shrubs. This species can be found in cultivated fields, grasslands, and pastures. Farmed areas adjacent to fallow fields provide nesting habitat, cover, foraging sites, and singing perches, and are considered preferred habitat for this species (CWFNJ 2012, 1-2). This species typically breeds in the inner Coastal Plain of South New Jersey and the Piedmont, Highlands, and Ridge and Valley regions of northern and central New Jersey. Nesting occurs in the north-west area of the state. This species could occur within the parks during the summer breeding season, but they are more likely found in migration as transient in open areas of mowed grasslands. The vesper sparrow was not observed along the alignments for the proposed alternatives during field surveys; however, potential habitat does occur along the alignments for alternatives 1, 2, 2b, and 3.

Horned lark (*Eremophila alpestris*): The breeding population of the horned lark is state-listed as threatened in New Jersey. The horned lark is a small songbird occurring in open habitats with short, sparse grasses and wildflowers, bare ground, and few shrubs. As vegetation grows thicker, the horned lark is known to abandon sites quickly. Females build nests in small depressions on the bare ground next to clusters of grass or other plants with egg-laying beginning in February (CWFNJ 2012, 1-2). This species is known to occur in the parks; however, the horned lark was not observed along the alignments for the proposed alternatives during field surveys. Potential habitat for the horned lark occurs along the alignments for alternatives 1, 2, 2b, and 3.

Special-status bird species analysis are shown in table 16.

TABLE 16: SPECIAL-STATUS BIRD SPECIES ANALYSIS BY ALTERNATIVE WITHIN THE STUDY AREA

| Special-status Species | Alternatives | | | | | |
|------------------------------|--------------|---|----|---|---|---|
| | 1 | 2 | 2b | 3 | 4 | 5 |
| Bird Species | | | | | | |
| Great blue heron | X | X | X | X | — | — |
| Osprey | X | X | X | X | — | — |
| Bald eagle | X | X | X | X | X | X |
| Northern harrier | X | X | X | X | — | — |
| Cooper's hawk | X | X | X | X | X | X |
| Northern goshawk | X | X | X | X | X | X |
| Red shouldered hawk | X | X | X | X | X | X |
| Peregrine falcon | X | X | X | X | X | X |
| American kestrel | X | X | X | X | | |
| Barred owl | X | X | X | X | X | X |
| Short-eared owl | X | X | X | X | | |
| Veery | X | X | X | X | X | X |
| Golden-winged warbler | X | X | X | X | X | X |
| Black-throated green warbler | X | X | X | X | X | X |
| Cerulean warbler | X | X | X | X | X | X |
| Vesper sparrow | X | X | X | X | | |
| Horned lark | X | X | X | X | | |

X = species is known to be present or has potential to be found based on presence of habitat.

— = species is not likely to be present based on absence of habitat.

Reptile and Amphibian Species

Bog Turtle (*Glyptemys muhlenbergii*): The bog turtle is listed as endangered in Pennsylvania and New Jersey. The bog turtle is one of smallest turtles in North America and is separated taxonomically into two geographically distinct populations. The federally threatened northern population ranges from Massachusetts to Maryland and is found in the intermountain valleys and rolling hills of the Piedmont Physiogeographic Province, occupying suitable wetland habitat that is often found as transitional strips between drier upland areas and more thickly vegetated, wetter, wooded swamp or marsh. As a result, the wetland areas are a mosaic of microhabitats that include dry pockets, saturated areas, and periodically flooded areas. Seeps or spring-fed emergent wetlands associated with streams, often at or near the

headwaters of streams or small tributaries, are the bog turtle's primary habitat. The diversity of microhabitats provides this species with areas for foraging, nesting, basking, hibernation, shelter, and other needs. Individuals also use more densely vegetated areas for hibernation. Unlike other turtle species, the bog turtle's range is small, with the turtles rarely leaving the marsh for upland foraging. In a survey of 200 colonies, most habitat areas were found to be less than 2 acres (EcolSciences 2010c). The bog turtle is highly susceptible to habitat loss, degradation, and fragmentation. Individuals were formerly known to be present in 18 counties in New Jersey and 17 in Pennsylvania; they now are found in 13 in New Jersey and 14 in Pennsylvania. Most are found in the Delaware and Susquehanna river watersheds (USFWS 2001, 11, 12). DEWA is part of the Delaware Recovery Unit for the bog turtle, which includes the following minimum, long-term protection measures (USFWS 2001):

- The habitat areas used by a population are under conservation management and are protected against adverse effects (e.g., wetland draining, ditching, filling or excavation; drawdown by water supply wells; pollution from point and non-point sources; succession to woody vegetation; invasive plant species), and
- Recharge areas and buffer zones are protected by conservation to prevent adverse hydrological alterations (such as stream diversions, mining, wells, roads, and impervious surfaces).

Projects in and adjacent to bog turtle habitat can cause habitat destruction, degradation, and fragmentation. Therefore, bog turtle conservation zones have been designated with the intent of protecting and recovering known bog turtle populations within the northern range of this species. The conservation suggestions for each zone guide the evaluation of activities that may affect high-potential bog turtle habitat, potential travel corridors, and adjacent upland habitat that may serve to buffer bog turtles from indirect effects. The following bog turtle zones have been described in the recovery plan for this species (USFWS 2001, A-1 through A-3):

- **Zone 1:** includes the wetland and visible spring seeps occupied by bog turtles. Bog turtles rely upon different portions of the wetland at different times of year to fulfill various needs; therefore, this zone includes the entire wetland (the delineation of which will be scientifically based), not just those portions that have been identified as, or appear to be, optimal for nesting, basking or hibernating. In this zone, bog turtles and their habitat are most vulnerable to disturbance; therefore, the greatest degree of protection is necessary.
- **Zone 2:** The boundary of this zone extends at least 300 feet from the edge of Zone 1 and includes upland areas adjacent to Zone 1. Activities in this zone could indirectly destroy or degrade wetland habitat over the short or long-term, thereby adversely affecting bog turtles. In addition, activities in this zone have the potential to cut off travel corridors between wetlands occupied or likely to be occupied by bog turtles, thereby isolating or dividing populations and increasing the risk of turtles being killed while attempting to disperse.
- **Zone 3:** includes upland, wetland, and riparian areas extending either to the geomorphic edge of the drainage basin or at least one-half mile beyond the boundary of Zone 2. Despite the distance from Zone 1, activities in these areas have the potential to adversely affect bog turtles and their habitat. This particularly applies to activities affecting wetlands or streams connected to or contiguous with Zone 1, because these areas may support undocumented occurrences of bog turtles and/or provide travel corridors.

In January 2012, a Phase I bog turtle habitat suitability assessment was performed within eight separate wetland complexes: wetlands 3, 4, 5, 6, 8, and 10 along alternative 3, and wetlands 1 and 2 along alternatives 4 and 5. Hydrology, soils, and vegetation were assessed within the project ROW to determine habitat suitability. The result of the Phase I bog turtle habitat suitability assessment concluded that wetlands

3, 4, 5, 6, and 8 of alternative 3 and wetlands 1 and 2 of alternatives 4 and 5 do not contain either the necessary hydrology, soils, and/or vegetation to support the bog turtle. Wetland 10 of alternative 3 does contain suitable hydrology, soils, and vegetation to support the bog turtle. Although suitable, the existence of a dense monoculture of common reed in portions of wetland 10 and sporadic areas underlain by cobble contribute to reduce the habitat value for the bog turtle within this wetland. However, wetland 10 is connected to wetlands outside of the proposed ROW area that may have the potential to host the bog turtle, which renders wetland 10 part of an interconnected habitat mosaic (NPS 2012a, 12).

During consultation, agencies stated that the bog turtle is present in wetlands along the alignment for alternatives 1, 2, and 2b and that potential habitat is found along the alignments of alternatives 1, 2, 2b, and 3 inside the study area (USFWS 2010b; PFBC 2010a, 1). Future coordination with appropriate federal and state agencies would clarify the extent to which adverse effects to listed species would be likely to occur and would determine whether a biological assessment (BA) would be required.

Wood Turtle (*Glyptemys insculpta*): The wood turtle is listed in New Jersey as threatened. The wood turtle uses habitats that include both wetlands and uplands. Aquatic habitats are required for mating, feeding, and hibernation, while terrestrial habitats are used for egg laying and foraging. Freshwater streams, brooks, creeks, or rivers with good water quality within undisturbed uplands such as fields, meadows, or forests are preferred habitat areas. Open fields and thickets of alder (*Alnus* spp.), greenbrier, or multiflora rose are favored basking habitats. Lowland, mid-successional forests dominated by oaks, black birch, and red maple may also be used (NJDEP 2010a, 1). This species may also be found on abandoned railroad beds or agricultural fields and pastures (NJDEP 2010a, 1). During consultation, NJENSP identified the presence of wood turtles along the alignment for alternatives 1, 2, and 2b (NJENSP 2010a, 2). The New Jersey Landscape Project identified habitat for the wood turtle along the alignments for alternatives 1, 2, 2b, and 3 (Niles et al. 2008). Individuals were observed along the alignment for alternatives 1, 2, and 2b (NPS 2011b; PSE&G 2010a).

A multi-phased wood turtle study within the proposed ROW for alternative 2 was conducted in 2010 and 2011. During the study, numerous wood turtles and wood turtle hibernacula, nesting sites, and foraging habitat were observed within the proposed ROW. Surveys included opportunistic searches, which resulted in the capture of 17 wood turtles within the proposed ROW. Ten additional wood turtles were captured within 2,000 feet of the proposed ROW (EcolSciences 2011, 4). To document the movement of adult wood turtles within the proposed ROW along alternative 2, a radio-telemetry survey was conducted from June 2010 through September 2011. Turtles used locally available habitats including upland hardwood forests, upland conifer forests, forested, scrub shrub, and emergent wetlands, stream corridors, riparian areas, and successional fields. Five of the ten wood turtles tracked were initially captured in or confirmed to use or cross the proposed ROW for alternative 2 (EcolSciences 2011, 4). Six wood turtles were tracked during the winter of 2010 and 2011 to evaluate the presence of hibernacula within the proposed ROW. Five of the tracked turtles used locations upstream of the proposed ROW and one turtle used a location downstream and adjacent to the proposed ROW (EcolSciences 2011, 5). The tracked turtle hibernated within the channel of a stream or under banks, roots, logjams, or rock structures within a stream. In the spring of 2011, the proposed ROW for alternative 2 was surveyed for suitable wood turtle nesting habitat. Three suitable nest sites were identified within the vicinity of the proposed ROW and included upland soil berms within the ROW, successional fields, and dry portions of the channel and banks along a stream. Wood turtle hatchlings were tracked using radio telemetry and were found to use the proposed ROW and adjacent habitats for dispersal (EcolSciences 2011, 10). Overall, this study confirmed that wood turtles use the proposed ROW for foraging and for juvenile dispersal. In addition, wood turtles used the areas adjacent to the proposed ROW for foraging, breeding, hibernating, and nesting (EcolSciences 2011, 11).

Eastern Box Turtle (*Terrapene carolina carolina*): The eastern box turtle (*Terrapene carolina carolina*) is the only species of box turtle in New Jersey, where it is listed as a species of special concern. This

species occupies forests or meadows and will seek out muddy areas or shallow pools in times of heat. The box turtle can also be found under rotting logs or other decaying vegetation and is typically active from April through September (NJENSP 2001a). During consultation, NJENSP identified the presence of eastern box turtles along the alignment for alternative 3 (NJENSP 2010a, 2). The New Jersey Landscape Project identified habitat for the eastern box turtle along the alignments for alternatives 1, 2, 2b, and 3 (Niles et al. 2008). Individuals have been observed along the alignment for alternatives 1, 2, and 2b (NPS 2011b; PSE&G 2010a).

Northern Copperhead (*Agkistrodon contortrix mokasen*): The northern copperhead is state listed in New Jersey as a species of special concern. This species can exist in a variety of habitats, including suburban areas, but typically uses rock outcrops or rocky areas with talus slopes for cover, feeding, and as entranceways to subterranean hibernating quarters. During the warm months individuals may occupy a variety of habitats, such as emergent wetlands, areas along streams, and upland areas. Overwintering and basking areas are usually located where individuals can receive maximum sunlight exposure. The northern copperhead may overwinter alone or with other species, such as the timber rattlesnake. The northern copperhead is the most widely distributed reptile species from New England to Florida in the eastern United States and can be locally abundant in appropriate habitat in the northern counties of Pennsylvania and New Jersey (PFBC 2010b; NJDEP 2002b). The copperhead can be active in Pennsylvania from mid-April to late October, and depending on the air temperature and latitude, into November. This species has been known to eat small mammals, reptiles, such as other snakes and skinks, amphibians (frogs, salamanders), and even insects. Foraging and the pursuit of mates can lead individuals up to 2 miles from their overwintering habitat (PFBC 2010b). During consultation, NJENSP identified the presence of northern copperhead along the alignments for alternative 1, 2, 2b, and 3 (NJENSP 2010a, 2). The New Jersey Landscape Project identified habitat for the northern copperhead along the alignments for alternatives 1, 2, 2b, and 3 (Niles et al. 2008). Individuals have been observed along the alignment for alternatives 1, 2, and 2b (PSE&G 2010a).

Timber Rattlesnake (*Crotalus horridus*): The timber rattlesnake is listed in New Jersey as an endangered species, and in Pennsylvania, this species is a candidate for listing. In northern New Jersey and Pennsylvania, this species occupies deciduous upland habitats consisting of hemlock forests, seeps, open fields, floodplains, talus slopes, or rock outcrops. Dens are typically on rocky wooded slopes facing southeast to southwest. Population declines are believed to be from loss of habitat and killings (NJENSP 2010b, 2). The timber rattlesnake's pattern of movement through the summer range is loop-like, starting at the den with the spring emergence. Individuals will forage periodically over a small area before moving to another area, gradually covering a territory of approximately 2 miles from the den and returning to the den in the fall. Mature individuals will typically travel along a similar pathway and through the same general area during each active season of its life (PADCNR 2010e). For hibernation, northern New Jersey populations of timber rattlesnake use communal den sites in rock outcroppings and talus slope areas associated with major ridges. Studies using transmitter-implanted timber rattlesnakes have found that this species also hibernates within the forest among boulder fields and small clusters of rocks. Migration back to the winter dens begins as the weather cools between mid-September and late October. Mature and juvenile individuals then follow scent trails back to their dens (EcolSciences 2009b, 4, 5). Suitable basking, foraging, and transient timber rattlesnake habitats exist along the entire length of the alignment for alternatives 1, 2, and 2b; however, potential hibernacula exist only in the New Jersey portion of these alignments (EcolSciences 2009b, 15). There is one known timber rattlesnake den location within alternatives 2 and 2b ROW inside the study area (Boder et al. 2005). The den is located close to the construction zone for a proposed tower. During consultation, agencies identified the presence of timber rattlesnakes along the alignments of alternatives 1, 2, 2b, and 3 (NJENSP 2010a, 2; PFBC 2010b, 1). The New Jersey Landscape Project identified habitat for the timber rattlesnake along the alignment for alternatives 1, 2, and 2b (Niles et al. 2008). In addition, individuals were observed along the alignments

and/or access roads for alternatives 1, 2, 2b, and 3 (NPS 2011b; PSE&G 2010a). Potential habitat also exists along the alignments for alternatives 4 and 5, because these alignments contain talus slope areas.

Northern Fence Lizard (*Sceloporus undulatus*): The northern fence lizard is listed in Pennsylvania as a species of special concern. The northern fence lizard is arboreal and uses trees for hunting, resting, and safety when threatened. This species prefers open wooded areas and sunny, grassy areas where rotting logs or rocky outcrops can be found (NJDFW 2002, 1; PFBC 2011, 31). The northern fence lizard requires extended periods for basking, often in rocky outcroppings, and is well camouflaged within these environments (Sheils 2011, 1). The northern fence lizard is found in several areas of New Jersey and in a few areas of Pennsylvania; it is the only species of spiny lizard that is found in Pennsylvania and New Jersey. Within DEWA, individuals are often found along ridges with pitch pines in the Pennsylvania portion of the park (NJDFW 2002, 1). Vegetation surveys in 2010 and 2011 documented the northern fence lizard at one location in the Pennsylvania portion of the alignments for alternatives 1, 2, 2b, at one location along the alignment for alternative 3 as well as at one location along the alignments for alternatives 4 and 5 (NPS 2011b).

Longtail Salamander (*Eurycea longicauda*): The longtail salamander is listed in New Jersey as threatened due to habitat loss and pollution of larval ponds (NJENSP 2001b). The longtail salamander is usually closely associated with calcareous spring-fed seepages, fens, or abandoned mines or caves that contain calcareous groundwater in upland deciduous forests. A groundcover of rotting logs, stones, moss, and leaf litter provides cover for this species. The New Jersey Landscape Project identified habitat for the longtail salamander along the alignments for alternatives 1, 2, 2b, and 3 (Niles et al. 2008). Special-status reptile and amphibian species analysis are shown in table 17.

TABLE 17: SPECIAL-STATUS REPTILE AND AMPHIBIAN SPECIES ANALYSIS BY ALTERNATIVE WITHIN THE STUDY AREA

| Special-status Species | Alternatives | | | | | |
|-------------------------------|--------------|---|----|---|---|---|
| | 1 | 2 | 2b | 3 | 4 | 5 |
| Reptile and Amphibian Species | | | | | | |
| Bog turtle | X | X | X | X | | |
| Wood turtle | X | X | X | X | — | — |
| Eastern box turtle | X | X | X | X | — | — |
| Northern copperhead | X | X | X | X | — | — |
| Timber rattlesnake | X | X | X | X | X | X |
| Northern fence lizard | X | X | X | X | X | X |
| Longtail salamander | X | X | X | X | — | — |

X = species is known to be present or has potential to be found based on presence of habitat.

— = species is not likely to be present based on absence of habitat.

Mammal Species

Bobcat (*Lynx rufus*): In New Jersey, the bobcat is listed as endangered. The bobcat can survive in a variety of habitats as long as there is a food source; individuals feed on a variety of prey from insects and small rodents to rabbits and hares. The bobcat requires natural cover but can survive in areas of limited natural cover among agricultural fields. In New Jersey, individuals inhabit forested areas and use rock outcroppings or caves for cover and rearing young. If rock outcroppings are not available, the bobcat will adapt to areas of thick vegetation that provide good cover (NJDFW 2010g). The bobcat is considered a crepuscular mammal since it is most active in both the early evening and early morning hours; however,

bobcats may move around at anytime during the day or night. During consultation, NJENSP identified the presence of bobcats along the alignments for alternatives 1, 2, 2b, and 3 (NJENSP 2010a, 2). This species was observed in the alignment and/or access roads for alternatives 1, 2, and 2b on the New Jersey side (PSE&G 2010a); potential habitat for the bobcat has been identified along the alignments for all alternatives.

Indiana Bat (*Myotis sodalis*): The Indiana bat is federally listed as endangered and is also listed as endangered in both Pennsylvania and New Jersey. The Indiana bat is an insectivorous migratory bat that hibernates in mines and caves in winter and spends the summer in woodlands. In spring, reproductive females migrate to wooded areas and form maternity colonies, where they bear young. Males and nonreproductive females usually stay close to hibernation sites (hibernacula) but may migrate to summer roosts. Summer roosts are typically found behind exfoliating bark of large, often dead, trees. Both males and females return to hibernacula in late summer or early fall to mate and enter hibernation (USFWS 2007b, 1). Migration routes could be found within any of the alternative alignments due to available forested habitat. No potential Indiana bat hibernacula were found within the corridor for alternatives 1, 2, and 2b during surveys within the study area (Sanders Environmental, Inc. [Sanders] 2009). The USFWS has stated in an agency coordination letter that the Indiana bat is present along the alignment for alternatives 1, 2, and 2b and that the New Jersey portions of the alignments for alternatives 3 through 5 (including outside the study area) are all within the geographic range of this species. The eastern portions of the alignment for alternative 5 crosses known migratory corridors, swarming habitat associated with known hibernacula, and foraging habitat associated with known maternity colonies (USFWS 2010b, 2). Following this agency response, the geographic information system (GIS) data layers depicting known Indiana bat habitat were acquired from the NJENSP. Based on the NJENSP data, it was determined that the alignments for alternatives 1, 2, 2b, and 3 are within summer habitat for the Indiana bat.

In February 2012 an Indiana bat habitat assessment was performed along the proposed ROW for alternatives 3, 4, and 5. One-half acre sub plots per every 5 acres were surveyed throughout the proposed ROW to qualitatively identify suitable winter and summer habitat for the Indiana bat. Caves and abandoned mines were assessed for winter habitat using USFWS Indiana Bat Survey Protocol for Assessing Use of Potential Hibernacula (USFWS 2011c). A deep mine portal was located in the vicinity of alternatives 4 and 5, however; this portal was assessed and deemed not suitable for winter populations of Indiana bats. Indiana bat summer habitat was characterized by determining the distribution, density, and quality of roost trees in the project area. Suitable roosting and foraging habitat is present within and adjacent to alternatives 3, 4, and 5. Alternative 3 has greater number and diversity of potential roost trees than alternatives 4 and 5. Potential roost tree density would average approximately 8.86 potential roost trees per acre along alternative 3 and 4.5 potential roost trees per acre along alternatives 4 and 5 (NPS 2012b, 13).

Small-footed Bat (*Myotis leibii*): USFWS is conducting a status review of the small-footed bat in response to a petition to list this species under the Endangered Species Act. This species is listed as threatened in Pennsylvania. This species is one of the smallest bats in North America and resembles the little brown bat but has a distinctive black mask and ears. From Ontario, Quebec, and New England south and west to Arkansas, Kentucky, and Virginia, distribution is very spotty, and the largest populations are in New York, Pennsylvania, West Virginia, and Virginia. The small-footed bat uses hilly or mountainous areas in or near deciduous or evergreen forest. In Pennsylvania, this species is found mostly in heavy hemlock forests in the foothills of mountains. Summer roosts include caves, coal mines, buildings, rock crevices, and bridges over rivers (in expansion joints). Warm-season roosts include buildings, hollow trees, and spaces under loose bark, among others (NatureServe 2009). No potential bat hibernacula were found within the alignment for alternatives 1, 2, and 2b during surveys in the study area; however, 14 small-footed bats were captured between May 27 and August 12, 2009, along the alignment for alternatives 1, 2, and 2b in Pennsylvania outside the study area (Sanders 2009). In addition, talus slopes

are potential small-footed bat habitat and this habitat exists along each of the alternatives as discussed in the “Rare and Unique Communities” section of this chapter. The alignments for alternatives 3 through 5 have not been specifically surveyed for bats at this time. Potential small-footed bat habitat could be found within any of the alternative alignments due to available forested habitat and talus slopes along alternatives 1 through 5.

Northern Myotis (*Myotis septentrionalis*): The USFWS is conducting a status review of the Northern myotis in response to a petition to list this species under the Endangered Species Act. This species is also listed as a species of special concern in Pennsylvania. This is a nocturnal species that feeds along small ponds, in forest clearings, and along the edges of forests, where individuals forage for a variety of night-flying insects. The northern myotis hibernates in caves and underground mines, but uses tree cavities and buildings for maternity roosts (PNHP 2011, 1). The range of the northern myotis extends through much of Canada and the eastern United States. Potential habitat for the northern myotis could be present along the alignments for all alternatives. The Pennsylvania Game Commission has stated that the alignments for alternatives 1, 2, 2b, and 3 are outside the buffers (habitat that could support the bat) of northern myotis but the alignments for alternatives 4 and 5 are within the buffers of the northern myotis (PGC 2010a, 2). Individuals were collected during mist net surveys conducted from May to August of 2009 in the ROW for alternatives 1, 2, and 2b (Sanders 2009).

Outside the Study Area

Outside the study area in Pennsylvania, the proposed S-R Line could pass through Carbon, Lackawanna, Luzerne, Monroe, Pike, Northampton, and Wayne counties. PFBC indicated that the timber rattlesnake, bog turtle, and blue-spotted salamander have the potential to be present outside the study area to Susquehanna in appropriate habitat (PFBC 2010a, 1). Timber rattlesnake individuals were observed within Pike, Monroe, and Lackawanna counties during a habitat assessment (NPS 2011b, 12). Small-footed bat individuals were caught during mist-netting surveys within Monroe, Pike, and Lackawanna counties (Sanders 2009, 6). In addition to these observations, any of the species discussed in this section could be found within these counties, provided the proper habitat exists.

Outside the study area in New Jersey, the S-R Line could traverse Warren, Sussex, and Morris counties. During consultation, NJENSP reviewed state-owned and NPS lands. NJENSP identified the following species as present outside the study area: Mitchell’s satyr, arogos skipper, bald eagle, osprey, red shouldered hawk, barred owl, Cooper’s hawk, northern harrier, long-eared owl, great blue heron, cerulean warbler, cliff swallow, timber rattlesnake, northern copperhead, eastern box turtle, bog turtle, wood turtle, longtail salamander, blue-spotted salamander, bobcat, and Indiana bat (NJENSP 2010a, 2–4). The USFWS also indicated that habitat for the bog turtle exists outside the study area (USFWS 2010b, 4), and potential bog turtle habitat was identified within Sussex and Morris counties (EcolSciences 2008, 8–15). In addition, any of the species listed in table 18 could be found within these counties, provided the proper habitat exists.

Two additional terrestrial listed species, the long-eared owl and cliff swallow, have the potential to be present outside the study area and were not analyzed for presence inside the study area.

TABLE 18: SPECIAL-STATUS MAMMAL SPECIES ANALYSIS BY ALTERNATIVE WITHIN THE STUDY AREA

| Special-status Species | Alternatives | | | | | |
|------------------------|--------------|---|----|---|---|---|
| | 1 | 2 | 2b | 3 | 4 | 5 |
| Mammal Species | | | | | | |
| Bobcat | X | X | X | X | X | X |
| Indiana bat | X | X | X | X | X | X |
| Small-footed bat | X | X | X | X | X | X |
| Northern myotis | X | X | X | X | X | X |

X = species is known to be present or has the potential to be found based on presence of habitat.

— = species is not likely to be present based on absence of habitat.

Long-eared Owl (*Asio otus*): Currently, the long-eared owl is listed in New Jersey as a threatened species. The long-eared owl is a widely distributed, year-round resident in the northern United States and Canada, only visiting other portions of the United States in the winter. This species inhabits dense vegetation adjacent to open habitats such as fields and scrub shrub where it can actively hunt for small mammals and occasionally birds. Roosting and nesting sites may be within dense stands of either natural or ornamental evergreens, such as Scotch pine (*Pinus sylvestris*), Austrian pine (*P. nigra*), Virginia pine (*P. virginiana*), eastern red cedar, Norway spruce (*Picea abies*), arborvitae (*Thuja orientalis*), eastern hemlock, red pine (*Pinus resinosa*), and white pine. The long-eared owl has historically been one of the rarest New Jersey regularly breeding birds, and there are scattered historical records of breeding individuals from Salem, Burlington, Morris, Essex, Hunterdon, and Middlesex counties. Declines in long-eared owl populations in New Jersey are likely due to development (Cornell 2009; Terres 1991, 669). The long-eared owl has been identified by NJENSP as a potentially present species along the alignment for alternatives 1, 2, and 2b outside the study area (NJENSP 2010a).

Cliff Swallow (*Petrochelidon pyrrhonota*): The cliff swallow is listed in New Jersey as a species of concern. The cliff swallow is a migratory bird, spending the summer months in the United States and Canada. Nesting occurs on cliffs, near water, and typically in a colony. Nesting can also occur on buildings and under bridges (Cornell 2009). The cliff swallow has been identified by NJENSP as a potentially present species along the alignment for alternative 3 outside the study area (NJENSP 2010a).

FEDERALLY AND STATE-LISTED PLANT SPECIES

Surveys for special-status plant species were conducted in 2009 along the alignment for alternatives 1, 2, and 2b in Pike County, Pennsylvania, as well as in Pike and Monroe counties, Pennsylvania, and Warren County, New Jersey (Mellon 2010a, 1; 2010b, 2); surveys were completed to a width of approximately 200 feet and did not include all NPS lands along the alignment. Vegetation surveys of all the proposed alternative routes were conducted in 2010 and 2011 (NPS 2011b); these studies covered a width of approximately 400 feet and only included NPS lands, not privately owned lands. These two surveys within NPS lands differ in the amount of area surveyed. As a result of the surveys, four special-status plant species were documented: prickly-pear cactus (*Opuntia humifusa*), stiff club moss (*Lycopodium annotinum*), pasture rose (*Rosa virginiana*), and netted chainfern (*Woodwardia areolata*). One additional species, reed meadowgrass (*Glyceria grandis*), which was not on the special-status plant lists provided during consultation, was identified from vegetation surveys conducted in 2009 (Mellon 2010a, 12). Table 19 presents the state- and federally listed plant species identified through consultation that are present or have the potential to be found within the study area. New Jersey consultation did not provide a list of plant species. In addition to the species listed in table 19, bog asphodel (*Narthecium americanum*) and

Hirsts' panicgrass (*Dichanthelium hirstii*) are candidate species for federal listing; however, because these species do not occur along any of the alternative alignments, they are not discussed further.

TABLE 19: SPECIAL-STATUS PLANT SPECIES IDENTIFIED THROUGH AGENCY CONSULTATION

| Species | Federal Status | PA State Status | NJ State Status |
|--|----------------|-----------------|-----------------|
| Mosses, Ferns, and Fern Allies | | | |
| Netted chainfern (<i>Woodwardia areolata</i>) | | NL, PT | |
| Clinton's wood fern (<i>Dryopteris clintoniana</i>) | | NL, PT | |
| Stiff club moss (<i>Lycopodium annotinum</i>) | | | E |
| Sedges, Grasses, and Herbaceous Species | | | |
| Northern arrowhead (<i>Sagittaria cuneata</i>) | | | E, HL |
| A-sedge (<i>Carex tetanica</i>) | | T | |
| Yellow sedge (<i>Carex flava</i>) | | T | |
| Long's sedge (<i>Carex longii</i>) | | TU, PT | |
| Matted-spikerush (<i>Eleocharis intermedia</i>) | | T | HL |
| Northeastern bulrush (<i>Scirpus ancistrochaetus</i>) | E | E, PT | |
| Reed meadowgrass (<i>Glyceria grandis</i>) | | | E |
| Small-headed rush (<i>Juncus brachycephalus</i>) | | T | HL |
| Small-whorled pogonia (<i>Isotria medeoloides</i>) | T | E | E |
| Bog goldenrod (<i>Solidago uliginosa</i>) | | NL, PT | HL |
| White heath aster (<i>Symphyotrichum ericoides</i>) | | TU, PT | |
| Brook lobelia (<i>Lobelia kalmii</i>) | | E | |
| Marsh bedstraw (<i>Galium palustre</i>) | | | HL |
| Downy willow-herb (<i>Epilobium strictum</i>) | | E, PR | HL |
| Shrubby cinquefoil (<i>Potentilla fruticosa</i>) | | E | |
| Carolina grass-of-Parnassus (<i>Parnassia glauca</i>) | | E | |
| Swamp pink (<i>Helonias bullata</i>) | T | | E, HL |
| American bittercress (<i>Cardamine rotundifolia</i>) | | | E, HL |
| Shore aster (<i>Symphyotrichum tradescantii</i>) | | | HL |
| Trees and Shrubs | | | |
| Pasture rose (<i>Rosa virginiana</i>) | | TU | |
| Swamp dog-hobble (<i>Leucothoe racemosa</i>) | | TU, PT | |
| American holly (<i>Ilex opaca</i>) | | T | |
| Susquehanna sand cherry (<i>Prunus pumila</i> var. <i>susquehannae</i>) | | NL, PT | HL |
| Canadian serviceberry (<i>Amelanchier canadensis</i>) | | NL, PE | |
| Cactus | | | |
| Prickly-pear cactus (<i>Opuntia humifusa</i>) | | R | |

Note: Species identified during surveys are in **BOLD**.

Status Codes: E = endangered, T = threatened, TU = tentatively undetermined, NL = not currently listed, R = rare; SC = special concern; P = proposed; HL = protected by the Highlands Protection and Planning Act.

Netted Chainfern (*Woodwardia areolata*): The netted chainfern is currently not listed but proposed for state listing as a threatened species in Pennsylvania. The netted chainfern is deciduous and is usually found in wet woods and shaded swamps (CBS 2005a). The netted chainfern was observed in the corridor of alternative 3 (NPS 2011b), and suitable habitat for this species is found throughout the study area for alternative 3.

Clinton's woodfern (*Dryopteris clintoniana*): Clinton's woodfern is currently not listed but is proposed for listing as a threatened species in Pennsylvania. Clinton's woodfern grows in swampy woodlands ranging from northeastern Canada to the Great Lakes and east to the mid-Atlantic region. It grows from 1.5 to 3 feet tall. Individuals are deciduous and have reproductive spores on the undersides of their leaves (NRCS 2010b). Generally, the habitat for Clinton's woodfern is described as swampy woods, especially red maple swamps (NPS 2002a, 5). This species is found most frequently in limy red maple swamps and there are a number of areas of limestone geology in DEWA (NPS 2002a, 3–5). Suitable habitat for Clinton's woodfern is found in wetlands along the alignment for alternatives 1, 2, and 2b (NPS 2002a, 3–5). Although numerous wetlands that are dominated by red maple have been delineated in the parks, Clinton's woodfern was not observed during the vegetation surveys conducted in 2010 and 2011 (NPS 2011b; Mellon 2010a). PADCNr identified this species as present along the alignment for alternatives 1, 2, and 2b during consultation (PADCNr 2010a, 2).

Stiff Club Moss (*Lycopodium annotinum*): The stiff club moss is listed in New Jersey as an endangered plant. The stiff club moss is a native perennial club moss with long, creeping, forked, erect branches that grows as a clone. It inhabits moist woodlands, thickets, bogs, and meadows that are typically shaded and cool with acidic, well-drained to poorly drained soils (Matthews 1993). During vegetation studies, stiff club moss was observed in a seep and within the ROW corridor for alternatives 1, 2, and 2b (NPS 2011b); however, potential habitat is present along all the alternative alignments.

A-sedge (*Carex tetanica*): The A-sedge, also known as rigid sedge (NRCS 2010b), is threatened in Pennsylvania. This sedge species is generally found in calcareous fens, bogs, and swales from the Dakotas south to North Carolina and north into Canada. Suitable habitat for A-sedge has been identified along the alignment for alternatives 1, 2, and 2b (NPS 2011b; Mellon 2010a). During consultation, PADCNr identified the presence of A-sedge along the alignment for alternatives 1, 2, and 2b (PADCNr 2010a, 2).

Reed Meadowgrass (*Glyceria grandis*): Reed meadowgrass, also known as American manna grass, is state listed by New Jersey as an endangered plant species. Reed meadowgrass grows on banks and in the water of streams, ditches, ponds, and wet meadows, from Alaska to Newfoundland and south in the mountains to California, Arizona, and New Mexico in the western United States, and to Virginia and Tennessee in the eastern United States. This species flowers during the months of July and August (NRCS 2010b). Reed meadowgrass was observed during rare plant surveys conducted in 2010 along the alignment for alternatives 1, 2, and 2b (Mellon 2010a, 2010b). This species was observed within the ROW, tucked in a seepage area with other herbaceous wetland plants.

Small-headed Rush (*Juncus brachycephalus*): The small-headed rush is listed by Pennsylvania as a threatened species and is protected by the Highlands Protection and Planning Act. The small-headed rush is found in wetland habitats such as calcareous marshes, wet meadows, and wetland shores. Fruiting occurs in summer and early fall (NRCS 2010b). Small-headed rush was not observed during any of the vegetation surveys (NPS 2011b; Mellon 2010a), but this special-status wetland plant species has the potential to be present in appropriate wetland habitats along the alignment for alternatives 1, 2, and 2b (PADCNr 2010a, 2).

Bog Goldenrod (*Solidago uliginosa*): Bog goldenrod is not currently state listed by Pennsylvania, but it is proposed for listing as a threatened species; it is protected by the Highlands Protection and Planning Act. Bog goldenrod is a wetland-obligate species found in most states east of Minnesota. Flowering occurs from July to September. Height is variable depending on conditions but typically ranges from 1 foot to 5 feet (NRCS 2010b). Suitable habitat for bog goldenrod has been identified along the alignment for alternatives 1, 2, and 2b within the ROW (Mellon 2010a). In addition, PADCNr identified the presence of this species along the alignment for alternatives 1, 2, and 2b during consultation (PADCNr 2010a, 2).

White Heath Aster (*Symphyotrichum ericoides*): White heath aster is state listed by Pennsylvania as tentatively undetermined, but it is proposed for listing as a threatened plant species. The white heath aster is a small, daisy-like native plant that grows in dry soils. Its white flowers bloom from September to November. The native population of white heath aster is distributed from Pennsylvania to Maine and north into Canada and from Mississippi to Mexico. It can be found in dry prairies and along roadsides (UT 2010). The white heath aster has been documented along the Delaware River (NPS 1986, 106) and although this species is reported to be rare, it has been found to be locally common in dry spots along the Delaware River, particularly in limestone ledge areas (NPS 1986, 106). This species has been observed on limestone rocks along the alignment for alternatives 1, 2, and 2b (Mellon 2010a, 13). However, communications with DEWA park staff indicated the presence of white heath aster near, but not within, the study area (Mellon 2010a, 8). White heath aster was not detected during the vegetation surveys (Mellon 2010a; NPS 2011b); however, farther north along the Delaware River but outside the DEWA study area, a previously reported stand of white heath aster was observed (Mellon 2010a, 9). In addition, during consultation PADCNr identified the presence of this species along the alignment for alternatives 1, 2, and 2b (PADCNr 2010a, 2).

Brook Lobelia (*Lobelia kalmii*): Brook lobelia is listed in Pennsylvania as endangered. It is a wetland-obligate species that can be found across the northern United States. Plants vary in height from 4 inches to 16 inches. Blue-and-white flowers appear from July to October (NRCS 2010b). Suitable habitat for brook lobelia has been identified along the alignment for alternatives 1, 2, and 2b within the B-K Line ROW (Mellon 2010a). Although brook lobelia was not observed during vegetation surveys conducted in 2010 and 2011 (NPS 2011b), this special-status wetland plant species has the potential to be present within the corridor in appropriate wetland habitats along the alignment for alternatives 1, 2, and 2b (PADCNr 2010a).

Marsh Bedstraw (*Galium palustre*): Marsh bedstraw is protected by the Highlands Protection and Planning Act in New Jersey (NJNHP 2010). A member of the madder family, marsh bedstraw is found in swamps, along streambanks, and in wet meadows. It flowers from June to August (CBS 2005b). In New Jersey there are 21 to 100 known populations. Marsh bedstraw, a rare species in New Jersey, was identified in Pennsylvania and New Jersey during 2010 and 2011 vegetation surveys along the alignments for alternatives 1, 2, 2b, 4, and 5 (NPS 2011b). Suitable habitat also exists along the alternative 3 alignment.

Downy Willow-herb (*Epilobium strictum*): Downy willow-herb is currently listed in Pennsylvania as an endangered species; however, a change to rare status is proposed. Downy willow-herb is a wetland species found in fens, marshes, and sedge meadows throughout northeastern Canada and the United States from Minnesota to Maine and south to Virginia. Blooming occurs from July to early September, with fruiting occurring from late July to early October (NRCS 2010b). Suitable habitat for downy willow-herb has been identified within the B-K Line ROW for alternatives 1, 2, and 2b (Mellon 2010a). In addition, PADCNr identified the presence of this species along the alignment for alternatives 1, 2, and 2b during consultation (PADCNr 2010a, 2).

Shrubby Cinquefoil (*Potentilla fruticosa*): Shrubby cinquefoil is listed in Pennsylvania as an endangered species. It is a small perennial shrub that is generally found in bogs, fens, and near interdunal ponds, but it can be found in upland areas as well. Flowers are yellow, solitary or a few in a cluster, and approximately an inch across and appear in early summer (NRCS 2010b). Shrubby cinquefoil was observed during the 2010 and 2011 vegetation surveys along the alignment for alternatives 1, 2, and 2b (NPS 2011b). Suitable habitat for shrubby cinquefoil has been identified within the B-K Line ROW for alternatives 1, 2, and 2b (Mellon 2010a). In addition, PADCNr identified the presence of this species along the alignment for alternatives 1, 2, and 2b during consultation (PADCNr 2010a, 2).

Carolina Grass-of-Parnassus (*Parnassia glauca*): Carolina grass-of-Parnassus is listed in Pennsylvania as an endangered species. The Carolina grass-of-Parnassus is a wetland species, typically found in wet meadows throughout the northeastern United States from the Dakotas to Maine and up into Canada. It produces small, 1-inch-wide flowers from July to October (NRCS 2010b). Suitable habitat for Carolina grass-of-Parnassus has been identified within the B-K Line alignment for alternatives 1, 2, and 2b (Mellon 2010a). In addition, PADCNr identified the presence of this species along the alignment for alternatives 1, 2, and 2b during consultation (PADCNr 2010a, 2).

American Bittercress (*Cardamine rotundifolia*): American bittercress is listed in New Jersey as endangered, and it is also protected by the Highlands Protection and Planning Act. It is a small herbaceous plant (8 to 18 inches in height) with white flowers in a terminal cluster and elongated seed pods that are pointed at the apex. The basal leaves are kidney-shaped and each leaf exists on a long leaf petiole. American bittercress is found along cold springs, brooks, and wet, forested areas. NPS records have indicated that American bittercress has been documented near the alternative 3 alignment. Although American bittercress was not observed during vegetation surveys conducted in 2010 and 2011 (NPS 2011b), this special-status plant species does have the potential to be present within the corridor for alternative 3.

Shore Aster (*Aster tradescantii*): Shore aster is protected by the Highlands Protection and Planning Act. Shore aster is a perennial herbaceous plant in the aster family that often grows in clumps. Flower heads are white and relatively small and leaves are narrow. Shore aster inhabits damp, rocky, and gravelly shores, silt- or loam-filled cracks in rocky rapids of streams, or areas along freshwater estuaries. NPS records have indicated that the shore aster has been documented outside the study area along the alignment for alternative 3. Although the shore aster was not observed during vegetation surveys conducted in 2010 and 2011 (NPS 2011b), this special-status plant species does have the potential to be present within the corridor for alternative 3.

Pasture Rose (*Rosa virginiana*): Pasture rose (or Virginia rose) currently has an undetermined status and is a species that is believed to be in danger of decline in Pennsylvania. A native species, pasture rose is found in thickets and meadows, where it blooms from May to July (NRCS 2010b). Pasture rose was observed in Pennsylvania within the alignments of alternatives 1, 2, 2b, 4, and 5 during seasonal vegetation surveys conducted in 2010 and 2011 (NPS 2011b). Suitable habitat also exists along the alternative 3 alignment.

Swamp Dog-hobble (*Leucothoe racemosa*): Swamp dog-hobble is currently listed in Pennsylvania as tentatively undetermined, but is proposed for listing as a threatened species. Swamp dog-hobble is found mostly in coastal states from Massachusetts to Texas, inhabiting wetlands, swamps, and wet thickets. Flowers are white, bell-shaped, grouped clusters that appear in May or June. As of 2007, there were 30 documented populations in the state of Pennsylvania (PNHP 2010d). Although swamp dog-hobble was not observed during vegetation surveys (NPS 2011b), this special-status plant species does have the potential to be present along the alignments for alternatives 4 and 5 (PATNC 2005a, 131). In addition,

PADCNR identified the presence of this species along the alignments for alternatives 4 and 5 during consultation (PADCNR 2010a, 2).

American Holly (*Ilex opaca*): American holly is listed in Pennsylvania as threatened. This species is found west from Texas to Florida and north to Maine. It is easily distinguishable by its thick, alternating, evergreen leaves with sharp spines on the tip and margins. Small red berries appear on female plants after approximately 4 to 7 years of maturity. Although American holly is adapted to grow in a variety of site conditions, it grows best on well-drained, sandy soils. The plant will tolerate somewhat poorly drained soils but does not handle sea spray well (NRCS 2010b). Although American holly was not observed during vegetation surveys (NPS 2011b), according to agency consultation, this special-status plant species does have the potential to be present along the alignments for alternatives 4 and 5 (PATNC 2005a, 131), and PADCNR identified the presence of this species along the alignments for alternatives 4 and 5 (PADCNR 2010a, 2).

Susquehanna Sand Cherry (*Prunus pumila* var. *susquehannae*): Susquehanna sand cherry is currently not listed in Pennsylvania, but is proposed for listing as a threatened species; it is also protected by the Highlands Protection and Planning Act. Susquehanna sand cherry grows in dry, sandy soils. This species blooms with white, conspicuous flowers (NRCS 2010b). Susquehanna sand cherry was not observed during vegetation surveys conducted in 2010 and 2011 (NPS 2011b). During agency consultation, this special-status plant species was identified as having the potential to be present along the alignments for alternative 4 and 5 (PATNC 2005a, 131), and PADCNR identified this species as present along the alignments for alternatives 4 and 5 (PADCNR 2010a, 2).

Prickly-pear Cactus (*Opuntia humifusa*): Prickly-pear cactus is widely distributed across North America, but it is listed in Pennsylvania as a rare species. Prickly-pear cactus can flourish under a great range of conditions, including elevation, moisture regime, and soil type (Taylor 2005). This cactus is known to be present at Shoemakers Barren, which is considered a regionally rare community and is discussed in more detail in the “Rare and Unique Communities” section of this chapter. The alignment for alternatives 1, 2, and 2b would pass approximately 475 feet west of the acidic rocky summit community known as Shoemakers Barren. Due to the distance of this site from the study area, the site is not anticipated to be affected by the proposed project and prickly-pear cactus is not discussed further under alternatives 1, 2, or 2b. However, PADCNR has suggested that the prickly-pear cactus has the potential to be present within the alignment for alternative 3, although neither this plant nor potential habitat within the corridor was observed during the vegetation surveys conducted in 2010 and 2011 (NPS 2011b).

Small-whorled Pogonia (*Isotria medeoloides*): The small-whorled pogonia is listed as federally threatened, as well as state-listed by Pennsylvania as endangered. This species, a member of the orchid family (*Orchidaceae*), is sparse but widely distributed, with a range extending from southern Maine and New Hampshire to northern Georgia and southeastern Tennessee. The small-whorled pogonia occurs on upland sites in mixed deciduous or mixed deciduous/coniferous forests that are generally second- or third-growth successional stages. Habitat characteristics include sparse to moderate ground cover, relatively open understory, and proximity to features that create long-persisting breaks in forest canopy (USFWS 1992, 1). Deer browsing, fragmentation, and possibly alterations in soil moisture were identified as threats to the small-whorled pogonia. Species within the northern range emerge from leaf litter in May and flower in June. An individual plant may stay in flower from 4 days to nearly 2 weeks (USFWS 1992, 20). Small-whorled pogonia was not observed during any of the field surveys (NPS 2011b; Mellon 2010a) and there are no records of this species occurring within the study area for this project. Because small-whorled pogonia was not observed within the alignment for any of the alternatives and there are no records of occurrence, this plant species was dismissed from further analysis.

Swamp Pink (*Helonias bullata*): Swamp pink is a federally threatened species and is state-listed by New Jersey as endangered, which is also protected by the Highlands Protection and Planning Act. Swamp pink is a perennial herbaceous plant with a small pink flower and oblong, dark-green leaves; the evergreen leaves of swamp pink can be seen year-round, and flowering occurs between March and May (USFWS 2011b). Swamp pink is a wetland plant species and occurs in a variety of palustrine forested wetlands, including swampy forested wetlands bordering meandering streamlets, headwater wetlands, sphagnum Atlantic white-cedar swamps, and spring seepage areas (USFWS 2011b). The primary threats to swamp pink are the indirect effects of off-site activities and development, such as pollution, introduction of invasive species, and subtle changes in groundwater and surface water hydrology (USFWS 2011b). The USFWS, New Jersey Field Office, responded in an October 21, 2010, letter that a survey should be conducted to document the presence or absence of swamp pink in all forested wetlands along alternatives that have since been dismissed (USFWS 2010b, 4). Therefore, this plant species is not discussed in further analysis.

Outside the study area, the proposed S-R Line could pass through Carbon, Lackawanna, Luzerne, Monroe, Pike, Northampton, and Wayne counties in Pennsylvania and Warren, Sussex, and Morris counties in New Jersey. The special-status plant species that have been listed by consulting agencies as having the potential to be present within the proposed alternative alignments could be present in these counties if the appropriate habitat exists. In addition, any of the species listed in table 20 could be found in these counties, provided the proper habitat exists.

RARE AND UNIQUE COMMUNITIES

A rare or unique community is a subset of an ecosystem that is recognized for its contribution to biological diversity—locally, regionally, or globally. Rare or unique communities include sites identified by the DEWA general management plan (GMP) (NPS 1987), county natural areas inventories, and state natural heritage programs. Often, the physical characteristics of an area create a specific set of unusual conditions that foster rare or unique communities. The geology, hydrology, and soil conditions of a site can determine the vegetation that grows there, which in turn influences the wildlife that use the habitat. Because these conditions create microclimates with unusual conditions, these communities are often globally or state ranked for rarity. Rare and unique communities often contain a high number of rare, threatened, or endangered species, because these species are adapted to thrive in the specific conditions found in the communities. Because of the rarity of such areas and the higher number of species of special status they often harbor, rare and unique communities should be considered in a holistic manner, rather than by looking at the importance of the geology, vegetation, or wildlife alone. Nearly half of the 69 vegetation associations within DEWA can be considered state or globally rare or unique. The state and global importance of some of these areas has led to them being classified as natural heritage areas. Additionally, several rare and unique communities within DEWA have been identified as outstanding natural features due to their unique ecological values. Communities given this designation receive the highest level of protection and preservation efforts. These sites are open for visitor use, but this use may be limited to protect these areas from degradation. Development, such as trails, interpretive waysides, exhibits, and parking areas, is kept to a minimum in areas of outstanding natural features (NPS 1987, 18).

The rare and unique communities that are present or have the potential to be found within the study area for the S-R Line are presented in table 21 and are described in the following sections.

TABLE 20: SPECIAL-STATUS PLANT SPECIES ANALYSIS BY ALTERNATIVE WITHIN THE STUDY AREA

| Special-status Species | Alternatives | | | | | |
|-----------------------------|--------------|---|----|---|---|---|
| | 1 | 2 | 2b | 3 | 4 | 5 |
| Plant Species | | | | | | |
| Netted chainfern | — | — | — | X | — | — |
| Clinton's woodfern | X | X | X | — | — | — |
| Stiff club moss | X | X | X | X | X | X |
| A-sedge | X | X | X | — | — | — |
| Reed meadowgrass | X | X | X | — | — | — |
| Small-headed rush | X | X | X | — | — | — |
| Bog goldenrod | X | X | X | — | — | — |
| White heath aster | X | X | X | — | — | — |
| Brook lobelia | X | X | X | — | — | — |
| Marsh bedstraw | X | X | X | X | X | X |
| Downy willow-herb | X | X | X | — | — | — |
| Shrubby cinquefoil | X | X | X | — | — | — |
| Carolina grass-of-Parnassus | X | X | X | — | — | — |
| American bittercress | — | — | — | X | — | — |
| Shore aster | — | — | — | X | — | — |
| Pasture rose | X | X | X | X | X | X |
| Swamp dog-hobble | — | — | — | — | X | X |
| American holly | — | — | — | — | X | X |
| Susquehanna sand cherry | — | — | — | — | X | X |
| Prickly-pear cactus | — | — | — | X | — | — |

X = species is known to be present or has potential to be found based on presence of habitat.

— = species is not likely to be present based on absence of habitat.

TABLE 21: RARE AND UNIQUE COMMUNITIES PRESENT WITHIN THE STUDY AREA

| Community | Global Rank | NJ Rank | PA Rank | Alternatives | | | | | |
|---|-------------------------------------|----------------|-------------------------|--------------|---|----|---|---|---|
| | | | | 1 | 2 | 2b | 3 | 4 | 5 |
| Arnott Fen ^a | Imperiled to critically imperiled | — | Critically imperiled | X | X | X | | | |
| Hogback Ridge ^a | — | — | — | X | X | X | | | |
| Hemlock Forests | | | | | | | | | |
| Eastern hemlock forest | Secure | Not ranked | Apparently secure | X | X | X | | X | |
| Eastern white pine forest | Secure | Not ranked | Apparently secure | X | X | X | | | |
| Eastern hemlock/northern hardwood forest | Apparently secure (?) | Vulnerable | Apparently secure | X | X | X | X | | |
| Dry eastern hemlock/oak forest | Apparently secure to vulnerable (?) | Not ranked | Apparently secure | X | X | X | X | | |
| Lichens | — | — | — | X | X | X | X | X | X |
| Riparian Corridors | | | | | | | | | |
| Delaware River riparian corridor ^a | — | — | — | X | X | X | X | | |
| Van Campen Brook riparian area | — | — | — | X | X | X | | | |
| Kittatinny Ridge ^a | — | — | — | X | X | X | X | X | X |
| Talus Slopes | | | | | | | | | |
| Sandstone talus | Apparently secure | Vulnerable | Vulnerable | X | X | X | X | | |
| Oak/birch talus | Apparently secure to vulnerable | Vulnerable (?) | Vulnerable | X | X | X | X | X | X |
| Natural Heritage Sites | | | | | | | | | |
| Totts Gap and Totts Gap Swamp | — | — | — | | | | | X | X |
| Bear Swamp | Unknown | — | Imperiled to vulnerable | | | | | X | X |
| Minsi Lake vernal pools | Unknown | — | Vulnerable | | | | | | |

a. Indicates an outstanding natural feature.

— = Community not ranked, or not found in state.

Ranking Definitions: **Critically imperiled:** At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

Imperiled: At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

Vulnerable: At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

Apparently secure: Uncommon but not rare; some cause for long-term concern due to declines or other factors.

Secure: Common; widespread and abundant.

Not ranked: Conservation status not yet assessed.

Unknown: Possibly in peril range-wide but status uncertain; need more information.

CALCAREOUS WETLANDS

DEWA contains a number of calcareous wetland communities, including seeps and fens. These wetlands typically have a very limited geographic range and a unique combination of plant species, thereby gaining recognition for their global rarity. A fen is a nutrient-rich marshy area associated with limestone and calcareous siltstone where calcareous groundwater discharges to the surface. The soils of a calcareous fen vary from silt loams to shallow mucky peat. Generally, such wetlands have little cover, contain mainly grasses or shrubby vegetation, and include plant species such as silky dogwood, poison sumac (*Toxicodendron vernix*), shrubby cinquefoil, and steeplebush. Several calciphytic (calcium-loving) plant species, including Ontario lobelia (*Lobelia kalmii*) and rigid sedge, grow in the herbaceous layer (NPS 2007b, 313–315). Six rare plant species have been identified within the calcareous wetlands of DEWA. Additionally, 29 taxa of lichens have been found in this habitat type in the park (TNC 2000, 9).

Arnott Fen: Arnott Fen is a calcareous wetland close to Bushkill, Pennsylvania. A calcareous fen arises out of the unique geological conditions that foster a unique biological community. Calcareous fens form in areas with limestone bedrock. The geologic formation underlying Arnott Fen is Buttermilk Falls Limestone through Esopus formation, undivided. This includes four formations; Buttermilk Falls Limestone, Palmerton Sandstone, Schoharie, and Esopus formations. The Schoharie Formation is calcareous, with a significant portion of the interstitial material containing calcium carbonate (PADCNr 2009, 15, 17–18).

Calcareous groundwater is discharged at Arnott Fen as a result of the calcareous geologic formations, which support calciphytic vegetation. A calcareous fen like Arnott Fen can only be found on areas of highly calcareous rock, which is necessary to provide the calcium needed to support calciphytic vegetation (Mellon 2010a, 11). Generally, calcareous wetlands are grassy or shrubby, with little cover. Sedges are often a prominent vegetation type. Arnott Fen is classified as a poison sumac/red-cedar/bayberry fen. This community type exists in areas with base-rich water, often with a pH ranging from 7.0 to 8.1, and usually contains a rich organic layer (Fike 1999, 42). This plant community is considered globally imperiled, ranked as G1G2, and is the only community of its kind in Pennsylvania (NPS 2009g, 4). The unusual conditions present support six known Pennsylvania special-status plant species and one plant that is a proposed threatened species for Pennsylvania but is not yet listed (NPS 1983a, 43). Within DEWA, 29 taxa of lichens have also been found in this habitat type (TNC 2000, 9). These rare plant communities support rare wildlife species that depend on the hydrologic conditions found at Arnott Fen and the surrounding wetland complex. The fen with surrounding wetlands and forest compose a unique ecosystem that supports diverse breeding bird, reptile, and amphibian populations, including species of conservation concern.

The larger wetland that encompasses Arnott Fen has been altered by beaver and human activity. Since the initial discovery of special-status species in the fen, beaver activity has altered water levels, flooding much of the area for several years. Remnant dams are still present and functioning in some parts of the wetland complex. In other areas, woody species are encroaching and succession has become a concern. Historical impacts on the wetland from beaver and humans have not been documented, nor have the changes been compared over time. The threat of encroachment of shrubby species and saplings may also affect the wetland and fen (TNC 2000, 1).

OUTSTANDING NATURAL FEATURES

An outstanding natural feature is defined in the DEWA GMP as one that has a high intrinsic or unique value. The NPS-identified outstanding natural features are open for visitor use; however, these areas are also managed to prevent degradation (NPS 1987, 18).

Hogback Ridge: A hogback ridge is a bedrock ridge with steep sides. The geology of Hogback Ridge is Devonian Buttermilk Falls Limestone (NPS 1983a, 4). The ridge runs roughly northeast to southwest in DEWA and drops off steeply on the southeastern side. The northern slope of the ridge contains eastern hemlock/northern hardwood forests, as well as extensive wetland areas.

Hogback Ridge is important to the conservation of biodiversity in Pennsylvania (PATNC 1991a, 14–25). The Hogback Ridge is an outstanding natural feature in the park, and its hemlock forest, which is a rare community type in DEWA, contributes significantly to the biological diversity of the state and county (NPS 1987, 18; PATNC 1991a, 14–25). A unique community type in DEWA, the hemlock forest is dominated by eastern hemlock in the canopy, with sweet birch (*Betula lenta*) and sugar maple as codominant canopy species (NPS 2009g, 4). Canopy cover is thick—generally more than 70%. The dense cover of the canopy creates a densely shaded understory. This lowers air and water temperatures in these forests, as well as providing specific habitat and soil nutrients for a host of species. Many species rely on the conditions found in these forests. The eastern hemlock/northern hardwood forest along Hogback Ridge also supports several species of native wildflowers and rare plants (NPS 2009g, 4). It also holds an abundance of lichen species and is an area where new species are currently being discovered (Harris and Lendemer 2005, 4–6; 2006, 69–71).

A few bird species are hemlock specialists, meaning that they require a limited set of conditions found within hemlock forests for survival, and can be found exclusively in hemlock stands such as the stand on Hogback Ridge. Hemlock-specialist bird species include the black-throated green warbler, blue-headed vireo (*Vireo solitarius*), and northern goshawk. The red shouldered hawk, barred owl, Acadian flycatcher, winter wren (*Troglodytes troglodytes*), and hermit thrush (*Catharus guttatus*) are also highly associated with hemlock ecosystems (Ross et al. 2004, 4). Pennsylvania state-threatened bald eagles are known to roost in trees on the ridge with easy access to foraging points along the Delaware River. Several bird species of concern also nest in the area (NPS 2009f, 4). These species are not common breeders in DEWA.

The cooler and darker conditions found in hemlock forests such as those found along the northern side of Hogback Ridge support a higher abundance of aquatic species as well. Brook trout and benthic invertebrates are often found in greater numbers in streams under hemlock stands (USGS 2003, 2.17, 3.3). The large forest block provided by Hogback Ridge has benefits for forest-interior species. The conditions found in the eastern hemlock/northern hardwood forest also support many of the reptile and amphibian species found in DEWA (NPS 2009f, 4).

Hogback Ridge contains several wetland areas along higher elevations (500–600 feet AMSL) that run between limestone ridges. Although many of these wetlands have been affected by beaver activity, a small population of a proposed Pennsylvania state-threatened reptile species was observed at the edge of one of the linear wetlands on Hogback Ridge. The wetlands on Hogback Ridge also support special status plants, and the beavers have created habitat for the great blue heron and red-headed woodpeckers, two uncommon breeders in DEWA.

HEMLOCK FORESTS

Eastern hemlocks are found within four forest types within the study area: eastern hemlock forest, eastern hemlock/northern hardwood forest, dry eastern hemlock/oak forest, and eastern white pine forest. Hemlock forests provide densely shaded areas that aid in lowering surrounding air and water temperatures, provide habitat structure, and affect soil nutrients, providing important habitat for several plant, animal, and insect species. Several bird species are found exclusively in hemlock stands (black-throated green warbler, blue-headed vireo, and northern goshawk) or are highly associated with them (red-shouldered hawk, barred owl, Acadian flycatcher, winter wren, and hermit thrush) (Ross et al. 2004,

4). In riparian areas, the streams associated with hemlock stands generally contain more taxa than those with hardwood forest associations. Fish, such as brook trout, and many benthic invertebrates are found in greater abundance in streams underneath hemlock stands (USGS 2003, 2.17, 3.3). Aquatic diversity is predicted to decline with the loss of hemlock forests based on a study in DEWA (Snyder et al. n.d., i–ii). Hemlock forests are threatened by the spread of the hemlock woolly adelgid, which is discussed in the “Invasive Wildlife Species” section of this chapter.

Eastern Hemlock Forest: Eastern hemlock forests are found in dry–mesic conditions on steep slopes throughout the DEWA. These forests are dominated by eastern hemlocks or eastern white pine and grow in rocky soils. The understory is sparse and could include American witch-hazel, mountain laurel, and lowbush blueberry; the herbaceous layer is also sparse and species could include Indian cucumber and New York fern.

Eastern White Pine Forest: Eastern white pine forests are similar to eastern hemlock forests, with the exception of the abundance of eastern hemlocks in the canopy. In eastern hemlock forests, hemlocks constitute approximately 50% to 90% of the canopy, whereas only 50% or less of the canopy of eastern white pine forests consists of eastern hemlocks (NPS 2007b, 9–12, 15–18).

Eastern Hemlock/Northern Hardwood Forest: Eastern hemlock/northern hardwood forests are found in acidic soils on steep ravines and along north-facing lower slopes throughout DEWA. Eastern hemlocks make up 25% to 50% of the canopy of these forests, with sweet birch and sugar maple as codominant species. The bedrock that underlies eastern hemlock/northern hardwood forests varies from shale to calcareous shale and limestone. The shrub layer in these forests ranges from open to dense, while the herbaceous layer is usually sparse (NPS 2007b, 173–175).

Dry Eastern Hemlock/Oak Forest: The canopy of dry eastern hemlock/oak forests is codominated by eastern hemlock and oaks, predominantly chestnut oak. Eastern hemlocks compose more than 25% of the canopy. This forest type is found on shale, sandstone, siltstone, and limestone bedrock in extremely stony soils. Both the shrub and herbaceous layers are sparse. Dry eastern hemlock/oak forests are found on steep northeastern to northwestern exposures in DEWA.

LICHENS

Lichens are often used for natural resource assessment because they are responsive to environmental stressors in forests, such as habitat alteration and pollution (Lichen.com 2001). The Forest Inventory and Analysis Program of the U.S. Forest Service monitors lichen communities throughout the United States to evaluate biodiversity, air quality, and climate (USFS 2008, 4–7). Lichens provide food for animals such as deer and provide nesting materials for small mammals and birds. DEWA is considered one of the most diverse areas in the United States for lichen flora (Harris and Lendemer 2006, 75) and supports over 320 species of lichens (NPLichen 2010).

RIPARIAN CORRIDORS

Riparian corridors are vegetated areas that grow along streams, lakes, rivers, wetlands, and bays. Riparian corridors naturally consist of trees and grasses, and are predominately forested in the study area. These corridors protect water resources by removing contaminants from runoff water and providing habitat for riparian and aquatic organisms (Gilliam, Osmond, and Evans 1997).

Delaware River Riparian Corridor: The north-to-south orientation of the Delaware River riparian corridor provides crucial habitat for migratory bird species, particularly migratory songbirds, waterfowl, and wading bird species. The bottomlands associated with this riparian corridor provide important habitat

for breeding and foraging for many bird species, including songbirds, raptors, and waterfowl (NPS 2009g, 5).

Van Campen Brook Riparian Area: Van Campen Brook and wetland complex is a high-value aquatic area on the New Jersey side of DEWA, off County Road 606. The brook itself is categorized as a category one stream, which is afforded the highest level of state water protection (NPS 2009c, 4). Category one streams are defined by the NJDEP as waters protected from any measureable changes in water quality because of their exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resources. The waters of Van Campen Brook and wetland complex support several aquatic species and are considered trout-producing for the native brook trout. The aquatic areas of the Van Campen Brook and associated wetlands are also important suitable habitat for many listed amphibian and trout species.

Within the Van Campen Brook area, Van Campen Glen is a steep hemlock ravine with a popular hiking trail. The ravine runs along Van Campen Brook, on the western side of Kittatinny Mountain, and the glen is an outstanding natural feature of DEWA that contributes to the uniqueness of the Van Campen Brook riparian corridor. A species of filmy fern found within the glen represents the only known population of this species in New Jersey. This species is found in deep recesses of crevices of the rocky sides of the ravine (NPS 1986, 125). The location of this species is such that it would not be affected by activities in the B-K Line ROW.

In the ROW near the Watergate Recreation Site, the floodplain of Van Campen Brook is generally dominated by hairyfruit sedge. This species is often associated with high pH soils. Other species found in this area include blue vervain (*Verbena hastata*), arrow-leaved tearthumb, woolgrass, giant goldenrod (*Solidago gigantea*), soft rush (*Juncus effusus*), rough-leaved goldenrod (*Solidago rugosa*), monkeyflower (*Mimulus rigens*), and mild water pepper (*Polygonum hydropiperoides*) (Mellon 2010a, 11).

Wetland areas along the B-K Line ROW near the Van Campen Brook wetland complex and Watergate Recreation Site include seepage wetlands and old ponds. These wetland areas were found to have a high diversity and abundance of plant species. Plants found included marsh fern (*Thelypteris palustris*), sensitive fern, yellow birch, Morrow's honeysuckle, autumn olive, and multiflora rose, among many others.

MIGRATORY BIRD FLYWAYS

Birds migrate between breeding and wintering locations in order to benefit from the ability to inhabit two different areas during seasons when each region provides favorable conditions (Lincoln, Peterson, and Zimmerman 1998, 13). Flyways generally contain several primary migration routes, many important tributaries, and suitable resting and feeding habitats where birds can stop during migration (Boere and Stroud 2006, 40). There are four major migratory flyways in North America: the Atlantic, Mississippi, Central, and Pacific flyways. The Atlantic Flyway spans more than 3,000 miles and stretches from the Arctic Tundra to the Caribbean (Kramer 2006, 1). The states that lie within the Atlantic Flyway in the United States are home to over 500 species of birds and contain a variety of habitats, including forests, coastal habitats, and wetlands. Kittatinny Ridge, DEWA, and APPA are within the Atlantic Flyway. The Delaware River is also a part of the Atlantic flyway, and provides important migratory habitat for waterfowl.

Kittatinny Ridge: Kittatinny Ridge (Blue Mountain in Pennsylvania and Kittatinny Mountain in New Jersey) runs through DEWA in both Pennsylvania and New Jersey. Within Kittatinny Ridge, Kittatinny Mountain is a priority site for the protection of New Jersey biodiversity (NPS 2009c, 3). Kittatinny Ridge supports a vast diversity of plant communities and wildlife, including endangered species, along its length. Kittatinny Ridge is identified as a priority site by the New Jersey Natural Heritage Program (NJNHP). It is also identified as an IBA by the Audubon Society in both Pennsylvania and New Jersey and a petition has been submitted to designate the ridge as a national raptor migration corridor (Audubon PA 1999b; NJ Audubon 2010d; Heintzelman 2009).

With its north–south orientation, Kittatinny Ridge is a globally significant fall migration corridor used by many thousands of raptors every year. Audubon Pennsylvania has named Kittatinny Ridge as the largest of the state’s IBAs (Audubon PA 2006, 7). The unique geology of the ridge results in the creation of wind currents that raptors and other species use to migrate. It is estimated that between 14,000 and 20,000 hawks and other raptors migrate through Kittatinny Ridge yearly (Heintzelman 2009, i). Aside from the benefits of the wind currents, the forested habitats along Kittatinny Ridge provide breeding, resting, and foraging areas for bird species. Information on the use of the ridge by bird species and the IBAs along Kittatinny Ridge is outlined in the “Migratory Birds” section of this chapter.

Other wildlife species can be found in the diversity of habitats along the ridge. The woodlands along Kittatinny Ridge provide critical, high quality interior-forest habitat for 143 breeding bird species, 55 fish species, 49 species of amphibians/reptiles, 83 butterfly species, 78 dragonfly/damselfly species, 292 woody plant species, 19 plant communities, and 33 mammal species (TNC 2009). The Kittatinny Ridge talus slopes, hemlock ravines, and conifer and hardwood swamps support a rare ecosystem within the parks. The varied habitats along Kittatinny Ridge provide habitat for many endangered or rare wildlife, including raptors, mammals, amphibians, and reptiles (NPS 2009c, 3). In addition, high-elevation ponds within Kittatinny Ridge provide important breeding habitat for dragonflies and damselflies (Shreiner 2008, 11).

TALUS SLOPES

Talus describes an area with large, boulder-like rocks found at the bottom of steep slopes, usually resulting from slides or rockfalls from unstable cliffs. The soils in this type of community are thin and dry. The vegetation grows on the face of the rock rubble or in the weakly developed soils between the rock fragments on steep slopes. With little soil in the field of boulders, talus areas are generally sparsely vegetated and moderately unstable. Within DEWA, talus slope communities are found along Kittatinny Ridge. Kittatinny Ridge maintains two unusual vegetation associations in Kittatinny talus.

Sandstone Talus: Sandstone talus is found on the steep southern and southeastern slopes of the Kittatinny Ridge in coarse, sandstone-based talus. Lichen cover is common on the boulders. Vegetation cover in sandstone talus ranges from 0% to 50% cover and is dominated by drought-resistant species such as sweet birch and chestnut oak. Other plant species common to this type of habitat include oak and hickory species, mountain laurel, poison ivy, and summer grape. The height of the canopy species ranges from 16.4 to 65.6 feet (5 to 20 meters). The shrub layer is usually sparse and the herbaceous layer is usually sparse to absent (NPS 2007b, 343–345).

Oak/Birch Talus Forest: In areas where vegetation cover is greater than 50% on talus slopes, the vegetation is considered oak/birch talus forest. Oak/birch talus forests can be found on the southeastern-facing parts of the Kittatinny Ridge, where the sandstone boulders are large and coarse with only small amounts of soil rock crevices. Oak/birch talus forests differ from sandstone talus in that the canopy cover ranges from 50% to 80% and the height of the canopy could reach 49.2 to 98.4 feet (15 to 30 meters). The dominant canopy cover is black birch, particularly in the less stable areas of the talus, although chestnut oak is also characteristic in the canopy. Other oaks, hickory, and two pine species, white pine and pitch pine, are also occasionally found in the canopy. Shrub species include American witch-hazel and mountain laurel, with early lowbush blueberry and other berry species in the shorter shrub layer. Poison ivy, Virginia creeper, and other vines grow on the boulders; however, the herbaceous layer tends to be barren (NPS 2007b, 197–199).

NATURAL HERITAGE SITES

Natural heritage sites are areas identified by PNHPs and NJNHPs as being significant natural areas that support species of special concern, exemplary natural communities, or larger areas supportive of the biodiversity of native species within the state. Inventories of these sites have helped to provide information on special-status species and natural communities threatened by extinction on a local or global level, and have helped to develop management and protection guidelines for these sites.

Acidic Broadleaf Swamps

Acidic broadleaf swamps are characterized by a tall shrub layer of highbush blueberry, with associate species of swamp azalea, red maple, and maleberry. The canopy is sparse, with a cover of less than 10%. Canopy species could include pitch pine, red maple, and black spruce. These communities are bog-like and the vegetation grows on organic soils, often on a floating mat (NPS 2007b, 251–254).

Totts Gap Swamp: The Totts Gap Natural Heritage Site is composed of Totts Gap and Totts Gap Swamp, both ranked as 5 in Northampton County, indicating that the two sites are the lowest priority for protection (PATNC 2005a, 43). Totts Gap Swamp is an acidic broadleaf swamp. The canopy is dominated by black gum, red maple, and yellow birch, with a fairly open canopy. The understory is dense, and dominated by great laurel, spicebush, winterberry, and highbush blueberry. The swamp is known to contain a Pennsylvania proposed threatened plant species, which is found along the edge of the swamp (PATNC 2005a, 131).

Rocky Summit Outcrops

Rocky summit outcrop communities are dominated by low shrubs with grasses, sedges, and a few herbaceous species forming a secondary component. These communities are open areas found on rocky summits of hills and mountains where bedrock is exposed, where vegetation is confined to cracks in the rocks or to areas of shallow soil between the rock outcrops. Vegetation in these communities can include scrub oak, blueberry varieties, pitch pine, and oaks (Commonwealth of Massachusetts [Commonwealth of MA] 2007, 1–2).

Totts Gap: The Totts Gap Natural Heritage Site is composed of Totts Gap and Totts Gap Swamp, both ranked as 5 in Northampton County, indicating that the two sites are the lowest priority for protection (PATNC 2005a, 43). The vegetation along the ridge of Totts Gap is generally shrubby in rocky summit outcrop areas, which are xeric in nature. These outcroppings are dominated by scrub oak, blueberry, black huckleberry, and black chokeberry. Interspersed within the shrubby vegetation, a few pitch pines can be found. The herbaceous layer includes hairgrass, little bluestem, and dewberry. Populations of a

Pennsylvania state-threatened plant species and a proposed Pennsylvania state-threatened plant species can be found within Totts Gap (PATNC 2005a, 131).

Circumneutral Broadleaf Swamps

Circumneutral broadleaf swamps are also known as buttonbush wetlands. These wetlands experience prolonged or semipermanent flooding throughout most of the growing season. The wet areas are dominated by buttonbush (*Cephalanthus occidentalis*). Other shrub species could include highbush blueberry, silky dogwood, and red maple seedlings. The tree canopy may reach 25% coverage and canopy species could include sugar maple and pin oak (NPS 2007b, 247–250).

Bear Swamp: Bear Swamp is part of the Minsi Lake Corridor, which also contains Minsi Lake vernal pools. This corridor represents a collection of forestlands and other natural areas that link and protect valuable wildlife habitat spanning several thousand acres. Bear Swamp is a circumneutral broadleaf swamp natural community that lies in two separate lobes along two separate tributaries of Martins Creek and occupies approximately 200 acres (PATNC 2005a, 31).

Ephemeral/Fluctuating Natural Pools

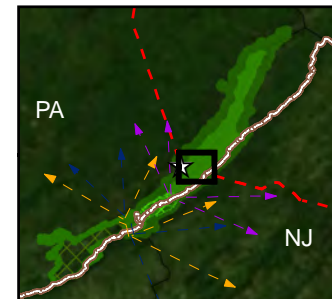
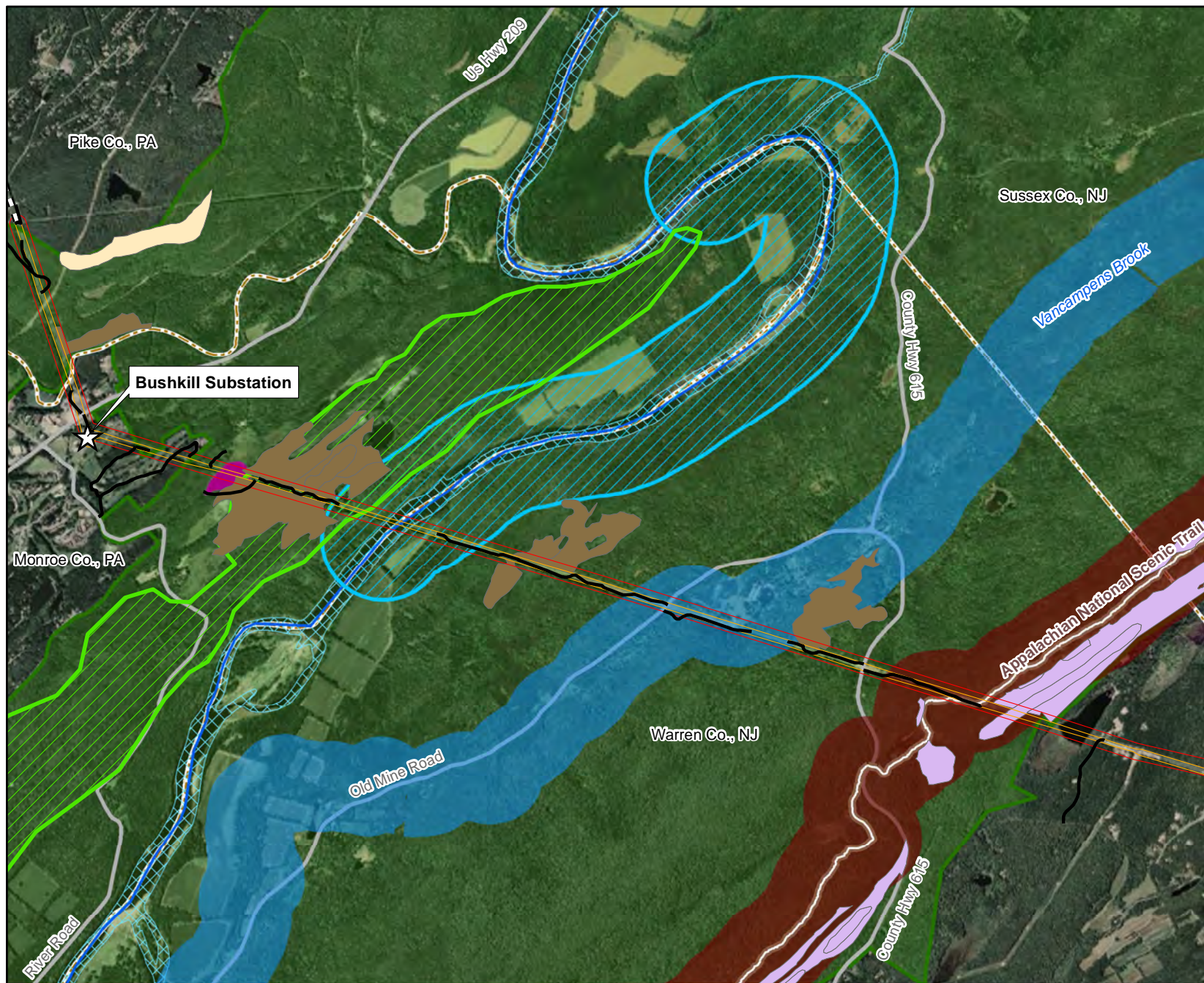
Vernal pools or ephemeral/fluctuating wetlands are natural wet areas that contain water during fall, winter, and spring months, but dry out during the summer due to evaporation. Because of the absence of water in the summer, these pools do not support fish species, but they do provide important breeding grounds for a number of amphibian species. Several special-status salamanders rely on ephemeral wetlands for metamorphosis from larva to adult (Indiana University–Purdue University Fort Wayne 2011, 1–2).

Minsi Lake Vernal Pools: The Minsi Lake vernal pools, together with Bear Swamp (described above), compose the Minsi Lake Corridor. The vernal pools contain a collection of more than 100 ponds of varying sizes scattered throughout several hundred acres of dry–mesic forest, as well as several streams and springs (PATNC 2005a, 128). The varied habitats of the Minsi Lake Corridor support a wide range of both plant and animal species, including those that are adapted to a dry phase, as the vernal pools dry up each fall (TNC 2011a). These varying wet areas support diverse plant species and create excellent breeding habitat for amphibians, including marbled and spotted salamanders. The Minsi Lake Corridor contains one of the largest collections of vernal pools in Pennsylvania (TNC 2011b). Additionally, the Minsi Lake vernal pools combined with Bear Swamp include some of the most extensive forests remaining within Northampton County, Pennsylvania, and could be used by forest-interior breeding species such as the cerulean warbler (PATNC 2005a, 128).

Alternative 1 (No Action), Alternative 2, and Alternative 2b

The alignment for alternatives 1, 2, and 2b would intersect three park-managed outstanding natural features (Arnott Fen, Hogback Ridge, and Kittatinny Ridge), and five rare and unique vegetation communities (Delaware River riparian corridor, hemlock forests, lichens, talus slopes, and Van Campen Brook riparian area) (table 21; figures 43 and 44).

The alignment for alternatives 1, 2, and 2b would pass directly through Arnott Fen and would bisect Hogback Ridge; these two communities are only present within the alignment for alternatives 1, 2, and 2b.



Legend

- ☆ Substation
- = = Outside Study Area
- Existing ROW in Study Area
- 350 ft Corridor
- Appalachian National Scenic Trail
- Delaware River
- Road
- Delaware Water Gap National Recreation Area
- Middle Delaware National Scenic and Recreational River
- County Line
- Rare and Unique Communities
 - Arnott Fen
 - Delaware River Riparian Corridor
 - Eastern Hemlock Forests
 - Hogback Ridge Woodlands
 - Kittatinny Ridge
 - Shoemakers Barren Natural Heritage Site
 - Talus Slopes
 - Vancampens Brook



Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

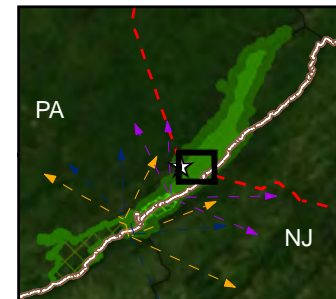
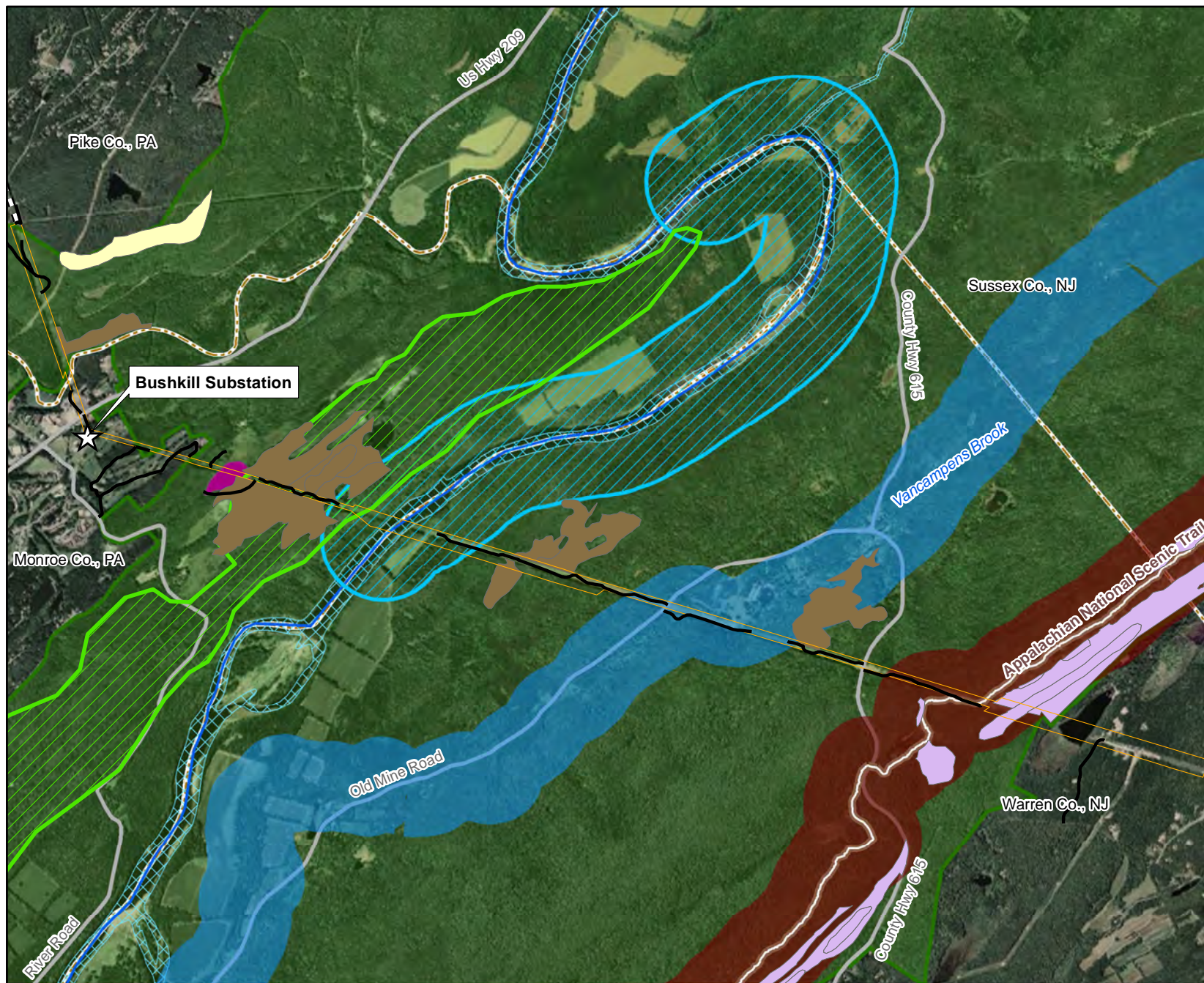
Figure 43
Alternative 2 Rare and Unique Communities

Source: ESRI Streetmap 2006, Penn State 2010,
ESRI ArcGISonline Map Service 2010,
PennDOT 2011, USGS 2006,
NJ DEP 2008

Projection: NAD 83 UTM Zone 18N
Date: October, 2011



0 1,500 3,000
Feet



Legend

- ☆ Substation
- = = Outside Study Area
- Alternative 2b Corridor
- Appalachian National Scenic Trail
- Delaware River
- Road
- Delaware Water Gap National Recreation Area
- Middle Delaware National Scenic and Recreational River
- County Line
- Rare and Unique Communities
 - Arnott Fen
 - Delaware River Riparian Corridor
 - Eastern Hemlock Forests
 - Hogback Ridge Woodlands
 - Kittatinny Ridge
 - Shoemakers Barren Natural Heritage Site
 - Talus Slopes
 - Vancampens Brook



Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

Figure 44
Alternative 2b Rare and Unique Communities

Source: ESRI Streetmap 2006, Penn State 2010,
ESRI ArcGISonline Map Service 2010,
PennDOT 2011, USGS 2006,
NJ DEP 2008

Projection: NAD 83 UTM Zone 18N
Date: July 2012



0 1,500 3,000
Feet

Four hemlock forest types are found along alternatives 1, 2, and 2b: eastern hemlock forests, eastern hemlock/northern hardwood forests, dry eastern hemlock/oak forests, and eastern white pine forests. Hogback Ridge is composed mostly of eastern hemlock/northern hardwood forests and also contains dry oak/eastern hemlock forests. Eastern hemlock/northern hardwood forests are found within the Van Campen Brook riparian area in New Jersey. Eastern hemlock/northern hardwood forests and eastern white pine forests are found in an undisturbed area between the Upper and Lower Hamilton Trails. The eastern hemlock forest type is found north of the Bushkill Substation along the banks of Big Bushkill Creek.

Lichens are found throughout the alignment for alternatives 1, 2, and 2b. In a 2005 survey of the lichens in the Pennsylvania side of DEWA, 209 species were collected (Harris and Lendemer 2005, 1). Of these, 133 species were collected from two locations on Hogback Ridge. On a follow-up survey a year later, the survey sites were revisited and 35 new species were collected at one site and 89 new species were collected at the second (Harris and Lendemer 2006, 69–75). Several of the species collected during these surveys were new to science and new to North America (Harris and Lendemer 2005, 1).

The alignment for alternatives 1, 2, and 2b would cross Van Campen Brook and Delaware River riparian corridors. This alignment is the only one that would run along Van Campen Brook and cross it. The Delaware River riparian corridor supports bald eagles, providing foraging, nesting, and roosting habitat. The alignment runs between a communal bald eagle roost and foraging habitat. During the winter, the riparian corridor is used by bald eagles for foraging, because the river provides open water that is free from ice (NPS 2009g, 5).

The alignment for alternatives 1, 2, and 2b would cross Kittatinny Ridge, which contains both sandstone talus and oak/birch talus. The sandstone talus plant community is found on the steep southern and southeastern slopes of the Kittatinny Ridge in coarse, sandstone-based talus. Oak/birch talus can be found on the southeastern-facing parts of the Kittatinny talus, where the sandstone boulders are large and coarse with only small amounts of soil rock crevices (NPS 2007b, 197).

Alternative 3

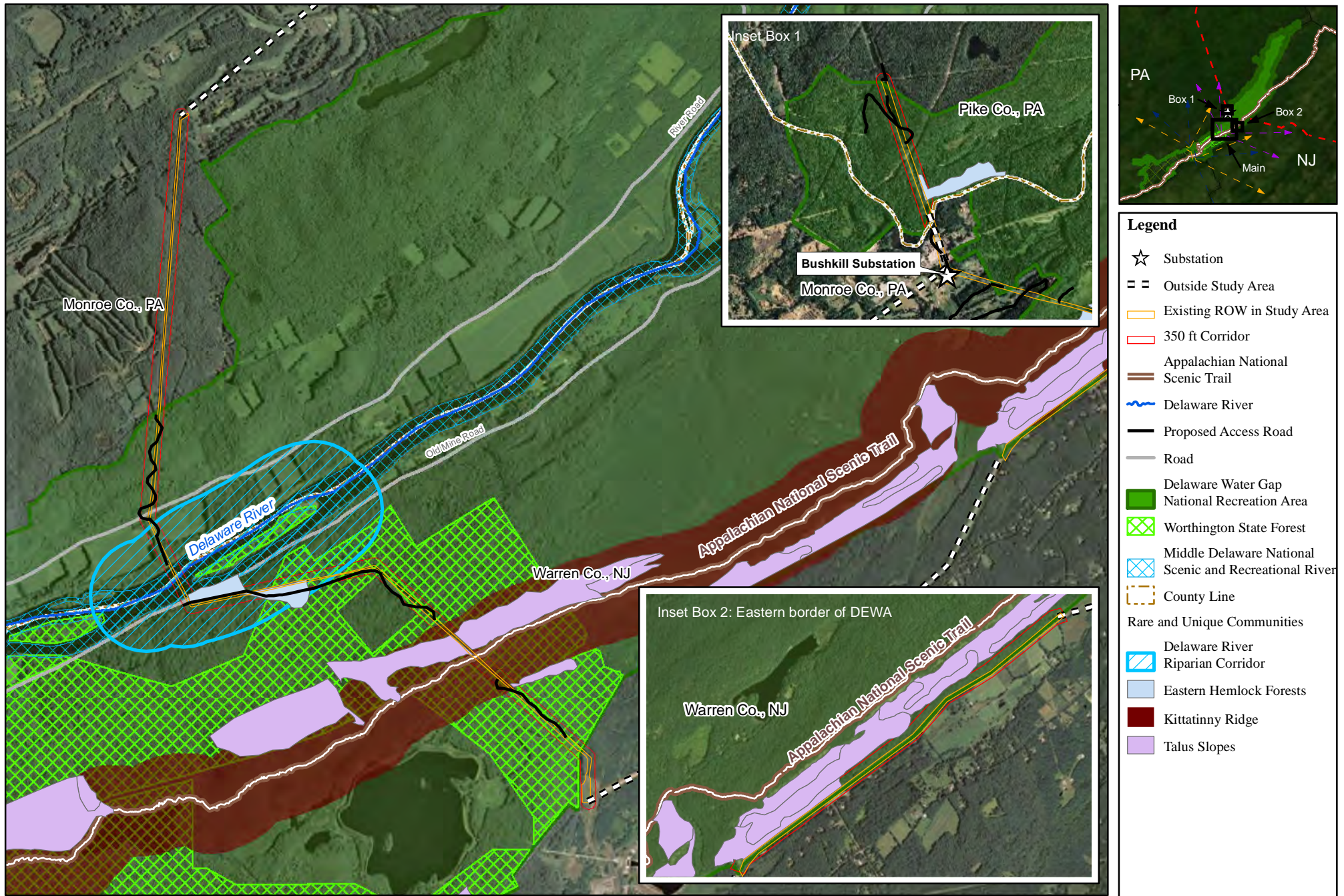
The alternative 3 alignment would intersect one park-managed outstanding natural feature (Kittatinny Ridge), four rare and unique vegetation communities (Delaware River riparian corridor, hemlock forests, lichens, and talus slopes), and one natural heritage site (Shoemakers Barren) inside the study area (table 21; figure 45).

Three types of forests containing eastern hemlocks are found along the alternative 3 corridor: eastern hemlock/northern hardwood, dry eastern hemlock/oak, and eastern hemlock forests. The first two forest types are just west of the Delaware River in New Jersey adjacent to the ROW. Eastern hemlock forests grow along Big Bushkill Creek in this area, as described under alternatives 1, 2, and 2b.

The alternative 3 alignment would cross the Delaware River riparian corridor approximately 5 miles south of alternatives 1, 2, and 2b. The riparian area supports migratory and resident birds by providing foraging and nesting habitat; however, this portion of the Delaware River riparian corridor does not contain a bald eagle winter roost.

Lichens are expected to be found throughout the habitats along the alternative 3 alignment; however, the quantity and number of unique species would likely be less than that found within Hogback Ridge.

The alternative 3 alignment would cross Kittatinny Ridge within DEWA. This portion of the alignment would traverse oak/birch talus forest near APPA. Both oak/birch talus forest and sandstone talus are found in the portion of the alternative 3 alignment that travels parallel to APPA along the DEWA boundary.



Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

Figure 45
Alternative 3 Rare and Unique Communities

Source: ESRI Streetmap 2006, Penn State 2010,
ESRI ArcGISonline Map Service 2010,
PennDOT 2011, USGS 2006,
NJ DEP 2008

Projection: NAD 83 UTM Zone 18N
Date: July, 2012



0 1,500 3,000
Feet

Scale applies to main frame and inset maps

Alternative 4

Inside the study area, the alternative 4 alignment would intersect one park-managed outstanding natural feature (Kittatinny Ridge), three rare and unique vegetation communities (hemlock forests, lichens, and talus slopes), and three natural heritage sites (Totts Gap, Minsi Lake vernal pools, and Bear Swamp) (table 21; figure 46).

The alternative 4 alignment would encounter hemlock forests where the alignment follows the B-K Line, as described for alternatives 1, 2, and 2b. Lichens are expected to be present along the alternative 4 alignment. Because the alignment is situated along the edge of DEWA and is more disturbed by development, the lichen flora is expected to be less diverse and plentiful than that found along Hogback Ridge as described for alternatives 1, 2, and 2b. The alternative 4 alignment would cross Kittatinny Ridge and a small portion of oak/birch talus forest habitat. This talus habitat is east of APPA; sandstone talus is not found along the alternative 4 route.

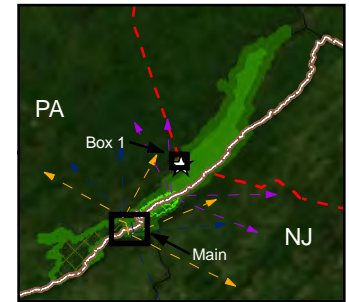
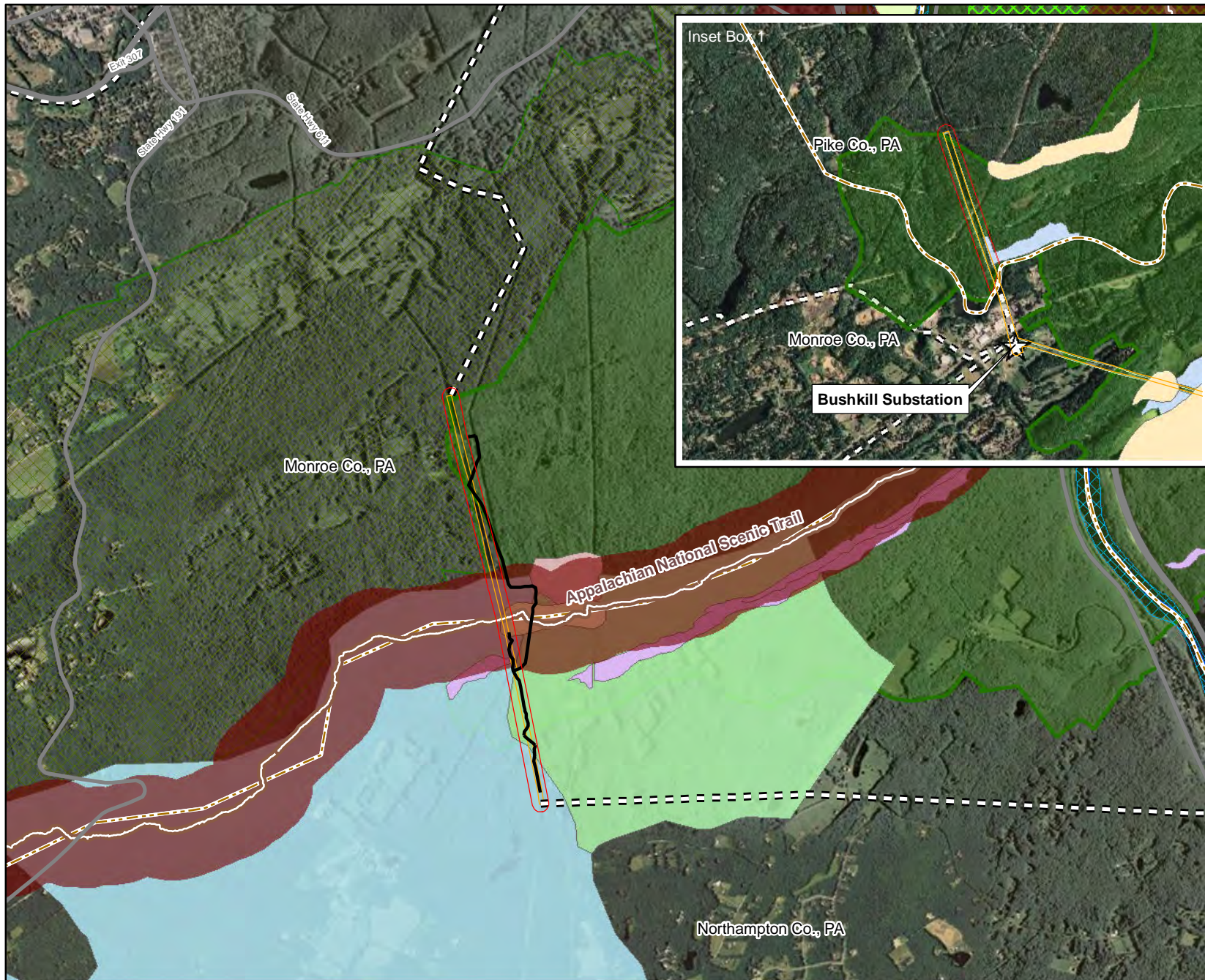
The southern half of alternative 4 within the study area crosses Totts Gap Natural Heritage Site and the Minsi Lake Corridor, which contains Minsi Lake vernal pools and Bear Swamp. These communities abut one another in the southernmost portion of DEWA and the alignment crosses the outermost edges of both (figure 46). These communities support state-listed plant species, as well as sensitive wildlife species.

Alternative 5

Inside the study area, alternative 5 would follow the same route through DEWA and APPA as alternative 4 except it would not include any portion of the B-K Line. Therefore, alternative 5 would intersect one park-managed outstanding natural feature (Kittatinny Ridge), two rare and unique vegetation communities (lichens and talus slopes), and three natural heritage sites (Totts Gap, Minsi Lake vernal pools, and Bear Swamp) (table 21; figure 46). The conditions of these communities are the same as those described for alternative 4.

Outside the Study Area

From the study area to the Susquehanna Substation, the S-R Line could pass through Carbon, Lackawanna, Luzerne, Monroe, Northampton, Pike, and Wayne counties in Pennsylvania. These counties contain 58 different types of rare and unique habitats, including a variety of wetlands, barrens, and rocky summits (PNHP 2010e). The rare and unique communities of these seven Pennsylvania counties and their state ranks are presented in appendix G. Rare and unique communities identified by the PNHP range from demonstrably stable to critically imperiled. Pike County contains 26 rare and unique communities, the largest number of any of the counties within the project vicinity in Pennsylvania; Lackawanna County contains the least, with 12 rare and unique community types. Two communities in Pennsylvania are also ranked globally: shrub fen is ranked as globally vulnerable to globally imperiled, and the northern Appalachian calcareous rocky summit community is listed as potentially globally imperiled (PNHP 2010e). The Pennsylvania Science Office of TNC has identified the outstanding or critical natural features in a series of natural area inventory reports. For the counties that may be affected by the S-R Line, the number of outstanding natural features range from 54 in Lackawanna County to 122 in Luzerne County (PATNC 1990, 1991a, 1991b, 1998, 1999, 2005a, 2005b, 2006). The outstanding natural features are presented in appendix G. Additionally, 11 preserves protected by TNC are within the counties that could be involved with the S-R Line outside the study area and are presented in appendix G-8 (TNC 2011c).



Legend

- ☆ Substation
- ≡≡ Outside Study Area
- Existing ROW in Study Area
- 350 ft Corridor
- Appalachian National Scenic Trail
- Proposed Access Road
- Delaware Water Gap National Recreation Area
- CVNWR Boundary
- Middle Delaware National Scenic and Recreational River
- County Line
- Rare and Unique Communities
 - Kittatinny Ridge
 - Shoemakers Barren Natural Heritage Ste
 - Talus Slopes
 - Totts Gap
- TNC Designations
 - Minsi Lake/Bear Swamp
 - Totts Gap
 - Totts Gap Swamp

Note: Designated boundary of CVNWR is depicted, not all property is owned within the boundary



Susquehanna to Roseland
Transmission Line Proposal
and
Right-of-Way Request EIS

Figure 46
Alternative 4/5 Rare and Unique Communities

Source: ESRI Streetmap 2006, Penn State 2010,
ESRI ArcGISonline Map Service 2010,
PennDOT 2011, USGS 2006,
NJ DEP 2008

Projection: NAD 83 UTM Zone 18N
Date: July, 2012



0 1,500 3,000
Feet
Scale applies to main frame and inset maps

Outside the study area to Roseland Substation, the S-R Line would traverse Sussex, Warren, and Morris counties on its route from the study area to the Roseland Substation in New Jersey; these counties contain 20, 10, and 4 rare and unique communities, respectively. The NJNHP has identified these communities as ranging from rare or vulnerable to critically imperiled for the state of New Jersey, and many are ranked as very rare globally (NJDEP 2008b, 2008c, 2008d). NJDEP has identified critically important habitat or natural heritage priority sites in Sussex, Warren, and Morris counties. There are 80 natural heritage priority sites in Sussex County, 39 in Warren County, and 22 in Morris County (NJDEP 2007). The outstanding natural features are presented in appendix G. In addition, there are eight preserves owned by TNC that could be encountered in Sussex, Warren, and Morris counties in New Jersey, which are presented in appendix G-8 (TNC 2010).

Depending on the route chosen, the transmission line could encounter one or more of these rare or unique communities, TNC preserves, or natural heritage site communities outside the study area in Pennsylvania and New Jersey.

ARCHEOLOGICAL RESOURCES

This section identifies potential archeological resources that could be affected by the S-R Line. Archeological sites are defined as follows:

A site is the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself maintains historical or archeological value regardless of the value of any existing structure. (36 CFR § 60.3[1])

Further, an archeological resource is a site that has been recognized by the NPS or, pending agency review, could be recognized by the Pennsylvania State Historic Preservation Office (SHPO) or the New Jersey Historic Preservation Office (NJ HPO) as historically and archeologically important and worthy of preservation. Sites include those that meet the eligibility requirements of the National Register of Historic Places (National Register) (36 CFR § 60.4) but can include other properties as well.

The affected environment for archeological resources is defined with reference to the implementing regulations of section 106 of the National Historic Preservation Act of 1966 (NHPA). Under section 106, the affected environment is referred to as the area of potential effects (APE), which is defined as follows:

Area of potential effects means the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking (36 CFR § 800.16[d]).

The federal undertaking for the S-R Line is the granting of permits requested by the applicant.

The S-R Line would involve the regular placement of new towers and intervening electrical transmission lines within identified alternative alignments. Because these features are large in scale and readily visible from great distances, they would have visual impacts on historic properties within the Delaware River valley. Therefore, within the park boundary, the NPS defined an APE that extends 8 miles laterally from each proposed alternative alignment. Outside the park boundary, the NPS defined an APE that extends 0.5 mile laterally from each proposed alternative alignment. The width of the APE is governed by VSLs, points where established alignment segments within the park meet one or more speculative segments that extend to the Susquehanna Substation to the west or Roseland Substation to the east (see appendix M,

figures M-1, M-2 and M-3). The archeology studies focused in areas of proposed ground disturbance, inside the ROW and within access roads.

The entire range of prehistory, from the Paleo-Indian period to the Late Woodland period (approximately 10,500 BC–AD 1600) is represented in the archeological record of DEWA, as well as many proto-historic and historic period sites. Archeological sites in and near the APE were identified in two stages. First, archeologists conducted a Phase IA-level investigation, including existing background publications, documents, and digital information. Sources included NPS GIS information, Pennsylvania SHPO files and NJ HPO files. These data helped to determine the presence and location of previously identified sites and resources, as well as where archeologists might most likely find sites. This research revealed that while numerous historic and prehistoric sites have been recorded on both the Pennsylvania and New Jersey sides of the Delaware, none have been found to be directly within the bounds of the transmission line alternatives. This is because systematic field survey of the transmission line corridors had not been conducted, and the other ways sites are discovered (plowing, erosion, illegal digging, etc.) had not occurred, either.

Subsequently, archeologists conducted a Phase IB archeological survey along all the alignments for alternatives 2 and 2b (Berger 2010b), 3, 4, and 5 (JMA 2011). Archeologists did not survey a short segment of the alternative 3 alignment within the Worthington State Forest due to lack of clearance from the New Jersey DEP. The Phase IB survey involved the hand excavation of shovel test units within the alternative ROWs on areas of high probability (low slope) and surface observation of areas of low probability (slope greater than 15 degrees).

There was a significant difference between the amount of testing on alternative 2/2b and the other alternatives. Because the applicants had substantially determined tower locations, crane pad locations, and the access routes to and from the ROW, they were able to direct Berger archeologists to survey those locations, as well as substantial portions of the APE within the alternative 2/2b ROW. In addition, Phase II archeological evaluation, consisting of hand-excavated units, was conducted on sites identified in Phase I identification surveys. Geophysical trenching took place for alternatives 2 and 2b adjacent to the Delaware River in areas where deeply-buried sites may be present. Because only general construction information is available for the other alternatives, archeologists only conducted centerline testing for alternatives 3, 4, and 5. In both cases, if additional, more specific construction documents are developed, additional Phase I testing may be required to comply with Archaeological Resources Protection Act and NHPA, along with Phase II and Phase III eligibility determinations and mitigation. The APE for archeological resources would not change for any of the alternatives regardless of additional specific construction documents. Archeologists discovered sites on all alternatives, as shown in table 22.

TABLE 22: SUMMARY OF IDENTIFIED ARCHEOLOGICAL SITES WITHIN THE STUDY AREA

| Classification | Alternatives | | | | | |
|----------------------------|--------------|---|----|---|---|---|
| | 1 | 2 | 2b | 3 | 4 | 5 |
| National Register listed | 0 | 0 | 0 | 0 | 0 | 0 |
| National Register eligible | 2 | 2 | 2 | 0 | 0 | 0 |
| Unevaluated | 0 | 0 | 0 | 1 | 1 | 1 |

ALTERNATIVE 1 (NO ACTION), ALTERNATIVE 2, AND ALTERNATIVE 2B

The intensive Phase I survey identified 25 archeological sites along the alignment for alternatives 1, 2, and 2b that were within the APE. Of these 25 sites, two sites within the APE have the potential to be affected; one site contained both prehistoric and historic components, and the second site contained

prehistoric components only. The applicants have asserted that the remainder would not be affected by construction activities (Berger 2010b) by using strategies of avoidance and/or non-ground-disturbing construction techniques. Phase II archeological investigations at both sites resulted in a recommendation of National Register eligibility for the prehistoric components.

ALTERNATIVE 3

One historic period site was identified along the alternative 3 alignment, on the Pennsylvania side of the river. The site consisted of a cellar hole and an associated surface feature. Artifacts recovered totaled 273. Artifact typology indicates a date range of approximately 1829–1895. The site deposits appear reasonably intact and display good integrity.

ALTERNATIVE 4

One prehistoric site was identified. The site assemblage consists of 46 black chert flakes and shatter. The site is adjacent to a wetland area and appears to be intact, displaying good archeological integrity. Archeologists uncovered no temporally or culturally diagnostic artifacts. Phase II excavations have not been conducted to determine the site's eligibility for the National Register.

ALTERNATIVE 5

The archeological resources along the alternative 5 alignment are the same as those described for alternative 4, because none were identified along the B-K Line portion of the alternative 4 alignment.

HISTORIC STRUCTURES

This section identifies specific historic structures that could be affected by the S-R Line. Historic structures are defined to include buildings, districts, and structures that have been recognized by NPS as listed or eligible for listing in the National Register (36 CFR § 60.4) or, pending agency review, could be recognized by the Pennsylvania SHPO or NJ HPO as eligible for listing in the National Register. Historic structures do not include sites of demolished buildings, districts, or structures.

The affected environment for historic structures is defined with reference to the implementing regulations of section 106 of the NHPA. Under section 106, the affected environment is referred to as the APE (see “Archeological Resources” for the definition of an APE under section 106 and the description of the APE for this analysis). NPS policy states that eligible structures are to be treated in the same manner as listed structures.

Researchers identified historic structures in several ways, depending on their locations. For portions of the APE associated with alternatives 1, 2, and 2b, information was drawn from the results of the cultural landscape investigation and the historic architecture eligibility report (Jacobs et al. 2011; Berger 2012). For portions of the APE associated with alternatives 3, 4, and 5 within the park boundary, where considerable previous surveys had occurred, researchers consulted the DEWA inventory of historic structures. This inventory included a GIS layer and database. The GIS layer contained points identifying the location of each identified resource, and the database contained standardized information about the identity, location, status, type, and age of each resource. For portions of the APE associated with alternatives 3, 4, and 5 outside the park boundary, where little or no previous investigation had occurred, field staff conducted a reconnaissance survey to determine the presence of buildings, districts, and structures that appeared to meet the 50-year age consideration of the National Register. Researchers also

reviewed the Pennsylvania SHPO and NJ HPO survey files to determine the presence and location of previously-identified historic structures (Clark et al. 2011).

The number and distribution of identified historic structures are summarized by National Register status and project alternative in table 23. The identified historic structures are listed by name in chapter 4, along with the determination of effects. Because the APEs for various alternatives intersect, some historic structures are represented more than once in table 23. Regarding National Register status, “listed” indicates that a historic structure is listed on the National Register, “eligible” indicates that either the historic structure has been formally determined to meet National Register requirements or the SHPO or NPS has issued an opinion that the historic structure meets at least one of the National Register eligibility criteria, and “undetermined” indicates that the historic structure has not been evaluated for listing on the National Register.

TABLE 23: SUMMARY OF IDENTIFIED HISTORIC STRUCTURES

| National Register Status | Alternatives | | | | | |
|---------------------------------|---------------------|----------|-----------|----------|----------|----------|
| | 1 | 2 | 2b | 3 | 4 | 5 |
| Listed/eligible | 36 | 36 | 36 | 33 | 9 | 9 |
| Undetermined | 0 | 0 | 0 | 28 | 15 | 15 |
| Total | 36 | 36 | 36 | 61 | 24 | 24 |

CULTURAL LANDSCAPES

In this identification and analysis of cultural landscapes there is an application of definitions of the small and easily recognizably individual cultural landscapes that are found within the three park areas. However, DEWA, including the portion of APPA found within it and the MDSR together constitute a cultural landscape. They encompass the Delaware River Valley with all of its architecture, history, pre-history, and traditions and significant natural resources around which that culture is built. DEWA represents the larger cultural landscape containing the smaller component landscapes identified as affected environments. This single large cultural landscape made up of many individual cultural landscapes is the context for the affected environment and the related analysis of impacts.

The proposed project includes the regular placement of new towers and intervening electrical transmission lines within identified alternative alignments. Because these features are large in scale and readily visible from great distances, they would have physical as well as visual effects on the larger cultural landscape of the Delaware Valley, the Delaware River, APPA, historic roads, and the property corridors that surround the roads and historic districts. Action alternatives will also affect the smaller component cultural landscapes that reflect the larger settlement patterns of the valley and are the setting for farmsteads, mining sites, campsites, and resorts and their associated historical features. A cultural landscape could be determined to be eligible for the National Register, but could also be determined not eligible.

The affected environment for cultural landscapes is defined with reference to the implementing regulations of section 106 of the NHPA. Under section 106, the affected environment is referred to as the APE (see the “Archeological Resources” section for the definition of an APE under section 106 and the description of the APE for this analysis). NPS policy states that eligible landscapes are to be treated in the same manner as listed landscapes.

DELAWARE WATER GAP NATIONAL RECREATION AREA

The Upper Delaware Valley, between the Delaware Water Gap and Port Jervis, New York, is located in a geomorphic zone known as the Appalachian Ridge and Valley Province. This zone runs in a northeast-to-southwest direction. The valley geology and geography determined communication networks, affected settlement patterns, and created scenic beauty. The Upper Delaware Valley contains cultural landscapes that reflect the American past. The valley still reflects the setting, feeling, and association of the earliest periods of habitation into the twenty-first century. The earliest known settlement of the area was in 8000 BCE by American Indians. European settlement in the seventeenth century to the twentieth century created impacts that changed the River Valley landscape; these established patterns remain substantially intact and are part of the ongoing process of landscape continuity and change. The overall cultural landscape of DEWA is a combination of significant natural and cultural resources (NPS 1993b, 1996; JMA 2011).

Cultural landscapes can range from thousands of acres of rural tracts of land to small homesteads on less-than-one-acre lots. Cultural landscapes also include historic roads, trails, and river corridors and the associated properties on either side. Like historic buildings and districts, these special places reveal aspects of our country's origins and development through their forms and features and the ways they were used. Cultural landscapes are significant historic resources that reveal information about places that have been part of the everyday lives of successive generations of people (NPS 1996; JMA 2011).

For the purposes of planning and management of cultural resources, *Preservation Brief 36: Protecting Cultural Landscapes, Planning, Treatment and Management of Historic Landscapes* defines a cultural landscape as follows:

A geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. (NPS 1994)

Overall, APPA has been determined eligible for listing on the National Register in its entirety and is listed in New Jersey both as a structure and as a cultural landscape. Recent discussions with the Pennsylvania SHPO have suggested that DEWA and MDSR should be evaluated as a singular cultural landscape based on their historical importance in defining the environmental movement in the United States and role in mobilizing people to oppose the damming of the Delaware River, as well as the push by the US Government in the 1960s to increase the availability and improve the quality of outdoor recreation for citizens and visitors (Safley pers. comm. 2011).

In addition to the parks as unified cultural landscapes, DEWA, MDSR, and APPA are complex in nature, possessing a number of interrelated cultural landscape components and features that could be affected by the proposed transmission lines and corridors. The park units are the large cultural landscapes that form the context for the associated smaller component landscapes, which are best described as historic vernacular landscapes. *Preservation Brief 36* defines a vernacular landscape as follows:

A landscape that evolved through use by the people whose activities or occupancy shaped that landscape. Through social or cultural attitudes of an individual, family or a community, the landscape reflects the physical, biological and cultural character of those everyday lives. Function plays a significant role in vernacular landscapes. They can be a single property such as a farm or a collection of properties such as a district of historic farms along a road or a river valley. (NPS 1994)

The larger landscapes as well as the component landscapes and road corridors have been documented and evaluated as cultural landscapes and many are either currently in the National Register or found to be eligible for listing in the National Register for contributions to the broad patterns of American history. Numerous landscape resources and features that survive include waterways, landforms and topography, historic roads and road traces, vegetation and agricultural use patterns, outbuildings, farm support structures, houses, recreational features, camp structures, cemeteries, and fence rows. Eligible cultural landscapes sometimes even include nonhistoric (not eligible for the National Register) elements, such as buildings, structures, and landscapes features, that do not contribute to the cultural landscape.

In the 1987 GMP for DEWA, goals were identified for the preservation of cultural landscapes, including the Old Mine Road, APPA, and other historic component landscapes and sites. The GMP states:

Cultural landscapes will be retained by keeping vegetation and agricultural use patterns near historic structures. Outbuildings, farm support structures, and fence rows will be kept wherever possible to maintain farmsteads and existing landscape configurations. Proposed treatment levels for related structures will depend on their physical condition and the potential need of a structure for agricultural purposes or adaptive uses. Based on the contribution of all features, individual structures could either be kept, or recorded and removed, with their component pieces being used for salvage materials to restore other historic properties.

Many old but nonhistoric structures and features contribute to the cultural landscape of the Delaware Valley. The landscape as a whole, as well as the individual features, will be evaluated as part of the area's landscape management plan to determine whether it is eligible for nomination to the National Register as a rural historic district.

The Old Mine Road, Appalachian National Scenic Trail, and other historic component landscapes and sites will be used for interpretation of historic development and growth of the area, as well as for recreational purposes such as hiking and scenic driving. Any actions that will affect the road or trail and their respective corridors will have to meet requirements for preserving their historical and cultural integrity. (NPS 1987)

Subsequent to the GMP, other studies of historic resources including cultural landscapes were developed by NPS and include the *Preliminary Historic Resource Study* (NPS 1996) and the *Draft Rural Landscape Management Plan* (NPS 1993b). Both studies identified and described the cultural landscape resources under primary areas of historic significance and considered surviving landscape patterns as dominant features. From 1995 to 2005, the park completed comprehensive cultural landscape inventories to evaluate the historic significance and integrity of its 70,000-acre rural landscape. Preliminary integrity determinations were made, and the park's cultural landscape inventory team recognized that consistent and repeating land use patterns were intact throughout the entire valley and were undoubtedly highly significant cultural landscape characteristics.

Within the APE for cultural landscapes, sites were identified in the 1987 GMP, the subsequent resource studies, and the cultural landscape inventory database for DEWA. Other sites were also identified by NPS staff and field checked as potential cultural landscapes.

APPALACHIAN NATIONAL SCENIC TRAIL

All the action alternatives have the potential to affect APPA, which is eligible for the National Register. The entire corridor of the trail is considered for this topic as a cultural landscape, which is consistent with

the NPS description of APPA in the DEWA GMP. The trail is listed as a culturally significant property within DEWA and is described in the GMP as follows:

Appalachian Trail, N.J. – Local: In addition to its scenic qualities, a 400-foot-wide corridor of the Appalachian National Scenic Trail in New Jersey has been determined historic because of its significance in conservation and outdoor recreation and its longstanding history as a natural area. Established between 1922 and 1937, the trail is usually a simple footpath extending nearly 2,100 miles from Maine to Georgia. (NPS 1987)

All the alternatives cross APPA, either within or outside DEWA boundaries.

ALTERNATIVE 1 (NO ACTION), ALTERNATIVE 2, AND ALTERNATIVE 2b

Alternative 1 is the no-action alternative and represents the existing transmission line corridor that alternatives 2 and 2b would follow. As early as 1966, NPS planners recognized that the existing line—as electrical transmission infrastructure within the park—was incompatible with development of the park for recreation and visitor experience and proposed removing it in the first DEWA Master Plan (NPS 1966).

Cultural landscapes located in the APE for the alignment of alternatives 2 and 2b could potentially be affected by physical and/or visual impacts. Physical impacts could occur due to the location of the proposed alignment directly across cultural landscape corridors (such as roads and trails) or landscape parcels (such as farms and cemeteries). Visual impacts to cultural landscapes could occur due to location of the lines and towers across landscape corridors or parcels and from disruption of viewsheds from more distant landscapes within the APE (JMA 2011). Although the alignment for alternative 2b would be the same as that for alternatives 1 and 2 and would therefore have the same APE and affect the same potential cultural resources, the additional towers needed for alternative 2b would be more intrusive to the cultural landscapes than the number proposed for alternative 2. Please see “Table 24: Identified Cultural Landscapes within the APE for All Alternatives,” for a list of all resources identified, as well as the documentation status for resources along the alternatives.

Alternatives 1, 2 and 2b Crossing the Old Mine Road (Documented in the River Road System, New Jersey Conservation Landscape Initiative)

The existing transmission line (alternative 1) and proposed alternatives 2 and 2b transmission line cross Old Mine Road at mile marker 11. This location of the road is included in the 26-mile section that is part of the Old Mine Road Historic District.



Alternatives 2 and 2b: Existing Transmission Line Crossing the Old Mine Road, Looking East and Looking West.

TABLE 24: IDENTIFIED CULTURAL LANDSCAPES WITHIN THE APE FOR ALL ALTERNATIVES

| Tract ID | Cultural Landscape Resource | Date | National Register Status | Alternatives | | | | | |
|---|---|---------------------------|--|--------------|---|----|---|---|---|
| | | | | 1 | 2 | 2b | 3 | 4 | 5 |
| 615-1 615-2 | Abraham Van Campen House / Zipser | c. 1900 | Listed as part of Old Mine Road Historic District | X | X | X | X | | |
| | Appalachian Trail (Appalachian National Scenic Trail) | 1926, 1933 | Determined Eligible in Pennsylvania and New Jersey | X | X | X | X | X | X |
| | Arnott Fen and Hogback Ridge | | <i>Undetermined</i> | X | X | X | | | |
| 617-1 | Benjamin B. Van Campen House | c. 1840 | Listed as Part of Old Mine Road Historic District | X | X | X | X | | |
| 8500 and 8552 | Broadhead Farm "Wheat Plains" (Heller Farm) | c. 1890 | Listed | X | X | X | | | |
| 7456 | Bushkill Dutch Reformed Church | 1860 | Determined Eligible for Listing | X | X | X | X | | |
| 7531 | Bushkill School | 1932 | <i>Ineligible</i> | X | X | X | X | | |
| 7455 | Peter's House | 1840 | Listed | X | X | X | X | | |
| 7502 | Ralph G. Turn, Jr., Farmstead | 1914 | <i>Undetermined</i> | X | X | X | X | | |
| 3001 | Camp Ken-Etiwa-Pec | 1938 | Determined Eligible for Listing | X | X | X | | | |
| 607 | Camp Mohican | 1926 | <i>Ineligible</i> | X | X | X | X | | |
| Paha-quarry Copper Mines Tract | Camp Pahaquarra | 1925 | <i>Ineligible</i> | X | X | X | X | X | X |
| 205 | Camp Weygadt | 1921 | <i>Ineligible</i> | | | | X | X | X |
| 6909-2 | Chado Farm Broadstone Farms | c. 1932 c. 1910s–1920s | Determined Eligible for Listing | X | X | X | | | |
| 2123 | Cold Spring Farm Spring House | Late 1800s | Listed | X | X | X | X | | |

| Tract ID | Cultural Landscape Resource | Date | National Register Status | Alternatives | | | | | |
|-------------------------------|---|-------------------------------|---|--------------|---|----|---|---|---|
| | | | | 1 | 2 | 2b | 3 | 4 | 5 |
| 603-1 | Copper Mine Inn | c. 1840 | Listed as part of Old Mine Road Historic District | X | X | X | X | | |
| 121 (on Slateford Farm tract) | Emory Pipher Quarry | 1820s–1843 | Determined Eligible for Listing | | | | | X | X |
| 7624-1 | Decker Ferry House as part of Old Mine Road Historic District | c. 1795/1895 | Listed as part of Old Mine Road Historic District | X | X | X | X | | |
| | Dimmick's Ferry | 1826–1937 | Determined Eligible for Listing | X | X | X | X | | |
| 2735 | Fort Hynshaw | c. 1756–1757 | Determined Eligible for Listing | X | X | X | X | | |
| 8300 or 8315 | Nyce Farm-Van Gordon House (Eshback Farm) | 1775–1795 1910–1920s dairy | Listed | X | X | X | | | |
| 2707-C | Grube Cemetery | | <i>Undetermined</i> | X | X | X | X | | |
| 8005-1 | Shoemaker-Houck Farm (Silver Spray Farm) | c. 1822 | Listed | X | X | X | | | |
| 1900 | Hidden Lake Lodge | 1940 altered in c. 1965 | <i>Ineligible</i> | X | X | X | X | | |
| 2148 | Horace Van Auken House | 1882 or 1868 | Determined Eligible for Listing | X | X | X | X | | |
| 7111-1 7111-2 7150 | Isaac Van Campen Inn | c. 1750 | Listed as part of Old Mine Road Historic District | X | X | X | | | |
| 7144 | Jacob Roe House | c. 1812 | Determined Eligible for Listing | X | X | X | | | |
| 2919 | Captain Jacob Shoemaker | c. 1790s | Listed | X | X | X | X | | |
| 1001-1 | James Van Campen Farm (Blasi) | c. 1880 | Determined Eligible for Listing | X | X | X | X | | |

| Tract ID | Cultural Landscape Resource | Date | National Register Status | Alternatives | | | | | |
|------------------|--|------------------------------------|---|--------------|---|----|---|---|---|
| | | | | 1 | 2 | 2b | 3 | 4 | 5 |
| 6907-1 6907-2 | John P. House Farmstead | c. 1900 | Determined Eligible for Listing | X | X | X | | | |
| 1359 | John Stark Michael Farm | c. 1875 | Listed | X | X | X | X | X | X |
| 2122 2164 | John Turn Farm: Limekiln, Smokehouse, Weavehouse | c. 1830s 1950s camp | Listed | X | X | X | X | | |
| 105 | Laurel Falls Schoolhouse | 1850, 1866 Altered c. 1945 | <i>Ineligible</i> | | | | X | X | X |
| 919 | McManus House | 1915 | Determined Eligible for Listing | X | X | X | X | X | X |
| 1506-C | Michael Cemetery | c. 1792–1860 | <i>Undetermined</i> | X | X | X | X | | |
| | Abraham Van Campen III | c. 1800 | <i>Ineligible</i> | X | X | X | X | | |
| 6500 | E.L. Garris House | c. 1852 | Listed as part of Old Mine Road Historic District | X | X | X | X | | |
| | Garris Mill site | 1832–1922 Reconstructed 1994 | <i>Ineligible</i> | X | X | X | X | | |
| 6504-1 | G. Trauger House | c. 1860 | Listed as part of Old Mine Road Historic District | X | X | X | X | | |
| 821 | Millbrook Schoolhouse | 1840 | Listed as part of Old Mine Road Historic District | X | X | X | X | | |
| | Millbrook Village Historic District | 1832–1875 | Determined Eligible for Listing | X | X | X | X | | |
| 6502-1 | Sylvester Hill House | c. 1850 | Listed as part of Old Mine Road Historic District | X | X | X | X | | |

| Tract ID | Cultural Landscape Resource | Date | National Register Status | Alternatives | | | | | |
|-------------------------------|---|---|---|--------------|---|----|---|---|---|
| | | | | 1 | 2 | 2b | 3 | 4 | 5 |
| 614-1 | Miller House Amos van Campen House (outbuildings) | House destroyed 2012, outbuildings remain | Listed as part of Old Mine Road Historic District | X | X | X | X | | |
| 807 | Minard-Hamilton Farmstead | c. 1870 | <i>Ineligible</i> | X | X | X | X | | |
| 121 (on Slateford Farm tract) | Munch-Cyr Farm | | Determined Eligible for Listing | | | | X | X | X |
| 6709-3 | Myers Farmstead | Early 1900s Moved to site | <i>Ineligible</i> | X | X | X | X | | |
| 901 or 905 | Newcomb House (Larch Hollow) | 1850 | Recommended Eligible for Listing | X | X | X | X | X | X |
| 121 | New York and Delaware River Slate Company Quarry | 1870–1873 | Determined Eligible for Listing | | | | X | X | X |
| 7106 | Oakley Stoll Farmstead | c. 1835, 1850 | <i>Ineligible</i> | X | X | X | | | |
| 1017-1 1017-2 | Otto Nehland House | 1950s | <i>Ineligible</i> | X | X | X | X | | |
| 2130-C | Overfield Cemetery | c. 1798 | <i>CLI</i> | X | X | X | X | | |
| 2130 | Owens / Stone Spring Farm Springhouse | c. 1840 | Determined Eligible for Listing | X | X | X | X | | |
| 2155 | Pennsylvania Subdistrict Office | 1932–1935 | <i>Ineligible</i> | X | X | X | X | | |
| 7101 | Richard Layton Farmstead | 1812 | Listed | X | X | X | | | |
| | River Road (PA) Shawnee to Decker's Ferry | 1744 Altered 1838, 1912, 1934 | <i>Undetermined</i> | X | X | X | X | X | X |
| | Route 209 (Community Drive to Spackman's Creek) | 1750s Altered 1920s and 1930s | <i>CLI Undetermined</i> | X | X | X | X | | |

| Tract ID | Cultural Landscape Resource | Date | National Register Status | Alternatives | | | | | |
|------------|--|-------------------------------------|--|--------------|---|----|---|---|---|
| | | | | 1 | 2 | 2b | 3 | 4 | 5 |
| 602-1 | Sadie Van Campen Farm | 1870 Altered 1930s | <i>Ineligible</i> | X | X | X | X | | |
| 6521-4 | Salamovka | 1850 | Listed as part of Old Mine Road Historic District | X | X | X | X | | |
| 2700 | Schoonover Farm (also called Schoonover Mountain House) | c. 1860 | Listed | X | X | X | X | | |
| 121 | Slateford Farm | 1800, 1833 | Listed | | | | X | X | X |
| | Rosenkrans House | 1800 | Listed as part of Old Mine Road Historic District | X | X | X | X | | |
| 1353 | Smithfield Beach | 1955, 1957 | Undetermined | X | X | X | X | X | X |
| 324 | Totts Gap Farm | 1820, 1835 Altered c. 1935, c. 1945 | Determined Eligible for Listing | | | | X | X | X |
| | Totts Gap Road | 1737 or earlier | Recommended Eligible for Listing | | | | X | X | X |
| 1357 | Trieble-Rouch House site | 1832 house demolished | Undetermined | X | X | X | X | X | X |
| 2704-C | Van Auken Cemetery | | <i>Undetermined</i> | X | X | X | X | | |
| | Van Campen Sawmill site | c. 1793 | Determined Eligible for Listing | X | X | X | X | | |
| 1016-1 | Watergate Recreation Site | c.1960 | <i>Recommended Ineligible, Awaiting SHPO concurrence</i> | X | X | X | X | | |
| 1502 | Zion Lutheran Church | 1851 | Listed | X | X | X | X | | |
| 204 205 | Delaware Water Gap Slate Company Quarry and Building Sites Historic District | 1870–1904 | Determined Eligible for Listing | | | | X | X | X |
| | Old Mine Road Historic District | | Listed | X | X | X | X | | |

| Tract ID | Cultural Landscape Resource | Date | National Register Status | Alternatives | | | | | |
|------------------------------|---|-----------|---------------------------------|--------------|---|----|---|---|---|
| | | | | 1 | 2 | 2b | 3 | 4 | 5 |
| 8203 8209 8223 8227 | Walpack Center Historic District | 1850 | Listed | X | X | X | | | |
| | Pennsylvania-New Jersey Interconnection (PNJ) utility line and corridor | 1928–1956 | Determined Eligible for Listing | X | X | X | | | |

Notes:

CLI = Cultural Landscape Inventory

The transmission line clearing creates an abrupt opening where it crosses Old Mine Road. The corridor can be seen extending to the east and west, and towers are very visible.

Alternatives 1, 2 and 2b Crossing Community Drive and the Horace Van Auken Landscape

The existing transmission line (alternative 1) and proposed alternatives 2 and 2b transmission line also cross Route 209 (Community Drive) and passes through the Horace Van Auken component landscape. This alternative location constitutes both a physical and visual impact to the historic Community Drive corridor and the adjacent cultural landscape site.



Van Auken House on Community Drive.



Van Auken Barn on Community Drive.



Arnott Fen at Community Drive.

Alternatives 1, 2, and 2b Crossing APPA

The existing transmission line (alternative 1) and proposed alignment for alternatives 2 and 2b cross APPA, creating both physical and visual impacts on the trail, trail corridor, and other cultural landscapes within the APE.

Alternatives 2 and 2b Outside the Study Area to Susquehanna Substation

The alternative 2 alignment, which would also provide connection to alternatives 3 and 4, would traverse a substantially large section of Delaware State Forest lands in Pike County. The majority of the line's path through the county would go through state forest.



Alternative 2 Transmission Lines and Corridor Crossing APPA.

Continuing west, the line would cross state game lands in Pike, Lackawanna, and Luzerne counties. The line would also cross a small section of a small state forest in Lackawanna County and would cross a state forest in Luzerne County. There are no documented cultural landscapes or landscapes determined to be potentially eligible for National Register recognition in these areas.

Alternatives 2 and 2b Outside the Study Area to Roseland Substation

The alternative 2 alignment, which would also provide connection to alternatives 3 and 4, would traverse the north end of a state park in Sussex County and some small game lands in Morris County, bypassing another state park and a natural area to the south. There are no documented cultural landscapes or landscapes determined to be potentially eligible for National Register recognition in these areas.

ALTERNATIVE 3

The alternative 3 alignment would follow an existing transmission line corridor that travels southwest from the Bushkill Substation and crosses the River Road System (New Jersey), River Road (Pennsylvania), the Delaware River, and Route 602 as it trends northeast to reconnect with the proposed alternative 2 route outside NPS boundaries.

Cultural landscapes that fall within the APE for the alternative 3 alignment could potentially be affected by physical and/or visual impacts. Physical impacts would be due to the location of the proposed alignment directly through or across cultural landscape corridors (such as roads and trails) or landscape parcels (such as farms, churchyards, and cemeteries). Visual impacts to cultural landscapes could also occur across landscape corridors and parcels and from disruption of viewsheds from more distant landscapes within the APE. Please see “Table 24: Identified Cultural Landscapes within the APE for All Alternatives,” for a list of all resources identified, as well as the documentation status for resources along the alternatives.

Alternative 3 Crossing APPA

The proposed alignment for alternative 3 crosses the APPA. This creates physical and visual impacts affecting the trail, trail corridor, and other cultural landscapes with the APE for this alternative.

Alternative 3 Outside the Study Area to Susquehanna Substation

The alternative 3 alignment would traverse a substantially large section of Delaware State Forest lands in Pike County. Continuing west, the line would cross state game lands in Pike, Lackawanna, and Luzerne counties. The line would also cross a small section of a small state forest in Lackawanna County and would cross a state



Alternative 3 Alignment Crosses APPA, Creating both Physical and Visual Effects for the Trail and Trail Corridor.

forest in Luzerne County. There are no documented cultural landscapes or landscapes determined to be potentially eligible for National Register recognition in these areas.

Alternative 3 Outside the Study Area to Roseland Substation

The alternative 3 alignment would traverse the north end of a state park in Sussex County and some small game lands in Morris County, bypassing another state park and a natural area to the south. There are no documented cultural landscapes or landscapes determined to be potentially eligible for National Register recognition in these areas.

ALTERNATIVES 4 AND 5

The alignment for alternatives 4 and 5 would follow I-80 from the west to near the town of Delaware Water Gap. From here, it would head south and roughly follow the southern boundary of DEWA, returning to I-80 slightly east of the park's eastern boundary.

Cultural landscapes that fall within the APE for alternative 4 and 5 alignments could potentially be affected by physical impacts and/or visual impacts. Physical impacts would be due to the location of the proposed alignment directly through or across cultural landscape corridors (such as roads and trails) or landscape parcels (such as farms, schools and camps). Please see "Table 24: Identified Cultural Landscapes within the APE for All Alternatives," for a list of all resources identified, as well as the documentation status for resources along the alternatives.



Totts Gap Road.



Totts Gap Farm Adjacent to Totts Gap Road.

Alternatives 4 and 5 Crossing Totts Gap Road near Totts Gap Farm

The proposed transmission line for alternatives 4 and 5 would cross Totts Gap Road, creating both physical and visual effects on the historic road and adjacent landscapes. The proposed alignment for alternatives 4 and 5 also crosses the APPA.

Alternatives 4 and 5 Outside the Study Area to Susquehanna Substation

The alternative 4 alignment in this area would be the same as alternative 2. The alternative 5 alignment could follow the I-80 ROW, which bypasses a state game area in Monroe County and passes through some game lands in Carbon and Luzerne counties. There are no documented cultural landscapes or landscapes determined to be potentially eligible for National Register recognition in these areas.