U.S. Department of the Interior
National Park Service

Appalachian National Scenic Trail
Delaware Water Gap National Recreation Area
Middle Delaware National Scenic and Recreational River

New Jersey and Pennsylvania

Susquehanna to Roseland 500kV Transmission Line Right-of-Way and Special Use Permit Final Environmental Impact Statement

August 2012

Volume II

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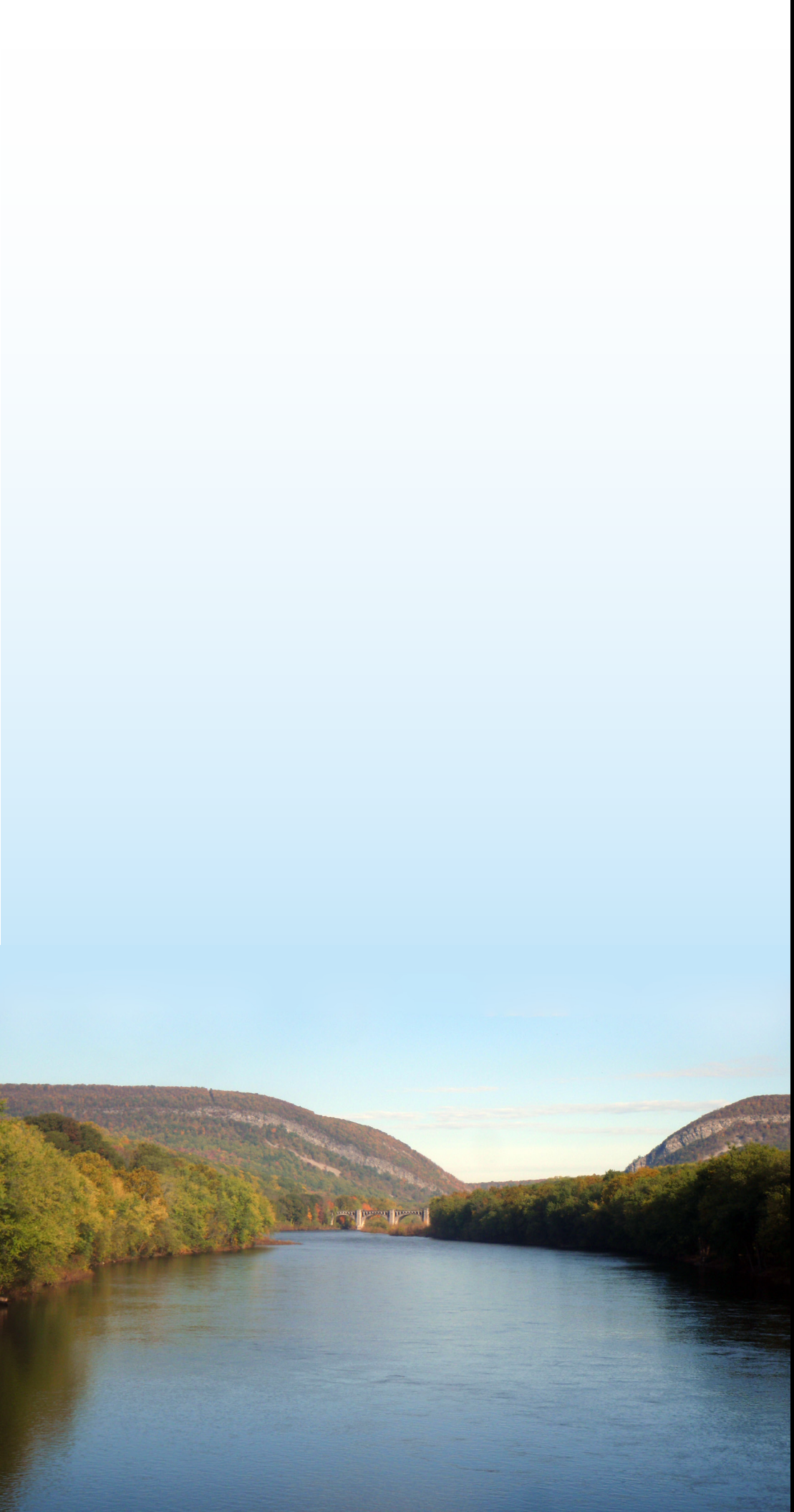

Chapter 5
Consultation and Coordination

CHAPTER 5: CONSULTATION AND COORDINATION

INTRODUCTION

The intent of National Environmental Policy Act (NEPA) is to encourage the participation of federal and state-involved agencies and affected citizens in the assessment procedure, as appropriate. As part of the NEPA process, issues associated with the proposed action were identified during scoping meetings with National Park Service (NPS) staff, coordination with other affected agencies, and public meetings, as well as through public comments. This chapter describes the consultation that occurred during development of this Preliminary Draft Susquehanna to Roseland 500-kV Transmission Line EIS, including consultation with stakeholders and other agencies. This chapter also includes a description of the public involvement process and a list of the recipients of the draft document. The public involvement activities for this environmental impact statement (EIS) fulfill the requirements of NEPA, Section 106 of National Historic Preservation Act of 1966 (NHPA), and NPS Director's Order 12 (NPS 2011g) and accompanying Director's Order 12 Handbook (2001c).

THE SCOPING PROCESS

Scoping is an effort to involve agencies and the public in determining the scope of issues to be addressed in an environmental document. Scoping includes consultation with all interested parties or any agency with jurisdiction by law or expertise to obtain early input. Among other tasks, scoping determines important issues and eliminates issues determined to be unimportant; allocates assignments among the interdisciplinary team members and/or participating agents; identifies related projects and associated documents; identifies other permits, surveys, consultations, etc. required by other agencies; and helps determine a schedule that allows for adequate time to prepare and distribute the environmental document for all interested parties to review before a final decision is made.

NPS divides the scoping process into two parts: internal scoping and external (or public) scoping. Internal scoping for the Susquehanna-to-Roseland Line (S-R Line) EIS involved discussions among NPS personnel and the interdisciplinary planning team regarding the purpose of and need for the management actions, issues, management alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance, and other project-related topics.

Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that people have an opportunity to comment and contribute early in the decision-making process. For this EIS, project information was distributed to individuals, agencies, and organizations early in the scoping process, and people were given opportunities to express concerns or views and to identify important issues or suggest other alternatives.

Taken together, internal and public scoping are essential elements of the NEPA process. The following sections describe the various ways scoping was conducted for this EIS.

INTERNAL SCOPING

The internal scoping process began with scoping meetings conducted on September 15, 16, and 17, 2009, with staff members from the parks, NPS Environmental Quality Division Northeast Region, and contractor personnel in attendance. The internal scoping meeting began with a presentation on the process and background of NEPA, followed by a presentation by the applicant. During the remaining days NPS

identified the purpose of and need for action, management objectives, issues, and impact topics. Park resources, possible alternative elements, and the project schedule were also discussed.

A preliminary alternatives meeting was held on December 16 and 17, 2009, with staff members from the parks, representatives from PPL and Public Service Electric and Gas Company (PSE&G), and contractor personnel in attendance. The purpose of the meeting was to discuss the route alternatives for the S-R Line developed by the applicant, develop the criteria to evaluate the different transmission line route alternatives, and work cooperatively to develop additional transmission line route alternatives in addition to the ones provided by the applicant.

A second preliminary alternatives workshop was held May 4, 5, 6, and 7, 2010. Attendees included staff members from the parks, NPS Environmental Quality Division Northeast Region, and contractor personnel. The meeting included a discussion of the project schedule, identification of additional data needed for the analysis of alternatives, a discussion of the proposed alternative, a discussion of which alternatives should be dismissed, and logistics for the public meetings.

PUBLIC SCOPING

Public scoping began with the January 21, 2010, Federal Register publication of the notice of intent to prepare an EIS (75 FR 3486–3487). The notice of intent summarized the proposed action and explained how to comment on the action. NPS released a public scoping newsletter to the public for review and comment on January 21, 2010. The newsletter included a description of the proposed S-R Line, the purpose and need, background information, project objectives, and a list of issues and impact topics. The newsletter also provided information on upcoming public scoping meetings. The newsletter was sent to individuals, businesses, agencies, and organizations on the parks' email distribution list. The parks also issued a news release inviting the public to comment at the scoping meetings.

On February 16, 17, and 18, 2010, public scoping meetings were held in Bushkill, Pennsylvania, Lake Hopatcong, New Jersey, and Parsippany, New Jersey, respectively. Each meeting began with an open house, followed by a short presentation by NPS explaining the project, as well as the project planning process. A formal public comment session with a court reporter was held after the NPS presentation. NPS staff members were present to visit with the workshop participants, answer questions, and address concerns. Posters, handouts, a PowerPoint presentation, and newsletters were made available at each public meeting. The public was invited to submit comments on the scope of the project and potential alternatives through March 12, 2010. A total of 311 participants attended the public scoping meetings and 102 spoke formally during the comment sessions. The number of attendees and formal commenters at each meeting included the following:

- Bushkill, Pennsylvania—93 attendees and 27 formal commenters
- Lake Hopatcong, New Jersey—98 attendees and 36 formal commenters
- Parsippany, New Jersey—120 attendees and 39 formal commenters

A 30-day public scoping comment period with a two-week extension of the comment period was provided from January 21 until March 12, during which members of the public were able to submit their comments on the proposed S-R Line.

During the entire public scoping period, over 6,500 pieces of correspondence were received from over 29 states and four countries (United States, United Kingdom, France, and Serbia and Montenegro) and entered into the Planning, Environment, and Public Comment (PEPC) database either from direct entry by the commenter, or uploading of emails, faxes, transcripts, and hard copy letters by NPS staff.

Approximately 6,343 letters were submitted by individuals living within the proposed area of the S-R Line. The NPS PEPC database was used for management of the comments. Comments were analyzed using a process developed by NPS to compile and correlate similar public comments into a format to be used by decision makers and the project team. Comment analysis assisted the team in organizing, clarifying, and addressing technical information pursuant to NEPA regulations. It also aided in identifying the topics and issues relevant for consideration in the EIS. A coding structure was developed during the internal scoping process to help sort comments into logical groups by topics and issues. A summary of the comments can be found in the *Public Scoping Comment Summary Report* dated April 2010, which is located on the NPS PEPC website. This report included the number and type of comments received, a summary of the substantive comments received, and a list of the organization or groups that participated in the public scoping effort.

The following were general concerns of the proposed project:

- Visual Resources—Multiple commenters stated concerns regarding the visual quality of the area and how the transmission line would destroy the natural and scenic beauty of the area.
- Wildlife—Commenters noted that the construction of the transmission line and access roads would destroy wildlife habitat and risk fatalities of migratory birds.
- Health and Safety—Commenters stated concerns for the health and safety of individuals living in close proximity to the proposed transmission line.

PUBLIC ALTERNATIVE DEVELOPMENT WORKSHOPS

After the internal and public scoping meetings, NPS held another set of public meetings regarding alternatives on August 17, 18, and 19, 2010, in Bushkill, Pennsylvania, Stroudsburg, Pennsylvania, and Lafayette, New Jersey, respectively. The public was invited to submit comments on alternatives from July 9, 2010, to September 14, 2010. During the public comment period, 1,700 separate pieces of correspondence from over 27 states and seven countries (United States, Germany, Egypt, India, Sweden, Turkey, and Italy) were received. The correspondence resulted in 3,342 substantive comments. Approximately 1,572 of the letters submitted were from individuals living within the proposed area for the S-R Line (Pennsylvania and New Jersey). Among the commenters from Pennsylvania and New Jersey, the topics that received the majority of the comments were expressions of support for or opposition to the proposed alternatives; concerns for vegetation, wildlife, and water quality; concerns about the health and safety of individuals living close to the proposed transmission line; and concerns regarding impacts to privately owned real estate.

The following were general concerns of the proposed alternatives:

- Overall scope of the project—Multiple comments were received suggesting that the parks and/or the applicant should explore other alternative means of energy production, including local generation, energy conservation, solar power, wind power, and new transmission technologies.
- The proposed alternative routes' cumulative effects on air and water pollution from the use of coal-fired generating plants.
- Either the need for the project is unclear or the project not necessary based on the decrease of energy demand within the local area.
- Homeowners/townships expressed concerns of the placement of the transmission line through populated areas. Safety concerns include the health of individuals, especially the children

attending schools along the proposed routes, the impact of construction on emergency vehicles, and cancer clusters.

- Homeowners are concerned about decreasing home values if the transmission line were to run through their neighborhoods.

- Impacts on the historic viewshed and historic sites, including the Parsippany Rock House, Old Mine Road, and Morris Canal.

- Impacts on visitor experience at the parks from the noise associated with the transmission line and construction equipment, in addition to the natural viewshed/scenery of the parks being destroyed.

- Clear-cutting would be required for the transmission line and access roads. Commenters are concerned that the removal of vegetation would destroy habitat for many wildlife species, create habitat fragmentation, increase soil erosion, and degrade the water quality of the Delaware River.

- The migratory bird flight line and corridor are located along the proposed transmission line routes. Commenters are concerned that there would be an increase in bird strikes.

- The alternate proposed routes would pass through other park lands, including Cherry Valley National Wildlife Refuge (NWR), Lehigh Gorge, and other state parks, which are used by many locals in the area. Commenters feel these areas should also be preserved.

- Wetlands would be impacted along the alternative routes due to destruction of the wetlands, alterations to hydrology, and filling of wetland areas.

- Mitigation should be required for all impacts on natural resources, including wildlife, vegetation, water resources, and wetlands.

PUBLIC COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

On November 21, 2011, the NPS released the draft EIS for the S-R Line for public review and comment. The draft EIS included a description of the proposed project and alternatives proposed, a description of the resources found within the study area, and an analysis of the impacts of the proposed project on these resources. The draft EIS was available for public review until January 31, 2012.

During the comment period, three public meetings were held in Pennsylvania and New Jersey from January 24 through 26, 2012. Meetings were held in Bushkill, Pennsylvania (January 24); Stroudsburg, Pennsylvania (January 25); and Lafayette, New Jersey (January 26). Each public meeting had an open house from 2:30 p.m. until 4:30 p.m. and a public hearing from 6:00 p.m. until 9:00 p.m. During the open house, the public was invited to look over the draft EIS and ask park staff questions regarding the draft EIS. The public hearing began with a meeting overview by the NPS project manager and welcome from the parks' superintendents. Formal public comment sessions were then recorded by a court reporter. The evening concluded with a return to the open house session. NPS staff were on hand to visit with meeting participants and to answer questions.

A total of 368 individuals attended the public comment meetings in Pennsylvania and New Jersey, and a total of 102 participants spoke during the formal public comment sessions. The number of participants and formal commenters at each meeting was as follows:

- Bushkill, Pennsylvania – 66 participants, 18 formal commenters
- Stroudsburg, Pennsylvania – 88 participants, 27 formal commenters
- Lafayette, New Jersey – 214 participants, 57 formal commenters

Nearly 27,000 pieces of correspondence from all 50 states, the District of Columbia, and 29 countries were received during the public comment period. Approximately 26,000 pieces of correspondence were form letters submitted by the National Parks Conservation Association and the Sierra Club. All form letters submitted by the National Parks Conservation Association and Sierra Club were read to determine if they contained any additional substantive material. Correspondences that did not contain any substantive material that differed from the form letter were included as a signature to the form letter. Correspondences with additional substantive text were considered individual correspondences. Of the correspondences submitted during the public comment process, 908 were not form letters. Of the 1,177 letters on PEPC, 896 were not associated with either the National Parks Conservation Association or Sierra Club form letter submittal.

Approximately 8,388 of the correspondences submitted were from individuals living within the proposed areas for the S-R Line (Pennsylvania and New Jersey), and of these, only 733 were not from the National Parks Conservation Association and Sierra Club submissions. After Pennsylvania and New Jersey, California, Florida, and New York were the states with the greatest number of submittals. Commenters who identified themselves as being outside the United States were mainly from Italy, France, Sweden, and Germany.

Among the comments received, a majority were expressions of support for the no-action alternative, general opposition to the project, and opposition to the proposed mitigation. Commenters cited concerns about impacts to natural and cultural resources and the visitor experience as reasons they did not support the proposed project.

These are some of the concerns expressed in the comments received (for an analysis of the correspondence received, please see appendix L):

- The project violates NPS mandates and policies to protect natural and cultural resources.
- Alternatives for routing and energy production – the park and/or applicant should explore other alternative means of energy production, including local generation, energy conservation, solar power, wind power, and new transmission technologies.
- The proposed project would result in cumulative effects to air and water pollution from the use of coal-fired generating plants.
- The need of the project is either unclear or is not necessary based on the decrease of energy demand within the local area.
- The scope of the project, including the study area, is not adequate to address the true impacts from the line.
- The methodology for establishing impacts was insufficient – commenters noted that the scope and/or method for impact analysis did not adequately assess the impacts of the proposed action.

- The width that would be needed for construction in alternative 2 is overestimated and the impacts should be reanalyzed with the narrower width.
- Visitor impacts – the proposed project would alter the experience of those who visit the parks, particularly from visual and sound impacts of the transmission line.
- Homeowners/townships expressed concerns about placing the transmission line through populated areas. Safety concerns include the health of individuals, especially children attending schools along the proposed routes, the impact of construction to emergency vehicles, and cancer clusters.
- Commenters are concerned that the removal of vegetation for the transmission line right-of-way (ROW) and the access roads would destroy habitat for many wildlife species, create habitat fragmentation, increase soil erosion, and degrade the water quality of the Delaware River.
- There is a migratory bird corridor that crosses the proposed transmission line routes. Commenters are concerned that there would be an increase in bird strikes.
- The alternate proposed routes would pass through other park lands including Cherry Valley NWR, Lehigh Gorge, and other state parks that are used by many locals in the area. Commenters feel these areas should also be preserved, and need to be included in the analysis.
- Wetlands would be impacted along the alternate routes due to destruction of the wetlands, alterations to hydrology, and from filling of wetland areas.
- Commenters suggested alternatives to the applicant's proposed mitigation, including additional specific measures for mitigation.
- Commenters expressed opposition to the applicant's proposed mitigation.
- Commenters expressed concern that cumulative impacts were not analyzed sufficiently.
- Commenters stated that alternatives 3, 4, and 5 are not viable alternatives.

AGENCY AND TRIBAL GOVERNMENT SCOPING

Consultation letters regarding the proposed S-R Line were mailed on February 1, 2010, March 29, 2010, June 7, 2010, and July 16, 2010, to local and federal agencies and Tribal government representatives requesting consultation and comments regarding the proposed project. A representative agency letter and representative Tribal government letter can be found in appendix I and appendix M, respectively. Table 63 presents the federal and state agencies and Tribal governments that received consultation letters regarding the S-R Line project. Responses received from the agencies on the consultation letters are discussed below in "Agency Meetings."

TABLE 63: LIST OF FEDERAL AND STATE AGENCIES AND TRIBAL GOVERNMENTS THAT RECEIVED CONSULTATION LETTERS REGARDING THE S-R LINE

Agency/Government Type	Agencies/Tribal Representatives
Federal agencies	Advisory Council on Historic Preservation National Oceanic and Atmospheric Administration-Fisheries Service U.S. Army Corps of Engineers U.S. Army Installation Management Command U.S. Forest Service U.S. Department of Defense U.S. Department of Energy U.S. Environmental Protection Agency U.S. Fish and Wildlife Service
State agencies	Delaware River Basin Commission New Jersey Board of Public Utilities New Jersey Department of Environmental Protection New Jersey Department of Transportation New Jersey Endangered and Nongame Species Program New Jersey Highlands Council New Jersey Natural Heritage Program New Jersey State Historic Preservation Office Pennsylvania Department of Conservation and Natural Resources Pennsylvania Department of Environmental Protection Pennsylvania Department of Transportation Pennsylvania Fish and Boat Commission Pennsylvania Game Commission Pennsylvania Historical and Museum Commission Pennsylvania Office of the Consumer Advocate Pennsylvania Public Utilities Commission
Tribal government representatives	Absentee-Shawnee Tribe of Indians of Oklahoma Delaware Nation Delaware Tribe Eastern Shawnee Tribe of Oklahoma Oneida Nation of Wisconsin Oneida Nation of New York Onondaga Nation of New York Saint Regis Mohawk Tribe of New York Seneca Nation of Indians Seneca-Cayuga Tribe of Oklahoma Shawnee Tribe of Oklahoma Stockbridge-Munsee Community Tonawanda Seneca Nation

AGENCY MEETINGS

On April 9, 2010, letters were sent out to 8 federal agencies, 16 state agencies, and 12 Tribal government representatives with information on an agency information session to be held with park staff on May 4, 2010, from 1:00 p.m. to 4:00 p.m. Six agencies—the New Jersey Highlands Council, U.S. Department of the Army, New Jersey Department of Environmental Protection (NJDEP), U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), and the Delaware River Basin Commission—attended the agency information session with one or more representatives, while the U.S. Environmental Protection Agency (USEPA), Pennsylvania Office of the Consumer Advocate, and NJDEP—and the Oneida Nation of New York also participated by phone. This meeting served as an agency scoping meeting, allowing each agency or government to present issues and concerns with the S-R Line project.

On May 20, 2010, a call was held between NPS and representatives from the Stockbridge-Munsee Community and The Delaware Tribe. The Tribal government representatives discussed what parts of the Delaware Water Gap National Recreation Area (DEWA) are important to their respective tribe and cultures and their concern with not having an opportunity to review resource reports before a preferred alternative was chosen.

A meeting was held on January 24, 2011, between USFWS, NPS, and the Department of the Interior. Topics discussed at this meeting included coordination between the three agencies for the S-R Line project and other projects moving forward, consultation under the Endangered Species Act, and the Avian Protection Plan for the S-R Line project.

On December 22, 2011, letters were sent to several tribes inviting representatives to attend an "on-site" tribal consultation for the S-R Line. Meetings were held January 23 through January 25, 2012, between the NPS, USFWS, and representatives from the Absentee Shawnee Tribe, the Eastern Shawnee Tribe of Oklahoma, the Delaware Tribe of Indians, the Delaware Nation, and the Stockbridge-Munsee Community. The meeting was an opportunity for the tribes to provide consultation on the proposed S-R Line project, and the potential impacts to park resources. Topics discussed at the meeting included an overview of the project and a discussion of concerns related to impacts, including impacts to wildlife, sacred sites, and burial ground concerns; the need to know pad locations; and a desire for more archeological work. All tribes present at the debriefing favored "Alternative 1: No Action." Consultation letters can be found in appendix M.

COOPERATING AGENCY

In a letter dated February 7, 2011, NPS invited USFWS to become a cooperating agency for this EIS. On March 14, 2011, USFWS responded and agreed to become a cooperating agency, pending a formal Interagency Agreement, and on April 1, 2011, NPS sent a request to USFWS to formalize the Interagency Agreement. These letters can be found in appendix I.

An initial letter was received by NPS on May 13, 2010, from USACE stating that USACE would participate as a cooperating agency. Upon further review, the USACE sent a letter to NPS on August 3, 2010, withdrawing their desire to be a cooperating agency on the project based on the current scope of the project and the permitting needs of the project. These letters can be found in appendix I.

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

Consultation with USFWS and National Oceanic and Atmospheric Administration (NOAA) Fisheries has been implemented as required by the Endangered Species Act and the Magnuson-Stevens Fishery Conservation and Management Act.

NPS has engaged with NOAA Fisheries with a formal consultation letter; on May 13, 2010, NPS received a response from NOAA Fisheries regarding the project. The letter stated that there are American shad between the Delaware Water Gap and the New York border; additionally, there may be also be shad in the Philadelphia reach of the river. Depending on further information regarding the transmission line crossing of the river, NOAA Fisheries may need to be consulted again. In addition, seasonal work restrictions should be incorporated into the project schedule for any work in the Delaware River. NPS received a response to the preliminary alternatives newsletter from NOAA Fisheries on July 22, 2010. The letter noted that while a population of an endangered species could be found in the Delaware River, the population was downstream of the NPS project area. NOAA Fisheries stated that as no listed species were found in the study area, further section 7 consultation would not be required. On January 31, 2012, the NPS received a letter from NOAA Fisheries indicating that NOAA had reviewed the draft EIS. The letter contained specific comments regarding the presence of the federally endangered shortnose sturgeon, federal candidate species Atlantic sturgeon, and the American shad within the project area during some periods of the year. However, NOAA Fisheries concluded that the detailed discussion of impacts to the river were discussed adequately in the draft EIS, and that no consultation would be required as part of the federal permit process. The letter recommended the use of best management practices (BMPs) to minimize turbidity and other water quality impacts. These letters can be found in appendix I.

After initial engagement of USFWS with a consultation letter, USFWS sent an initial response letter on June 11, 2010, regarding the project. The letter noted that the federally listed Indiana bat and bog turtle could be affected by the permit if specific permit conditions were not met. Migratory birds were also addressed, and USFWS provided recommendations on the draft Avian Protection Plan provided by PSE&G. Recommendations for all species included seasonal restrictions, mitigation measures, and additional surveys. NPS received a response to the preliminary alternatives newsletter from USFWS on September 3, 2010, and an additional response on October 21, 2010, with potential impacts of each alternative on federally listed species and suggested recommendations regarding listed species. In a letter dated January 10, 2011, NPS requested more information from USFWS on any federally listed species within the vicinity of the proposed alternatives within the park. The NPS sent a letter to the USFWS on November 16, 2011, requesting comments on the draft biological assessment (BA) and draft EIS for informal consultation. The USFWS replied to the letter indicating that the USFWS could not provide advice on the need for formal consultation, and noting that the USFWS cannot commit to completing consultation by May 2, 2012, as requested. The letter from the USFWS provided some comments on impacts and options on concluding consultation. Another letter received from the USFWS on January 31, 2012, included comments on the draft EIS and on impacts to the bog turtle, Indiana bat, bald eagle, and other migratory birds. These letters can be found in appendix I. Additionally, a copy of the draft BA was sent to USFWS on May 21, 2012.

Consultation with USFWS is ongoing.

SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT CONSULTATION

Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties, seeking to accommodate historic preservation concerns with the needs of federal undertakings through consultation between the agency and parties with an interest in the effects of the undertaking (36 CFR Part 800). The NPS is integrating compliance with Section 106 of the NHPA into the NEPA process and documentation pursuant to 36 CFR § 800.8(c).

A consultation letter was sent to New Jersey Historic Preservation Office (NJ HPO) and the Pennsylvania Historical and Museum Commission, which serves as the Pennsylvania State Historic Preservation Office (SHPO), on February 1, 2010, describing the proposed project. An email response from the NJ HPO on

June 22, 2010, indicated the interest of the NJ HPO in consulting for the project pursuant to section 106 and 36 CFR Part 800. This correspondence can be found in appendix M.

On July 30, 2010, a letter discussing the proposed alternatives was sent to the Tribal governments listed in table 91. The Delaware Nation, Delaware Tribe, Stockbridge-Munsee Community, and the Oneida Nation of New York agreed to be consulting parties. On August 16, 2010, NPS received a letter from the Delaware Tribe of Indians regarding agreement with the recommendations for the Phase I archeological surveys in New Jersey and Pennsylvania, and request to be a consulting party for the project. On August 17, 2010, The Delaware Nation wrote an email response to NPS expressing the opinion of the Cultural Preservation Officer that either alternative 6 or the no-action alternative would be the best course of action, and noting that the Delaware Tribe prefers to avoid DEWA. This correspondence can be found in appendix M.

On July 18, 2011, NPS sent a letter to the Tribal government representatives requesting information pertaining to: tribal laws and policies, ethnographic resources, and sacred and burial ceremonial sites. Meetings between the NPS and several tribes were held during an on-site consultation at DEWA on January 24-27, 2012 (appendix M). On April 17, 2012, NPS sent a letter to notify several tribes, the NJ HPO, the PA SHPO, and Advisory Council on Historic Preservation (ACHP) of the selection of alternative 2 as the preferred alternative. NPS sent an additional letter providing an update on the project and requesting additional consultation was sent on April 27, 2012.

On June 30, 2011, NPS sent a section 106 notification letter to the ACHP describing the proposed project and the current status. The ACHP sent a letter to the NPS on February 6, 2012, that noted the willingness of the ACHP to participate in consultation and development of a memorandum of agreement for the proposed S-R Line. The NPS provide the ACHP with resource reports on February 10, 2012, and sent a response letter to ACHP on February 27, 2012. These letters can be found in appendix M.

A letter announcing the release of the draft EIS was sent to SHPOs, the ACHP, and tribes on November 21, 2011; this letter also provided references to the historic property lists and effect determinations within the EIS for their comment under 36 CFR § 800.8(c). An additional consultation package was sent out on May 2, 2012 to the NJ HPO, PA SHPO, ACHP, and 12 tribes. An on-site consultation was held on May 24, 2012 with tribes at DEWA. The NPS sent a letter to the USFWS on May 31, 2012 regarding the concerns of tribes about impacts on the bald eagle from alternative 2 (appendix M).

Archeological Resources

The April 21, 2010, letter to NPS from the NJ HPO included comments and recommendations on several archeological sites discussed in the Phase I and Phase II archeological surveys. These recommendations included listing of certain sites with the New Jersey State Museum or National Register of Historic Places (National Register), further detailing of project plans in certain areas, and additional surveys and documentation at some sites. The overall conclusion by the NJ HPO was that the archeological survey did not include adequate subsurface testing to meet the NJ HPO Phase I archeological survey requirements (appendix I). A letter to NPS dated July 28, 2010, noted that further archeological investigations would be required at some sites, and that the NJ HPO wanted to consult on one site in particular site that may be eligible for the National Register (appendix I).

The Delaware Tribe Historic Preservation Office sent NPS a letter on August 10, 2010, noting that the office concurred with the recommendations of the Phase I archeological study, and noting that if certain sites cannot be avoided, a Phase II survey would be required. The Tribe Historic Preservation Office requested to continue consulting for the project (appendix I).

On January 12, 2012, the NPS received a letter from the NJ HPO providing consultation comments for the 2011 *Susquehanna to Roseland 500kV Transmission Project, Phase Ib and II Archeological and Geomorphological Investigations, End of Field Summary, The Delaware Water Gap National Recreation Area (NJ and PA).* The letter indicated that the NJ HPO anticipated that one archeological site may be eligible for inclusion on the National Register, and that the NJ HPO looks forward to receiving the report detailing the completion of the Phase I/II archeological testing. The NJ HPO sent the NPS a revised opinion on April 17, 2012 indicating the site identified in earlier letters would be eligible for inclusion on the National Register. The letter also summarizes other sites identified in the report, identified another site eligible for listing on the National Register, and provided comments on the need for continued consultation under Section 106. These letters can be found in appendix M.

Historic Structures

The April 21, 2010, letter from the NJ HPO also indicated that additional intensive-level surveys were needed for several properties, further research into the eligibility of several properties as historic district or cultural landscapes was necessary, and updates to some surveys would be needed (appendix M). An additional letter on August 31, 2010, from the NJ HPO included further comments on architectural surveys with further recommendations for intensive-level surveys at some properties (appendix M).

On August 15, 2011 letters were mailed along with CDs containing resource reports to the Tribal government representatives and SHPOs. Consultation with the SHPOs and Tribal government representatives is ongoing.

LIST OF RECIPIENTS

A copy of the draft EIS was provided to the following agencies and organizations. These agencies and organizations will also receive a copy of this final EIS. A notice of availability of the EIS has been sent to attendees of the public meetings, park partners, and others listed on the project mailing list.

ELECTED OFFICIALS AND COMMITTEES

- U.S. Senate New Jersey – Frank R. Lautenberg
- U.S. Senate New Jersey – Robert Menendez
- State Senate New Jersey District 24 – Steven V. Oroho
- State Senate New Jersey District 23 – Michael J. Doherty
- State Senate Pennsylvania – 18th District - Lisa Boscola
- State Senate Pennsylvania – 20th District - Lisa Baker
- State Representative Pennsylvania – 189th District - Rosemary Brown
- U.S. Senate Pennsylvania – Pat Toomey
- U.S. Senate Pennsylvania – Robert P. Casey
- U.S. Representative Pennsylvania – 11th District - Lou Barletta
- U.S. Representative New Jersey – 5th District - Scott Garrett
- U.S. Representative New Jersey – 11th District – Rodney P. Frelinghuysen
- U.S. Representative Pennsylvania – 10th District - Tom Marino
- State Representative Pennsylvania –139th District - Michael Peifer
- State Representative Pennsylvania – 137th District – Joe Emrick (Northampton Co / Upper Mt Bethel Township)
- U.S. Representative Pennsylvania –15th District - Charlie Dent
- Governor of New Jersey – Christopher Christie
- Governor of Pennsylvania – Thomas Corbett
- Office of the Governor, Pennsylvania, Director, Northeast Office

- Cong. Scott Garrett (NJ05)/District Coordinator – Gina Diorio
- Cong. Scott Garrett (NJ05)/Legislative Assistant – John Maniscalco
- Cong. Scott Garrett (NJ05)/Staff – Amy Nittolo
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- Mayor of Delaware Water Gap
- Mayor of East Stroudsburg
- Mayor of Hardwick Township –Kevin Duffy
- Mayor of Knowlton Township – Frank Van Horn
- Mayor of Matamoras
- Mayor of Milford
- Mayor of Montague Township – Joe Barbagallo
- Mayor of Newton
- Mayor of Portland
- Mayor of Sandyston – George Harper
- Mayor of Stillwater Township – William Morrison
- Mayor of Stroudsburg – Charlie Baughman
- Mayor of Sussex Borough
- Mayor of Walpack – Raymond Fuller
- Mayor of Wantage – Clara Nuss

FEDERAL AGENCIES

- Advisory Council on Historic Preservation
- Federal Highway Administration – Eastern Federal Lands Highway Division
- National Marine Fisheries Service
- U.S. Army Corps of Engineers
  - Baltimore District, Regulatory Branch
  - New York District, Regulatory Branch
  - Philadelphia District, Regulatory Branch
- U.S. Coast Guard
- U.S. Department of Agriculture
  - Grey Towers National Historic Site
  - U.S. Forest Service
- U.S. Department of the Army
  - Picatinny Arsenal
- U.S. Department of Commerce
  - National Oceanic and Atmospheric Administration (NE Regional Office)
- U.S. Department of Defense
- U.S. Department of Energy
  - Office of Electricity Delivery and Energy Reliability
- U.S. Department of the Interior
  - Office of Environmental Policy and Compliance
    - Boston, Massachusetts
    - Philadelphia, Pennsylvania
- U.S. Environmental Protection Agency
  - Environmental Review Section, Region 2
  - Region 2
  - Region 2, Watershed Management Branch
  - Region 3, Office of Environmental Programs
  - Section II
  - Section III
- U.S. Fish and Wildlife Service
  - New Jersey Field Office
  - Pennsylvania Field Office
  - Wallkill River, Great Swamp and Cherry Valley National Wildlife Refuges
- U.S. Forest Service
  - Washington, DC
- U.S. Geological Survey
  - Delaware River Master

INDIAN TRIBES

- Absentee Shawnee Tribe of Indians of Oklahoma
- Eastern Shawnee Tribe of Oklahoma
- Oneida Indian Nation of New York
- Onondaga Indian Nation
- Saint Regis Mohawk Tribe, New York
- Seneca Nation of Indians
- Seneca Nation Tribal Historic Preservation Office
- Seneca-Cayuga Tribe of Oklahoma
- Shawnee Tribe, Oklahoma
- Stockbridge-Munsee Community
- The Delaware Nation
- Tonawanda Seneca Nation Office

STATE AND LOCAL AGENCIES

New Jersey

- New Jersey Board of Public Utilities – Siting Approval Office
- New Jersey Department of Commerce
- New Jersey Department of Environmental Protection
  - Department Natural and Historic Protection, Office of Natural Resource Restoration
  - Division of Fish and Wildlife
  - Division of Land Use Regulation
  - Division of Natural Heritage Program
  - Division of Parks & Forestry
    - High Point State Park
    - Stokes State Forest
    - Worthington State Forest
  - Division of Watershed Management
  - Division of Water Quality
  - Geological Survey Bureau of Water Resources
  - New Jersey Historic Preservation Office
- New Jersey Department of Transportation
  - Northern District
- New Jersey Endangered and Nongame Species Program
  - Division of Fish and Wildlife
- New Jersey Highlands Council
- New Jersey Natural Heritage Program - Office of Natural Lands Management
- New Jersey Office of Permit Coordination and Environmental Review
- New Jersey Public Advocate
- New Jersey State Police

Pennsylvania

- Pennsylvania Department of Conservation and Natural Resources
  - Bureau of Forestry, District 19
  - Pennsylvania Natural Heritage Program
- Pennsylvania Department of Environmental Protection
  - Northeast Regional Office
- Pennsylvania Department of Transportation
  - District 4
  - District 5
- Pennsylvania Department of Transportation
  - I-84 Welcome Center in Matamoras
  - PennDOT I-80/DWG Welcome Center
- Pennsylvania Environmental Council
- Pennsylvania Fish and Boat Commission
  - Environmental Service Division
- Pennsylvania Game Commission
  - Bureau of Wildlife Management
  - Northeast Region
- Pennsylvania Historical and Museum Commission
- Pennsylvania Natural Heritage Program
- Pennsylvania Office of Consumer Advocate
- Pennsylvania Public Utility Commission
- Pennsylvania State Police

Counties

- Monroe County
  - Commissioners
  - Conservation District
  - Historical Association
  - Planning Commission
- Northampton County
  - Council
  - Executive
- Pike County
  - Chamber of Commerce
  - Conservation District
  - Historical Society
  - Office of Community Planning
  - Commissioners
- Sussex County
  - Board of Chosen Freeholders
  - Chamber of Commerce
  - Division of Planning
  - Office of Roads
  - Soil Conservation District
- Warren County
  - Chamber & Business Association
  - Department of Economic Development
  - Freeholders
  - Planning Department
  - Road Department
  - Soil Conservation District

Local

- Blairstown Township
- Branchville Borough
- Delaware Township Supervisors
- Delaware Water Gap Borough
- Dingman Township Supervisors
- East Stroudsburg Borough
- Knowlton Township
- Lehman Township Supervisors
- Matamoras Borough Supervisors
- Middle Smithfield Township
  - Planning Commission
  - Supervisors
- Milford Borough Supervisors
- Milford Township Supervisors
- Montague Township
- Portland Borough
- Sandyston Township
- Smithfield Township Supervisors
- Stillwater Township
- Stroud Township Supervisors
- Stroudsburg Borough
- Upper Mt. Bethel Township Supervisors
- Walpack Township
- Westfall Township Supervisors

Other

- Association of New Jersey Environmental Commission
- Community and Environmental Defense Services
- Delaware River Basin Commission
- Delaware River Greenway - Heritage Conservancy
- DRJTBC Delaware Water Gap
- DRJTBC Milford-Montague
- Emporia State University – Department of Sociology and Anthropology
- Greater Pocono Chamber of Commerce
- National Resources Defense Council
- Skylands of New Jersey Tourism Council
- Tri-State Chamber of Commerce
- Upper Delaware Citizens Advisory

PUBLIC UTILITIES

- Atlantic City Electric
- Jersey Central Power and Light
- Orange and Rockland Utilities, Inc.
- PJM Interconnection L.L.C.
- PPL Electric Utilities
- Public Services Electric and Gas

ORGANIZATIONS AND PARTNERS

- Adventure Sports Canoe & Raft Trips
- Allentown Hiking Club
- AMC - Mohican Outdoor Center
- American Canoe Association Inc.
- Appalachian Mountain Club
- Appalachian Trail Conservancy
- Audubon Pennsylvania
- BL Companies - NEPA Compliance, Cultural Resources Management
- Bushkill Outreach
- Camp Taylor Campground
- Chamberlain's Canoes
- Davis Chant Realtors
- Delaware Highlands Conservancy
- Delaware River Rafting & Canoeing
- Delaware Riverkeeper Network
- Delaware Valley Conservation Association
- Delaware Water Gap Welcome Center
- Delaware Water Gap/Tourist Information Counselor
- Dingmans Campground
- Dingmans Choice and Delaware Bridge
- Eastern National
- Fairview Lake YMCA Camps – Environmental Education
- Fernwood-Bushkill Group
- Friends of Delaware Water Gap NRA
- Kayak East
- Kennett Township Land Trust
- Kittatinny Canoes
- Matamoras Welcome Center
- Millbrook Village Society
- Montague Association for Restoration of Community History
- Montague Grange
- National Parks Conservation Association
- National Parks Traveler
- Natural Lands Trust
- New Jersey Audubon
- New Jersey Skylands
- New York-New Jersey Trail Conference
- Pack Shack Adventures
- Pennsylvania Association of Land Trusts
- Peters Valley Craft Center
- Pocono Environmental Education Center
- Pocono Heritage Land Trust
- Pocono Mountain Convention & Visitor Bureau
- Shawnee Development Co.
- Shawnee Inn & Golf Resort
- Shawnee River Adventures (Shawnee Inn)
- Sierra Club
- Silver Canoe Rentals
- Skylands Visitor
- Stop The Lines!
- The Nature Conservancy (Pennsylvania and New Jersey)
- The Paul F. Brandwein Institute, Inc.
- Walpack Historical Society
- Walpack Inn
- Wildlands Conservancy
- Wildlife Preserve, Inc. – Gateway One
- YMCA Camp Ralph Mason

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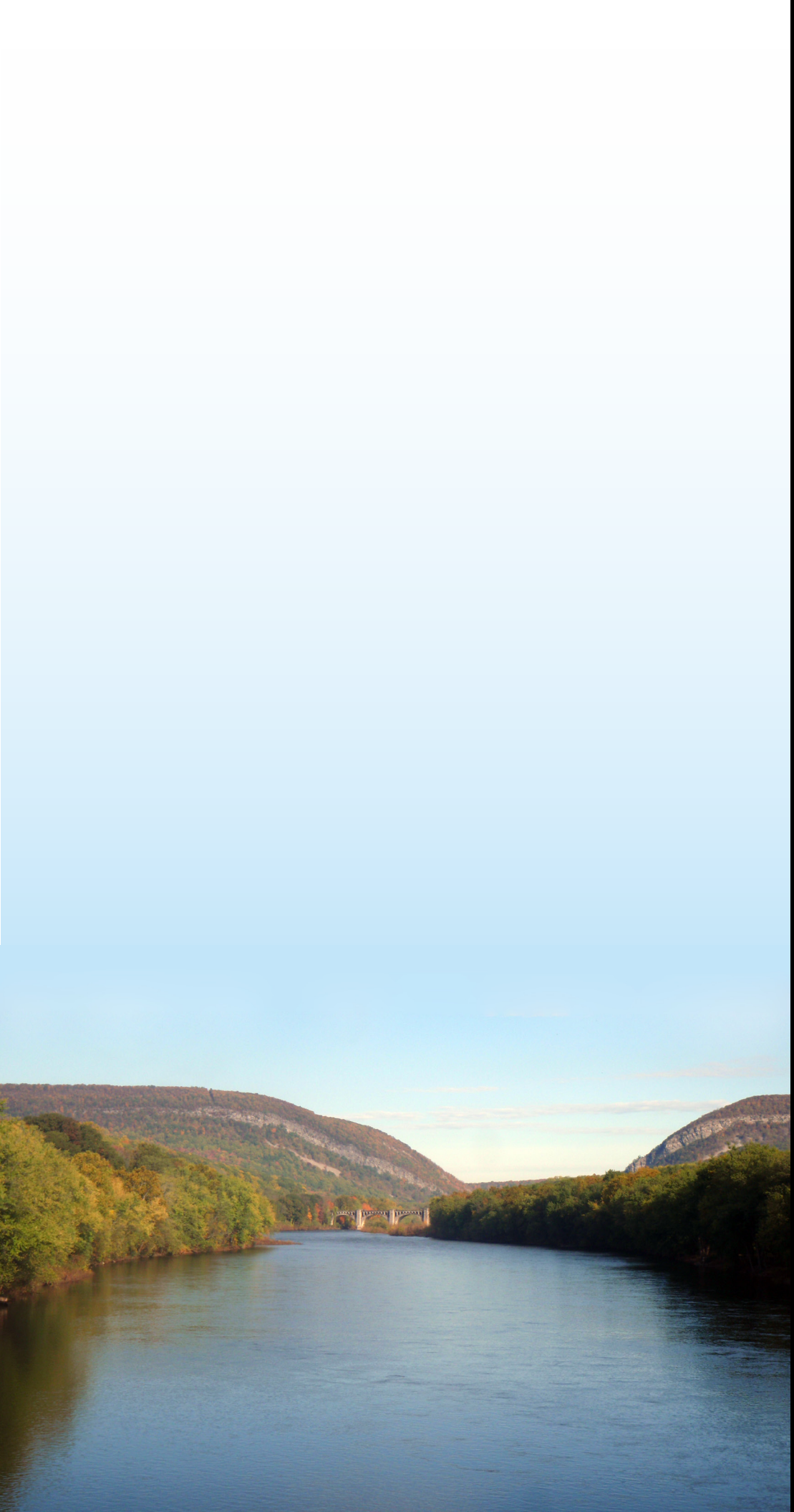


Glossary

GLOSSARY

abundance—Relative degree of plentifulness.

action alternative—An alternative that would involve a change from existing conditions, including changes to established trends or management direction.

affected environment—Term used in the National Environmental Policy Act to denote surface or subsurface resources (including social and economic elements) within or adjacent to a geographic area that could potentially be affected by a proposed action; the environment of the area to be affected or created by the alternatives under consideration. (40 CFR § 1502.15).

alternative—Combination of management prescriptions applied in specific amounts and locations to achieve desired management goals and objectives.

amphibian—Any of a class (Amphibia) of cold-blooded vertebrates intermediate between fishes and reptiles and having gilled aquatic young and air-breathing adults.

anemometer—Device used to measure wind speed.

aquatic environment—Marine, estuarine, or freshwater resources that support animal and plant species.

aquatic resources—Waterbodies and the flora and fauna within them.

aquifer—An underground layer of permeable rock that is capable of storing and transmitting water.

archeological resources—Any material remnants or physical evidence of past human life or activities of archeological interest, including the record of the effects of human activities on the environment. They are capable of revealing scientific or humanistic information through archeological research. Any material remnants of human life or activities at least 100 years of age, and of archeological interest (32 CFR § 229.3(a)).

area of potential effect—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]).

artifact—An object created by humans, usually for a practical purpose, that remains from a particular period.

Bald and Golden Eagle Protection Act—The Act, enacted for bald eagles in 1940 and amended in 1962 to include golden eagles, prohibits the take, transport, sale, barter, trade, import and export, and possession of eagles, making it illegal for anyone to collect eagles and eagle parts, nests, or eggs without a permit.

bedrock—Solid, unweathered rock beneath surface deposits of soil.

benthic macroinvertebrate—An organism without a spine that lives in the bottom of a body of water. Includes crustaceans, flatworms, and other species, many of which are vital food sources for birds.

best management practices (BMPs)—BMPs are state-of-the-art mitigation measures to help ensure that energy development and operations are conducted in an environmentally responsible manner. BMPs can be simple, such as choosing a paint color that helps oil and gas equipment blend in with the natural surroundings, while others involve cutting-edge monitoring and production technologies.

brackish water—Slightly saline water (between 0.5 and 30 ppm of salt) that often results from the mixing of freshwater and seawater.

chert—A hard, dark, opaque rock composed of silica with a fine-grained texture.

Code of Federal Regulations—The codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government.

coliform—Of or related to the rod-shaped bacteria (as E. coli) normally present in the intestine.

contiguous forest—Area of unfragmented, forested land with little or no human development such as roads, buildings, parking lots.

contiguous habitat—Unfragmented habitat. Particularly important for those species who have difficulty crossing from one chunk of habitat to another.

Council on Environmental Quality—As provided by NEPA, the Council on Environmental Quality (CEQ) was established in the executive office of the President. CEQ is composed of three members appointed by the President with the advice and consent of the Senate. The council is to "analyze and interpret environmental trends and information of all kinds; to appraise programs and activities of the Federal Government in the light of the policy set forth in subchapter I of this chapter; to be conscious of and responsive to the environmental, economic, social, esthetic, and cultural needs and interests of the Nation; and to formulate and recommend national policies to promote the improvement of the quality of the environment."

crackling—Noise produced by high-voltage power lines caused by the electric field the power line generates by carrying electricity. The sound may be louder if there is increased moisture or pollutants in the air.

critical habitat—The specific areas within the geographical area occupied by the species at the time it is listed in accordance with the provisions of Section 4 of the Endangered Species Act, on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species at the time it is listed…upon a determination by the Secretary that such areas are essential for the conservation of the species.

cultural landscapes—Combinations of elements including vegetation, earthworks, roads, paths, buildings, views, and other man-made and natural features that truly represent or suggest a particular event or time period.

cultural resources—Archeological, traditional, and built environment resources, including cultural landscapes.

dissolved oxygen—Oxygen saturation; a relative measure of the amount of oxygen dissolved or carried in water.

ecology—The pattern of relations between organisms and their environment.

ecosystem—The complex of a community of organisms and its environment functioning as an ecological unit.

electric fields—The spaces surrounding charged particles which exert a force on other charged objects.

elongate hemlock scale—A serious armored scale insect pest of hemlock. Scales injure host plants by inserting their threadlike, piercing-sucking mouthparts into needles and withdraw vital nutrients necessary for plant growth from mesophyll cells. Armored scale insects do not feed on the contents of vascular cells. Excessive loss of plant fluid reduces the growth and health of the plant.

encroachment—Invasion of natural habitat by nonnative, invasive vegetation or by human construction or development.

Endangered Species Act of 1973 (ESA)—Provides for the conservation of threatened and endangered species of fish, wildlife and plans, and the critical habitat upon which threatened and endangered species depend.

endangered species—Any species that is in danger of extinction throughout all or a significant portion of its range, other than pests whose protection would present a risk to man (ESA of 1973, Public Law 93–205).

Executive Order 11988, Floodplain Management—States that an action class and applicable regulatory floodplain must be identified for any proposed action that may be harmed by flooding or has the potential for adverse floodplain impacts.

exotics—Non-native and/or invasive plant animal species.

fault—A crack in the earth's crust marked by discontinuity of strata on either side.

Federal Register—Published by the Office of the Federal Register, National Archives and Records Administration (NARA), the Federal Register is the official daily publication for rules, proposed rules, and notices of federal agencies and organizations, as well as executive orders and other presidential documents (http://www.gpoaccess.gov/fr/).

federally listed endangered species—An endangered species is one that is in danger of extinction throughout all or a significant portion of its range. Before a species can receive protection under the Endangered Species Act, it must first be placed on the federal list of endangered species. All actions leading up to and including listing of a species as endangered are published in the Federal Register (USFWS Endangered Species Program).

fire roads—Periodically maintained and bladed roads, classified as driveable firebreaks, which are opened prior to the fire season to provide administrative and emergency access to strategic or remote locations.

flora—Plant life characteristic of a region.

forage—*noun* Plant material (mainly plant leaves and stems) eaten by browsing animals.

forage—*verb* To search (as animal) for food; browse.

fragmentation of habitat—Breaking up an organism's habitat into discontinuous chunks, particularly for organisms that have difficulty moving from one of those chunks to another.

geographic information system (GIS)—Any system that captures, stores, analyzes, manages, and presents data that are linked to location.

geological resources—A naturally occurring solid, liquid, or gas that is known or thought to exist in or on the Earth's crust in concentrations that make extraction economically feasible, either at present or at some time in the future.

habitat alteration—Alteration of habitat occupied by unique or sensitive species can include trampled vegetation, altered or eroded soils, inadvertently introduced non-native species of plants, and increased potential for predators. Some wildlife species are highly vulnerable to even slight changes in habitat.

habitat—The place or environment where a plant or animal naturally lives. Can be classified as nesting habitat, foraging habitat, wintering habitat, and other life-cycle divisions.

hemlock woolly adelgid—A true bug that feeds by sucking sap from hemlock trees. In eastern North America it is a destructive pest that poses a major threat to the eastern hemlock and the Carolina hemlock (*Tsuga caroliniana*). The presence of hemlock woolly adelgid can be identified by its egg sacs, which resemble small tufts of cotton clinging to the underside of hemlock branches. The hemlock woolly adelgid feeds on the phloem sap of tender hemlock shoots. It appears to also inject a toxin while feeding.

historic structures—Buildings or other man-made structures representative of a particular period in history.

human-made features—Characteristics of places and regions constructed by people as opposed to natural features such as buildings, roads, and bridges.

hydric soil—A soil formed under conditions of flooding, saturation, or ponding long enough to develop anaerobic conditions.

impacts—The likely effects of an action upon specific natural, cultural, or socioeconomic resources. Impacts may be beneficial, or adverse and direct, indirect, and / or cumulative.

impairment—As defined in NPS Management Policies, "impairment" means an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values including the opportunities that otherwise would be present for the enjoyment of those park resources and values.

impede—Hinder; discourage; prevent.

implementation—Carrying out, putting into practice (as a rule or alternative).

incubation—The act or process of hatching eggs with the adults warming and protecting them by sitting on them (brooding).

Indian Trust Resources—Indian trust assets are owned by Native Americans but held in trust by the United States. Since the lands within the park boundaries are not held in trust by the Secretary of the Interior for the benefit of Indians, this topic was dismissed from discussion in this plan/EIS.

infrastructure—System of public works (e.g., roads, sanitation, water); one of the socioeconomic links shared by the community.

interdisciplinary team—A group of individuals with varying areas of specialty assembled to solve a problem or perform a task.

interpretive—Using a teaching technique that combines factual information with stimulating explanatory content. Part of the range of experiences a visitor might have is using a park's interpretative or educational services via internet access, library, or at a park site.

interspersed—Separated by others, not continuous.

invasive species—Usually nonnative species, which can outcompete native species for habitat and resources.

knoll—A small, rounded hill.

landform—A natural feature of a land surface. Where unnatural landforms occur, they can indicate the presence of buried cultural resources.

lease—A legal document executed between a landowner, as lessor, and a company or individual, as lessee, that grants the right to develop the premises for minerals or other products.

loam—Soil containing 7 to 27% clay, 28 to 50% silt, and 23 to 52% sand by volume.

magnetic field— A condition found in the region around a magnet or an electric current, characterized by the existence of a detectable magnetic force at every point in the region and by the existence of magnetic poles.

management policies—The NPS *Management Policies* set the basic servicewide policy of the National Park Service. They provide the overall foundation, set the framework, and provide direction for management decisions within the National Park Service.

mandate—Because conservation remains its predominant mandate, the NPS seeks to avoid or to minimize adverse impacts on park resources and values.

marsh—A tract of soft, wet land usually characterized by monocotyledons (e.g., grasses, cattails).

Migratory Bird Treaty Act of 1918—A law making unlawful the kill, capture, buy, sell, import, or export of migratory birds, eggs, feathers, or other parts.

migratory birds—Birds that move periodically from one region to another for feeding, breeding, or wintering.

mitigation—"Mitigation" as defined in the National Environmental Policy Act (40 CFR § 1508.20), includes: avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action and its Implementation; rectifying the impact of repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; compensating for the impact by replacing or providing substitute resources or environments.

monopoles—A hypothetical particle with a single electric charge or magnetic pole instead of the usual two.

National Environmental Policy Act (NEPA)—An environmental law enacted in 1969 that established a national policy promoting the enhancement of the environment and also established the President's Council on Environmental Quality (CEQ). The most significant effect of NEPA was to set up procedural requirements for all federal government agencies to prepare environmental impact statements.

National Historic Preservation Act—A law enacted in 1966 that requires federal agencies to consider the effects of their undertakings on properties listed or potentially eligible for listing on the National Register of Historic Places. All actions affecting the parks' cultural resources must comply with this legislation.

Native American—Any of the indigenous peoples living within the United States.

native plant communities—Interdependent complexes of naturally occurring vegetation, which nourish native wildlife and which require specific soil conditions and other habitat characteristics to survive.

Neotropical migrant birds—Birds that breed in North America during the spring and early summer and spend the winter in Mexico, the Caribbean, and Central and South America. There are more than 200 species of Neotropical migrants, including songbirds, shorebirds, waterfowl, and some raptors such as hawks and vultures.

No-action alternative—An alternative that maintains established trends or management direction.

nonrenewable resources—Resources that cannot be produced or used on a scale that can sustain consumption. Once used, these resources can be replaced only after a considerable span of geologic time.

notice of intent—A notice of intent is a formal notice that an action will occur.

Organic Act of 1916—Established the National Park Service. The Act requires conservation of park scenery, natural and historic objects, and wildlife, and provision for the enjoyment of park resources in such a manner as to leave them unimpaired for the enjoyment of future generations.

organisms—Plants and animals, bacteria, and other living things.

paleontological resources—Fossil remains of life forms from past geological periods.

palustrine wetlands—All nontidal wetlands dominated by trees, shrubs, persistent emergent plants, or emergent mosses or lichens, as well as small, shallow open-water ponds or potholes. Often called swamps, marshes, potholes, bogs, or fens.

perennial—Persisting for several years, usually with new herbaceous growth.

pesticide—An agent, usually chemical, used to destroy pests. Pesticides have been detected in some of the waterbodies in the park.

physiographic province—A geographic region with a specific geomorphology and often specific subsurface rock type or structural elements.

population viability—The state of numbers and health at which a wildlife population is able to remain self-sustaining and continue to survive.

predation—Hunting and killing of prey by predators.

propagation—Increasing in numbers or area, usually by reproduction (plants).

raptors—Birds of prey; any bird that hunts other animals.

Regulations—Rules or orders prescribed by federal agencies to regulate conduct, and published in the Code of Federal Regulations.

revegetation—Reestablishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance, such as seedbed preparation, reseeding, and mulching.

Right of Way (ROW)—Strip of land in which the transmission line exists. The land is used by an electric utility to construct, maintain, or repair transmission line.

riparian—Related to, living on, or located on the bank of a natural watercourse.

riverine wetlands—Wetlands formed by and found alongside rivers. See **wetlands**.

sacred sites—Native Americans believe that certain areas of land are holy. Many of these places are fragile and have been adversely impacted by too many visitors or vehicles or activities.

sandstone—A sedimentary rock composed mainly of sand-sized minerals or rock grains.

scoping—Scoping is a process during the initial phase of project planning to seek input from a variety of sources. This input is used to identify issues, areas requiring additional study, alternative methods and locations, and topics to be analyzed in the National Environmental Policy Act document. Scoping is done internally with National Park Service staff and externally with the interested public, other agencies, and stakeholders.

Scrub shrub—A community characterized by woody vegetation less than 20 feet tall accounting for at least 30% of the vegetation.

Secretary of the Interior—Head of the Department of the Interior, which oversees such agencies as the Bureau of Land Management, the U.S. Geological Survey, and the National Park Service. The Secretary also serves on and appoints the private citizens on the National Park Foundation board and is a member of the President's Cabinet.

sediment—Particles of organic and mineral matter that settle to the bottom of a waterbody.

sensitive habitat—Natural communities that provide habitat for plant or animal species and that are particularly susceptible to human and other-related impacts. Species dependent on these habitats may suffer direct impacts from trampling and off-trail use of dunes and other fragile habitats.

shale—A fine-grained, clastic sedimentary rock composed of mud.

shear—A splitting force caused by tangential pressure.

socioeconomics—Relating to a combination of social and economic factors.

soundscapes—The overall auditory character of an area.

special-status species—Plant and animal species federally or state listed as endangered or threatened, or otherwise judged to be in need of protection.

special use permit—An exception to zoning regulations to allow special uses where they are not automatically allowed.

stewardship—Careful and responsible management of something entrusted to one's care.

surficial—Pertaining to or occurring on or near the earth's surface.

terrestrial forests—Area of land with a high density of trees.

terrestrial habitats—Land habitats, as distinct from freshwater and marine habitats.

terrestrial vegetation—Plants that have adapted to living on land.

terrestrial wildlife—Non-domesticated plants, animals, and other organisms that live on land.

threatened species—Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

topography—The configuration of a surface including its relief and the position of its natural and man-made features.

trail corridor—The area immediately surrounding and including the trail; invariably wider than the trail itself. Various factors influence the width of the trail corridor, including safety considerations, jurisdictional issues, and topography.

transmission line—Structure that is used to move large quantities of power at high voltage between generating or receiving point and major substations.

turbidity—Quality of being thick or opaque with roiled sediment.

understory—Layer of vegetation between the forest canopy (or top shrub layer) and the groundcover. Understory is an important wildlife habitat component of many tree- and shrub-dominated plant communities.

urbanized—Having taken on the characteristics of a city; nonrural.

U.S. Department of the Interior—The U.S. federal executive department that includes the National Park Service and the U.S. Fish and Wildlife Service, among other bureaus.

visual split location (VSL)—The first point at which the applicants would have a choice of routes for the transmission line outside the study area.

groundwater contamination—Contamination of a waterbody by introduction of microorganisms by wild birds and wild mammals.

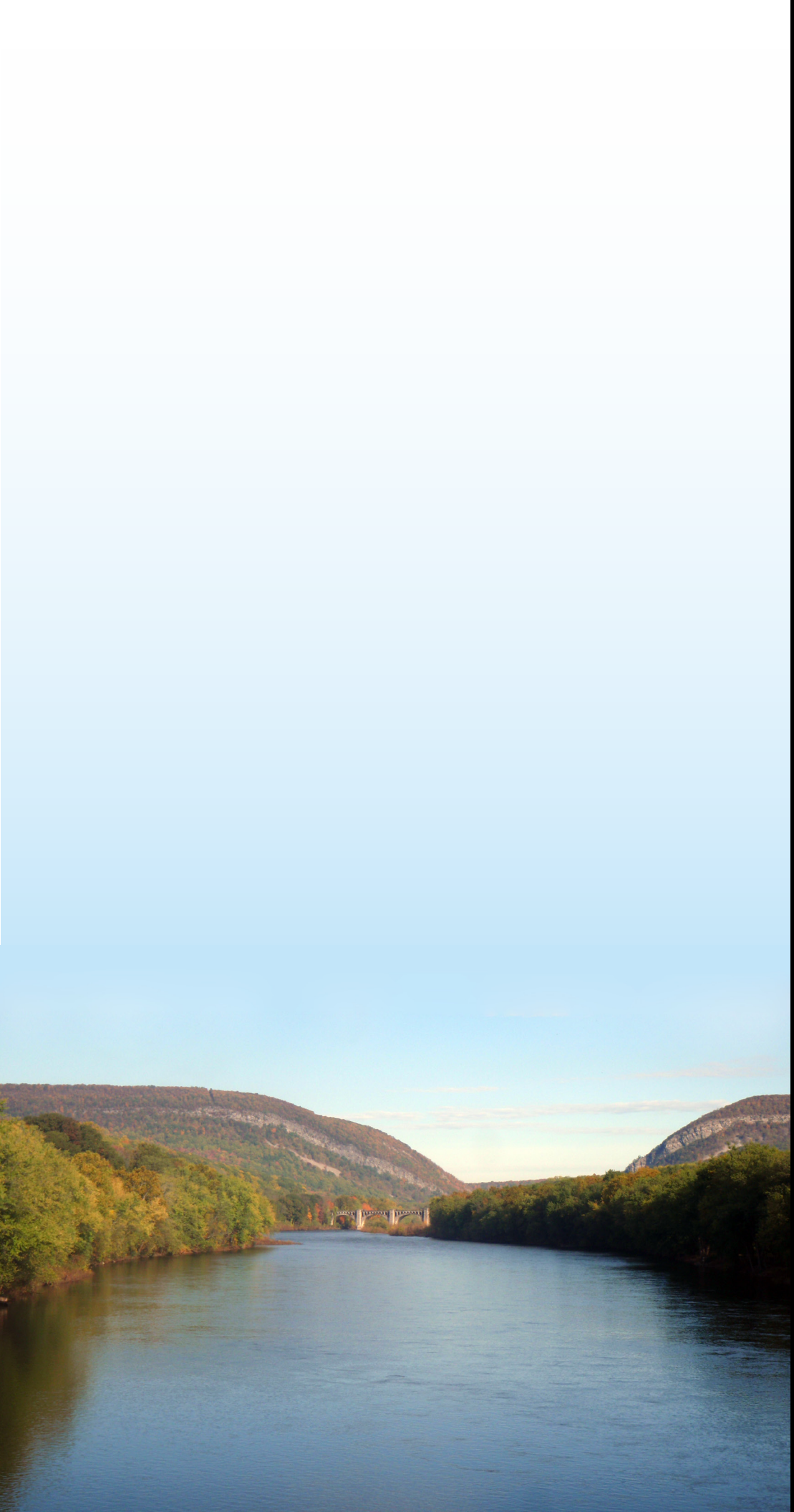
watercourses—Streams of water (rivers, brooks, underground streams, etc.).

wetlands—Lands transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is covered by shallow water.

Wild and Scenic Rivers—A river designated under the National Wild and Scenic Rivers Act (Public Law 90-542; 16 USC § 1271 et seq.) as having outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. Rivers may be designated by Congress or, if certain requirements are met, the Secretary of the Interior. Each river is administered by either a federal or state agency. Designated segments need not include the entire river and may include tributaries.

wildlife habitat—Environment in which organisms live and ideally provides elements needed for life and growth: food, water, cover, and space.

wintering habitat—Areas used by migratory birds during the winter; birds often return to the same wintering grounds year after year.



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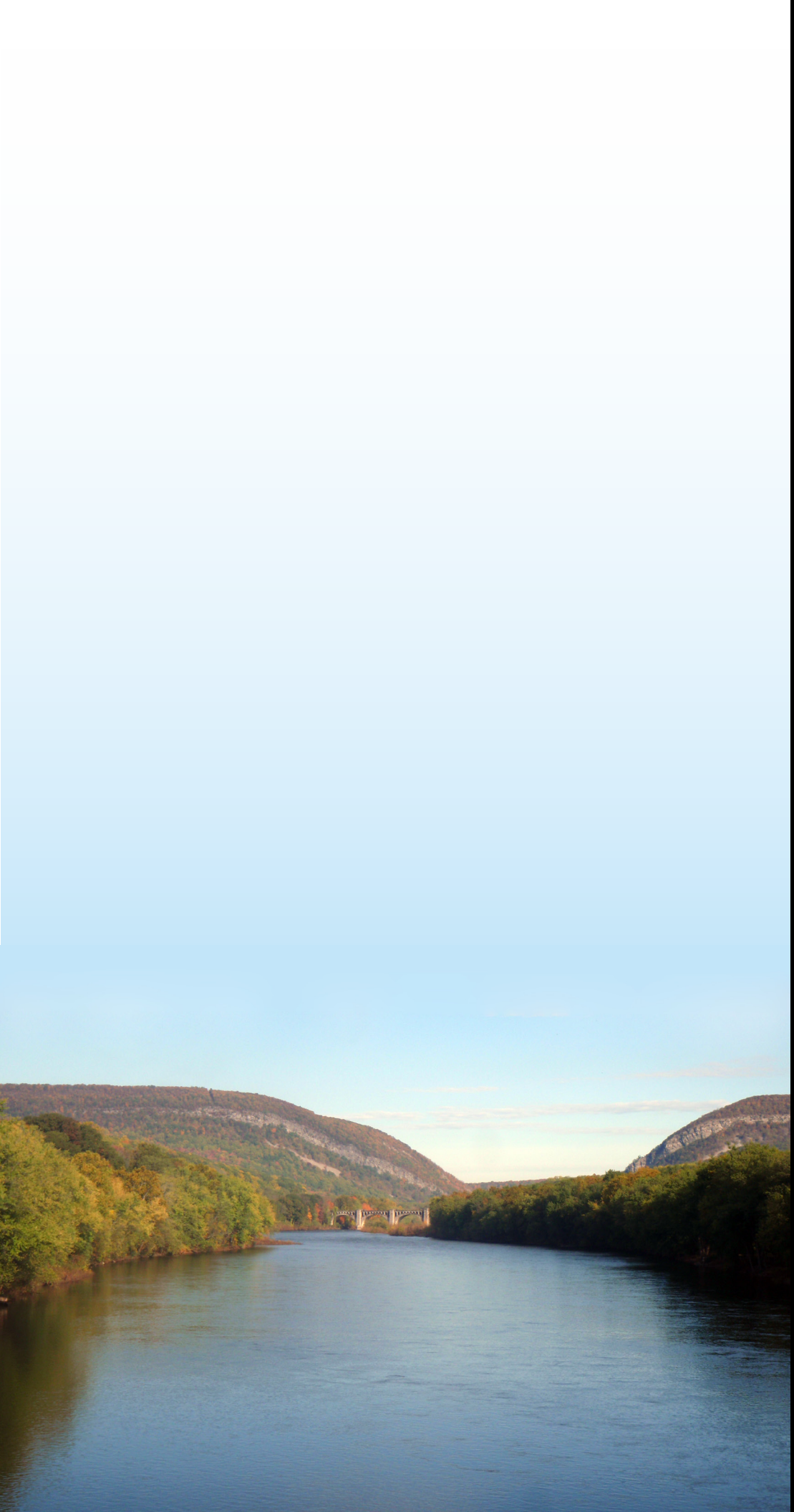

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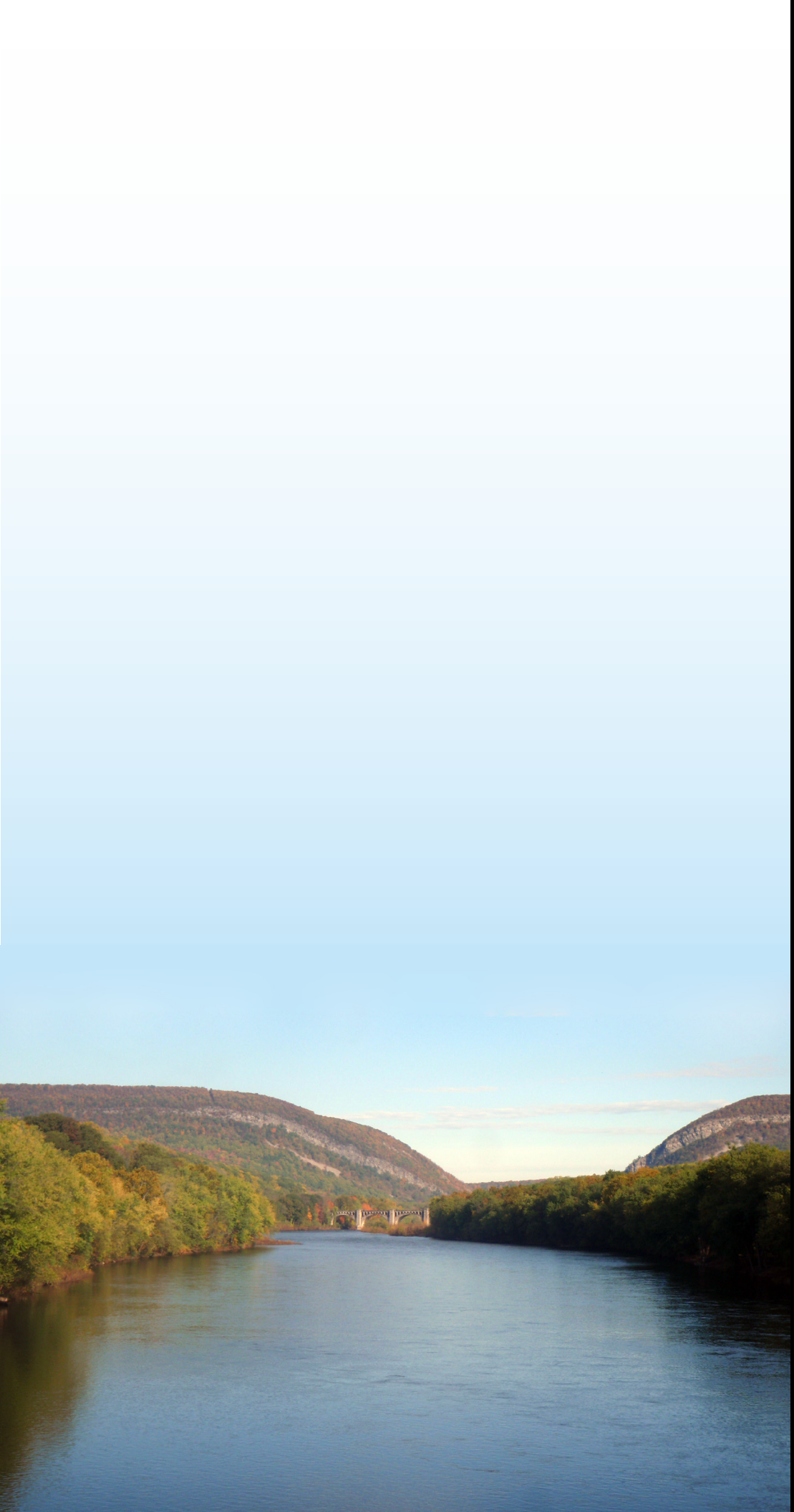


Appendix A

Legislation Authorizing
the Establishment of:

Delaware Water Gap
National Recreation Area

Middle Delaware National
Scenic and Recreational River

Appalachian National Scenic Trail

APPENDIX A:
LEGISLATION AUTHORIZING THE ESTABLISHMENT OF DELAWARE WATER GAP NATIONAL RECREATION AREA MIDDLE DELAWARE NATIONAL SCENIC AND RECREATIONAL RIVER APPALACHIAN NATIONAL SCENIC TRAIL

Public Law 89-158
89th Congress H.R. 89
September 1, 1965

An Act
To authorize establishment of the Delaware Water Gap National Recreation Area, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in order to further the purposes of the joint resolution approved September 27, 1961 (re Delaware River Basin compact; 75 Stat. 688), and to provide in a manner coordinated with the other purposes of the Tocks Island Reservoir project, for public outdoor recreation use and enjoyment of the proposed Tocks Island Reservoir and lands adjacent thereto by the people of the United States and for preservation of the scenic, scientific and historic features contributing to public enjoyment of such lands and waters, the Secretary of the Interior is authorized, as herein provided, to establish and administer the Delaware Water Gap National Recreation Area, hereinafter referred to as the "area", as part of the Tocks Island Reservoir project, hereinafter referred to as "the project".

SEC. 2. (a) The Secretary of the Army is authorized and directed to acquire, by such means as he may deem to be in the public interest, and as a part of this acquisition of properties for the project, lands and interests therein within the boundaries of the area, as generally depicted on the drawing entitled "Proposed Tocks Island National Recreation Area" dated and numbered September 1962, NRATI- 7100, which drawing is on file in the Office of the National Park Service Department of the Interior. In acquiring these lands, the Secretary of the Army may utilize such statutory authorities as are available to him for the acquisition of project lands: *Provided,* That the Secretary of the Army shall acquire no lands or interests in land by exchange for lands or interests in land in Federal ownership unless the latter are in the States of Pennsylvania, New Jersey, or New York. Periodically, and as soon as practicable after such lands and interests within the area are acquired, the Secretary of the Army shall transfer jurisdiction thereover to the Secretary of the Interior for the purposes of this Act

(b) Notwithstanding the provisions of subsection (a) of this section, the Secretary of the Interior is authorized, after consultation with appropriate public officials of the affected political subdivisions of the States of Pennsylvania or New Jersey, as the case may be, to designate not more than three hundred acres adjacent and contiguous to the Borough of Milford, Pennsylvania, and not more than one thousand acres in Sussex County, New Jersey, for omission from the Delaware Valley National Recreation Area and the lands so designated shall not be acquired, for said national recreation area under authority of this Act.

(c) The Secretary of the Interior shall investigate, study, and report to the President and the Congress on the feasibility and usefulness of I extending the boundaries of the Delaware Water Gap National Recreation Area to include, in whole or in part, that portion of Tocks Island Reservoir which lies upstream from the northern terminus of the national recreation area as shown on the map hereinbefore referred to and lands adjacent to said portion of said reservoir. No such extension of boundaries, however, shall be made until authorized by Act of Congress.

(d) The beneficial owner, not being a corporation, of a freehold interest acquired before January 1, 1965, in improved residential property within the area to be acquired by the Secretary of the Army under authority of this Act, the continued use of which property for noncommercial residential purposes for a limited time will not, in the judgment of the Secretary of the Interior, unduly interfere with the development of public-use facilities for the national recreation area and will not, in the judgment of the Secretary of the Army/unduly interfere with the operation of the Tocks Island Reservoir project, may

retain a right of use and occupancy of such property for noncommercial residential purposes for, as said owner may elect, either (i) a period terminating upon his death or the death of his spouse, whichever occurs later, or (ii) a term of not more than twenty-five years: *Provided,* That in no case shall the period or term for which such right of use and occupancy is retained extend beyond the term of the freehold interest acquired by the United States. The price payable to the owner of such property shall be reduced by on amount equal to the value of the right retained. As used in this Act "improved residential property" means a single-family year-round dwelling, the construction of which was begun before January 21, 1963, which dwelling serves as the owner's permanent place of abode at the time of its acquisition by the United States, together with not more than three acres of land on which the dwelling and appurtenant buildings are located which land the Secretary of the Interior or the Secretary of the Army, as the case may be, finds is reasonably necessary for the owner's continued use and occupancy of the dwelling.

SEC. 3. (a) As soon as practicable after the date of enactment of this Act and following the transfer to the Secretary of the Interior by the Secretary of the Army of jurisdiction over those lands and interests therein within the boundary generally depicted on the drawing described in section 2 hereof which, in the opinion of the Secretary of the Interior, constitute an efficiently administrable unit, the Secretary of the Interior shall declare establishment of the area by publication of notice thereof in the Federal Register. Such notice shall contain detailed description of the boundaries of the area which shall encompass, to the extent practicable, the lands and waters shown on said drawing. Prior to such establishment, the Secretary of the Interior shall administer such transferred lands and waters, consistent with the construction of the project, for purposes in contemplation of the establishment of the area pursuant to tins Act.

(b) The Secretary of the Interior may subsequently make adjustments in the boundary of the area by publication of the amended description thereof in the Federal Register and acquire, by such means us lie may deem to be in the public interest, including": an exchange of excluded for included lands or interests therein with or without the payment or receipt of money to equalize values, additional lands and interests therein included in the area by reason of the boundary adjustment: *Provided,* That. the area encompassed by such revised boundary shall not exceed the acreage included within the detailed boundary first described pursuant to this section.

(c) On lands acquired pursuant, to this Act for recreation purposes, the Secretary of the Army, with the concurrence of the Secretary of the Interior, may permit the continuance of existing uses consistent with the purposes of this Act.

SEC. 4. In the administration of the area for the purposes of this Act, the Secretary of the Interior may utilize such statutory authorities relating to areas of the national park system and such statutory authorities otherwise available to him for the conservation, management, or disposal of vegetative, mineral, or fish or wildlife resources as he deems appropriate to carry out the purposes of tills Act. To assure consistent and effective planning, development, and operation for all purposes of the project, the Secretary of the Interior and the Secretary of the Army shall coordinate the administration of their respective responsibilities in the project; and such administration shall be consistent with the I'oint resolution approved September 27, 1961 (re Delaware River Basin compact; 75 Stat. 688).

SEC. 5. In the administration of the area for the purposes of this Act the Secretary of the Interior, subject to provisions of section 4 hereof, shall adopt and implement, and may from time to time revise, a land and water use management plan, which shall include specific provision for, in order of priority—

1) public outdoor recreation benefits;

2) preservation of scenic, scientific, and historic features contributing to public enjoyment;

3) such utilization of natural resources as in the judgment of the Secretary of the Interior is consistent with, and does not significantly impair, public recreation and protection of scenic, scientific, and historic features contributing to public enjoyment.

SEC. 6. The Secretary of the Interior shall permit hunting and fishing on lands and waters under his jurisdiction within the area in accordance with the applicable laws and regulations of the States concerned and of the United States. The Secretary of the Interior may designate zones where, and establish periods when, no hunting shall be permitted for reasons of public safety, wildlife management, administration, or public use and enjoyment not compatible with hunting, and may, in his plan for the area, provide areas for intensive fish and wildlife management, including public hunting and fishing, and shall issue appropriate regulations after consultation with appropriate officials of the States concerned. The Secretary of the Interior shall encourage such officials to adopt uniform regulations applicable to the whole of the Delaware Water Gap National Recreation Area.

SEC. 7. Nothing in this Act shall be construed to deprive any State or political subdivision thereof, of its right to exercise civil and criminal jurisdiction over the lands and waters within the area or of its right to tax persons, corporations, franchises, or property on the lands and waters included in the area.

SEC. 8. There are hereby authorized to be appropriated to the Secretary of the Interior for the acquisition of lands and interests in land pursuant to the provisions of section 2 of this Act and for expenses incident thereto not more than $37,412,000 which moneys shall be transferred to the Secretary of the Army. There are also authorized to be appropriated not more than $18,200,000 for the cost of installing and constructing recreation facilities on the lands and interests in lands so acquired. The amounts herein authorized to be appropriated are supplemental to those authorized to be appropriated for the Tocks Island project and related facilities by the Flood Control Act of 1962 (76 Stat. ll82).

Approved September 1, 1965

Legislative History:

House Report No. 360 (Comm. on Interior & Insular Affairs)

Senate Report No. 598 (Comm. on Interior & Insular Affairs)

Congressional Record, Vol. 1ll (1965):

July 12: Considered and passed House

Aug. 13: Considered and passed Senate, amended

Aug. 17: House concurred in Senate amendment

Public Law 95-625
95th Congress H.R. 95
November 10, 1978

Title VII – Wild and Scenic River Act Amendments
Subtitle A – Addition of River Segments
Addition of Middle Delaware River Segment

SEC7. 05. Section 3 (a) of the Wild and Scenic Rivers Act is amended by adding the following new paragraph at the end thereof:

"(20) Delaware, New York, Pennsylvania and New Jersey. – The segment from the point where the river crosses the northern boundary of the Delaware Water Gap National Recreation Area to the point where the river crosses the southern boundary of such recreation area; to be administered by the Secretary of the Interior. For purposes of carrying out this Act with respect to the river designated by this paragraph, there are authorized to be appropriated such sums as may be necessary. Action required to be taken under subsection (b) of this section with respect to such segment shall be taken within one year from the date of enactment of this paragraph, except that, with respect to such segment, in lieu of the boundaries provided for in such subsection (b), the boundaries shall be the banks of the river. Any visitors facilities established for purposes of use and enjoyment of the river under the authority of the Act establishing the Delaware Water Gap National Recreation Area shall be compatible with the purposes of this Act and shall be located at an appropriate distance from the river."

THE NATIONAL TRAILS SYSTEM ACT
(P.L. 90-543)
(16 U.S.C. 1241 et. seq.)
as amended through P.L. 103-145, November 17, 1993

AN ACT
To establish a national trails system, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SEC 1. SHORT TITLE

This Act may be cited as the “National Trails System Act”.

SEC 2. STATEMENT OF POLICY

a) In order to provide for the ever-increasing outdoor recreation needs of an expanding population and in order to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation, trails should be established (i) primarily, near the urban areas of the Nation, and (ii) secondarily, within scenic areas and along historic travel routes of the Nation which are often more remotely located.

b) The purpose of this Act is to provide the means for attaining these objectives by instituting a national system of recreation, scenic and historic trails, by designating the Appalachian Trail and the Pacific Crest Trail as the initial components of that system, and by prescribing the methods by which, and standards according to which, additional components may be added to the system.

c) The Congress recognizes the valuable contributions that volunteers and private, nonprofit trail groups have made to the development and maintenance of the Nation's trails. In recognition of these contributions, it is further the purpose of this Act to encourage and assist volunteer citizen involvement in the planning, development, maintenance, and management, where appropriate, of trails.

SEC 3. NATIONAL TRAILS SYSTEM

a) The national system of trails shall be composed of the following:

(1) National recreation trails, established as provided in section 4 of this Act, which will provide a variety of outdoor recreation uses in or reasonably accessible to urban areas.

(2) National scenic trails, established as provided in section 5 of this Act, which will be extended trails so located as to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass. National scenic trails may be located so as to represent desert, marsh, grassland, mountain, canyon, river, forest, and other areas, as well as landforms which exhibit significant characteristics of the physiographic regions of the Nation.

(3) National historic trails, established as provided in section 5 of this Act, which will be extended trails which follow as closely as possible and practicable the original trails or routes

of travel of national historic significance. Designation of such trails or routes shall be continuous, but the established or developed trail, and the acquisition thereof, need not be continuous onsite. National historic trails shall have as their purpose the identification and protection of the historic route and its historic remnants and artifacts for public use and enjoyment. Only those selected land and water based components of a historic trail which are on federally owned lands and which meet the national historic trail criteria established in this Act are included as Federal protection components of a national historic trail. The appropriate Secretary may certify other lands as protected segments of an historic trail upon application from State or local governmental agencies or private interests involved if such segments meet the national historic trail criteria established in this Act and such criteria supplementary thereto as the appropriate Secretary may prescribe, and are administered by such agencies or interests without expense to the United States.

(4) Connecting or side trails, established as provided in section 6 of this Act, which will provide additional points of public access to national recreation, national scenic or national historic trails or which will provide connections between such trails.

The Secretary of the Interior and the Secretary of Agriculture, in consultation with appropriate governmental agencies and public and private organizations, shall establish a uniform marker for the national trails system.

b) For purposes of this section, the term 'extended trails' means trails or trail segments which total at least one hundred miles in length, except that historic trails of less than one hundred miles may be designated as extended trails. While it is desirable that extended trails be continuous, studies of such trails may conclude that it is feasible to propose one or more trail segments which, in the aggregate, constitute at least one hundred miles in length.

c) On October l, l982, and at the beginning of each odd numbered fiscal year thereafter, the Secretary of the Interior shall submit to the Speaker of the United States House of Representatives and to the President of the United States Senate, an initial and revised (respectively) National Trails System plan. Such comprehensive plan shall indicate the scope and extent of a completed nationwide system of trails, to include (l) desirable nationally significant scenic and historic components which are considered necessary to complete a comprehensive national system, and (2) other trails which would balance out a complete and comprehensive nationwide system of trails. Such plan, and the periodic revisions thereto, shall be prepared in full consultation with the Secretary of Agriculture, the Governors of the various States, and the trails community.

SEC 4. NATIONAL RECREATION TRAILS

a) The Secretary of the Interior, or the Secretary of Agriculture where lands administered by him are involved, may establish and designate national recreation trails, with the consent of the Federal agency, State, or political subdivision having jurisdiction over the lands involved, upon finding that--

(i) such trails are reasonably accessible to urban areas, and, or

(ii) such trails meet the criteria established in this Act and such supplementary criteria as he may prescribe.

b) As provided in this section, trails within park, forest, and other recreation areas administered by the Secretary of the Interior or the Secretary of Agriculture or in other federally administered areas may be established and designated as "National Recreation Trails" by the appropriate Secretary and, when no Federal land acquisition is involved–

(i) trails in or reasonably accessible to urban areas may be designated as "National Recreation Trails" by the appropriate Secretary with the consent of the States, their political subdivisions, or other appropriate administering agencies;

(ii) trails within park, forest, and other recreation areas owned or administered by States may be designated as "National Recreation Trails" by the appropriate Secretary with the consent of the State; and

(iii) trails on privately owned lands may be designated 'National Recreation Trails' by the appropriate Secretary with the written consent of the owner of the property involved.

SEC. 5 NATIONAL SCENIC AND NATIONAL HISTORIC TRAILS

a) National scenic and national historic trails shall be authorized and designated only by Act of Congress. There are hereby established the following National Scenic and National Historic Trails:

(1) The Appalachian National Scenic Trail, a trail of approximately two thousand miles extending generally along the Appalachian Mountains from Mount Katahdin, Maine, to Springer Mountain, Georgia. Insofar as practicable, the right-of-way for such trail shall comprise the trail depicted on the maps identified as "Nationwide System of Trails, Proposed Appalachian Trail, NST-AT-101-May 1967", which shall be on file and available for public inspection in the office of the Director of the National Park Service. Where practicable, such rights-of-way shall include lands protected for it under agreements in effect as of the date of enactment of this Act, to which Federal agencies and States were parties. The Appalachian Trail shall be administered primarily as a footpath by the Secretary of the Interior, in consultation with the Secretary of Agriculture.

TO WALLENPAUPACK

RELOCATION OF P.P.&L. CO'S
220 KV LINE (NPS SUGGESTION)

BUSHKILL SWITCHRACK & CONNECTING LINES
OBLITERATION SUGGESTED BY NPS

YARDS CREEK AREA

230 KV (P.S.E.&G. PROPOSAL)

P.S.E.&G. 220 KV

KITTATINY SUBSTATION (J.C.P.&L.)

TO SIEGFRIED

230 KV (J.C.P.&L. PROPOSAL)

TO PORTLAND

POSSIBLE CONNECTION IN VICINITY OF
PORTLAND (NPS SUGGESTION)

TO WHIPPANY & ROSELAND

LEGEND

EXISTING LINE TO REMAIN

PRESENTLY PROPOSED

NPS SUGGESTION

NPS SUGGESTED OBLITERATION

ABBREVIATIONS:
P.P.&L. PENNSYLVANIA POWER & LIGHT
P.S.E.&G. PUBLIC SERVICE ELECTRIC & GAS
J.C.P.&L. JERSEY CENTRAL POWER & LIGHT

ORIENTATION

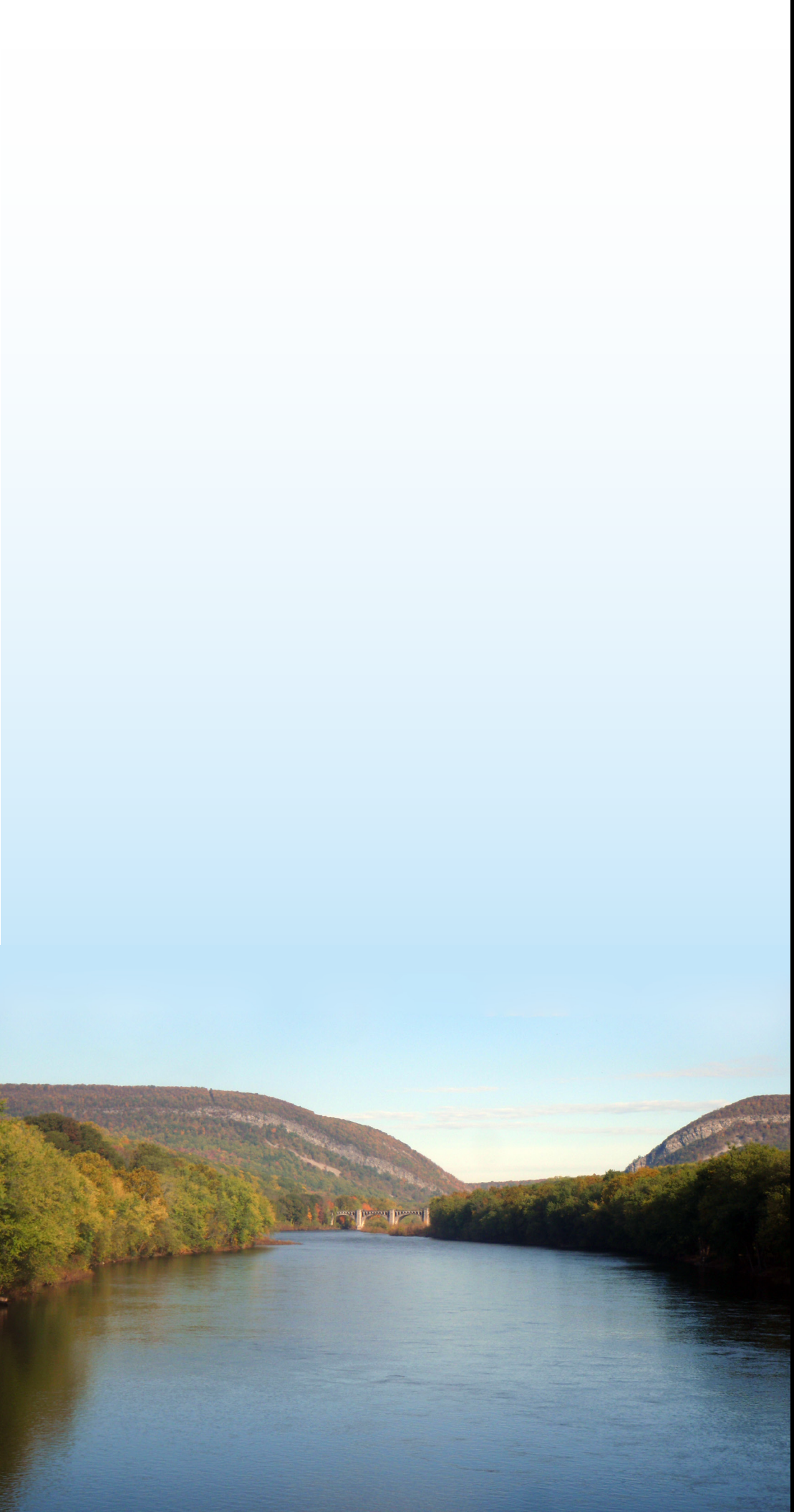
PREPARED
DESIGNED J.L.I.
DRAWN
CHECKED

SCALE | MARK | DESCRIPTION OF REVISION | DATE | INITIAL
REVISED

RECOMMENDED DATE
APPROVED

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
RECREATION RESOURCE SURVEYS DIVISION
NORTHEAST REGION
PREPARED BY
SUGGESTED POWER LINE RELOCATIONS
TITLE OF DRAWING
LOCATION WITHIN PARK
TOCKS ISLAND
NAME OF PARK

REGION NORTHEAST
PCP NO.
SHEET 1 OF 1
DRAWING NO.
DATE 8/8/62



Appendix B

Other Laws and Regulations

APPENDIX B:
OTHER LAWS AND REGULATIONS

INTRODUCTION

Various laws, policies, and regulations by NPS and the federal and state governments are described in this appendix to show the constraints within which this EIS will need to operate and the goals and policies it must meet. The NPS, in preparing this EIS, must conform to the federal laws, regulations, and policies described in this section. The parks planning documents are also presented in this section. A summary of federal, state and local laws, plans, regulations, and policies is presented. This list is not intended to be exhaustive and if a law is not listed it does not relieve the NPS from compliance with that directive.

FEDERAL LAWS

National Environmental Policy Act (NEPA) of 1969, as amended: Section 102(2)(C) of NEPA (42 USC § 4371 et seq.) requires that an EIS be prepared for proposed major federal actions that may significantly affect the quality of the natural and human environment. The EIS is to address the environmental impacts of the proposed action, any adverse environmental effects that cannot be avoided should the action take place, alternatives to the proposed action, the relationship between short-term uses of man's environment and maintenance of long-term productivity, and any irreversible and irretrievable commitments of resources needed should the project be implemented.

Title 36, Code of Federal Regulations: Title 36 provides the regulations "for the proper use, management, government, and protection of persons, property, and natural and cultural resources within areas under the jurisdiction of the National Park Service" (36 CFR § 1.1(a)). NPS regulations governing issuance of rights-of-way for power transmission lines falls under 36 CFR Part 5.

Endangered Species Act (ESA): ESA (16 USC §§ 1531-1544, 87 stat. 884) provides for the protection of federally listed threatened or endangered species and their habitats. NPS policy also requires examination of the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species. Section 7 of ESA requires federal agencies, through consultation with USFWS, to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat.

Bald and Golden Eagle Protection Act (BGEPA) of 1940, as amended: BGEPA (16 USC §§ 668-668c), enacted in 1940 and amended several times since then, prohibits anyone without a permit issued by the Secretary of the Interior from taking bald eagles, including their parts, nests, or eggs. BGEPA provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle… [or any golden eagle], alive or dead, or any part, nest, or egg thereof." BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

The National Bald Eagle Management Guidelines, released by the USFWS, provide guidance for the implementation of the BGEPA. These guidelines include general recommendations and information for agencies on measures for adherence to the BGEPA. These guidelines provide information the natural history of bald eagles, as well as information on impacts of activities on bald eagles (USFWS 2007a, 1). According to these guidelines, "disturb" means "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." (USFWS 2007a, 2).

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon

the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits and causes injury, death, or nest abandonment.

Migratory Bird Treaty Act (MBTA) of 1918: MBTA (16 USC §§ 703-711) implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under this act it is prohibited, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention … for the protection of migratory birds … or any part, nest, or egg of any such bird" (16 USC § 703). Subject to limitations in this act, the Secretary of the Interior may adopt regulations determining the extent to which, if at all, hunting, taking, capturing, killing, possessing, selling, purchasing, shipping, transporting, or exporting any migratory bird, part, nest, or egg will be allowed, having regard for temperature zones, distribution, abundance, economic value, breeding habits, and migratory flight patterns.

National Historic Preservation Act (NHPA) of 1966 as amended: Section 106 of NHPA (16 USC § 470 et seq.) requires federal agencies to consider the effects of their undertakings on properties listed or potentially eligible for listing on the NRHP. All actions affecting the parks' cultural resources must comply with this law, which is implemented through the Advisory Council on Historic Preservation (36 CFR § 800).

Wild and Scenic Rivers Act (WSRA): This act calls for the protection of specific U.S. rivers that "possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values" (16 USC §§ 1271, 1526). This policy is to preserve selected rivers "in their freeflowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes" (16 USC §§ 1271, 1526). These rivers are to be protected "for the benefit and enjoyment of present and future generations" (16 USC §§ 1271, 1526). This part of the act echoes the NPS Organic Act, which states that the purpose of the NPS is to conserve park resources "and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 USC § l). The WSRA identifies MDSR and the land adjacent to it as a component of the national wild and scenic rivers system to be administered by the Department of the Interior, specifically, the NPS (16 USC §§ 1274, 1530 and 1281(c), p. 1572).

Noise Control Act of 1972 and the Quiet Communities Act of 1978: These acts instituted federal laws relating to noise control. However, in 1981, it was determined that noise regulations were best administered at the state and local levels, thus allocating federal funding to state and local governments for the development of noise regulations. While these acts currently remain in effect, federal funding for the Noise Control Act of 1972 and The Quiet Communities Act of 1978 has terminated (USEPA 2009). The Federal Noise Control Act authorizes states to enforce noise rules, codes, and regulations, and allows municipalities to adopt noise control ordinances that usurp the state code. There are no noise regulations at the state level in Pennsylvania; local townships are responsible for developing their own noise ordinances.

Energy Policy Act of 2005: This act states just compensation shall be provided for any ROW acquired for electric transmission facilities on private property. Just compensation is defined as an amount equal to the fair market value of the property taken on the date of the exercise of eminent domain authority (Title XII – Electricity, Subtitle B, section 1221[e]).

Magnuson-Stevens Fishery Management and Conservation Act: This act, as amended by the Sustainable Fisheries Act of 1996 (PL 104-267), requires all federal agencies to consult with NOAA Fisheries on all actions or proposed actions allowed, funded, or undertaken by the agency that may adversely affect essential fish habitat. Essential fish habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

Federal noxious and invasive weed laws: Several federal laws pertain to noxious and invasive weeds, including the Lacey Act as amended (18 USC § 42), the Federal Plant Pest Act (7 USC § 150aa et seq.), the Federal Noxious Weed Act of 1974, as amended by the Food, Agriculture, Conservation, and Trade Act of 1990 ("Management of Undesirable Plants on Federal Lands," 7 USC § 2814), and the Carlson-Fogey Act of 1968 (PL 90-583).

Clean Water Act (CWA): Section 404 of the CWA established a program to regulate the discharge of dredged or fill material into waters of the United States. The CWA does not allow for the filling of wetlands if there is another practicable alternative that would be less damaging to aquatic resources or if significant degradation would occur. Permits for work in wetlands are issued by USACE and state agencies. USACE encourages agencies to avoid and/or minimize impacts on wetlands, and requires mitigation if unavoidable impacts on wetlands occur.

The Rivers and Harbors Act of 1899: This act defined navigable waters of the United States as "those waters that are subject to the ebb and flow of the tides." The CWA built on this definition and defined the waters of the United States to include tributaries to navigable waters and wetlands adjacent to other waters of the United States.

Fish and Wildlife Coordination Act of 1934 (as amended): This act authorizes Agriculture and Commerce Secretaries to provide assistance to state and federal agencies to protect, rear, stock, and increase the supply of game and fur-bearing animals, as well as to study the effects of sewage, trade wastes, and other polluting substances on wildlife. The act also authorizes the transfer of funds to USFWS to conduct investigations, and the transfer of project lands. Amendments in 1946 require consultation with USFWS and state fish and wildlife agencies where waters of any stream or water body are proposed or authorized to be impounded or diverted, or controlled in some manner under a federal permit or license, for the protection of wildlife resources.

Paleontological Resource Preservation Act of 2009 (P.L. 111-11): This act provides directives for the management of paleontological resources, and the development of inventory and monitoring plans, as well as the use of paleontological resources in science and education. It introduced permit requirements for the collection of paleontological resources on federal lands. This act also set criminal penalties for the illegal collection, exchange or sale of paleontological resources on federal lands, as well as the false labeling of such resources illegally collected on federal lands.

EXECUTIVE ORDERS

EOs are those orders issued by the president to alert federal agencies to new guidelines or practices. A complete listing of EOs can be found on the National Archives website (http://www.archives.gov/federal-register/executive-orders/disposition.html).

Along with NPS *Management Policies 2006*, the director of NPS may issue additional directives in DOs containing additional information or clarification of NPS practices. A complete list of NPS DOs can be found on the U.S. Department of the Interior National Park Service Office of Policy website (http://www.nps.gov/applications/npspolicy/DOrders.cfm).

The following sections present applicable EOs and DOs. This section is not intended to be an exhaustive list of all orders that may apply:

EO 11988, "Floodplain Management": EO 11988 directs all federal agencies to avoid both long- and short-term adverse effects associated with occupancy, modification, and development in the 1 percent annual chance floodplain, when possible. All federal agencies are required to avoid building in a 1 percent annual chance floodplain unless no other practicable alternative exists.

EO 11990, "Protection of Wetlands": EO 11990 directs federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. NPS complies with this executive order through the guidance outlined in DO 77-1.

EO 13112, "Invasive Species": This executive order directs all federal agencies to prevent and control introductions of invasive non-native species in a cost-effective and environmentally sound manner to minimize their economic, ecological, and human health impacts.

EO 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds": EO 13186 was established on the premise that migratory birds contribute to biological diversity, bring enjoyment to millions of Americans, and are of great ecological and economic value to this country and to other countries. Under this order, federal agencies taking actions that have, or are likely to have, a measurable negative effect on the migratory bird population are directed to develop and implement a memorandum of understanding with USFWS that promotes the conservation of migratory bird populations. This EO also requires that the environmental analysis of federal actions required by NPS or other established environmental review processes evaluate the effects of the action and agency plans on migratory birds, with an emphasis on species of concern. A *2010 Memorandum of Understanding (MOU) Between the U.S. Department of Interior National Park Service and the U.S. Fish and Widlife Service to Promote the Conservation of Migratory Birds* that sought to strengthen agency coordination on the protection of migratory birds. The MOUs meet the requirements outlined in EO 13186, section 3, which regards the responsibilities of federal agencies in protecting migratory bird species. These responsibilities include studies of migratory birds, the development of BMPs and conservation measures, and educational programs and training programs to promote ongoing education on migratory birds and integrated management for bird conservation across the agencies. The MOU also requires identifying actions that impact migratory birds and their habitats, and developing measures to mitigate these impacts. The MOU also requires that NPS implement measures to prevent or mitigate intentional and unintentional take of migratory birds as a result of authorized activities (NPS and USFWS 2010).

NATIONAL PARK SERVICE LAWS AND POLICIES

Organic Act: The Organic Act (16 USC § 1) commits NPS to conserve NPS resources and provide for their enjoyment, leaving them unimpaired for the benefit and enjoyment of future generations.

The Organic Act and its amendments afford NPS latitude when making resource decisions about visitor use and resource preservation. Despite this discretion, courts consistently interpret the Organic Act and its amendments to elevate resource conservation above visitor use. The Organic Act prohibits actions that permanently impair park resources unless a law directly and specifically allows for the action (16 USC § 1a-1). An action constitutes an impairment when its impacts "harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (NPS 2006a, section 1.4.5). To determine impairment, NPS must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts"

(NPS 2006a, section 1.4.5). The EIS that is being prepared, therefore, must analyze the effects of the alternatives on the parks' resources and values and determine whether these effects would cause impairment.

General Authorities Act of 1970 and the Redwood National Park Expansion Act of 1978: The General Authorities Act sought to improve the management and administration of the national park system, and defined it as a single unified system. This united the management of all NPS properties, regardless of the resources found at each park. The 1978 "Redwood Amendment" reaffirmed that the entire national park system was to be managed to the same high standard and stated that NPS must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 USC § 1a-1).

NPS Management Policies 2006, Section 1.4: Prohibition on Impairment of Park Resources and Values: Implementing the Organic Act, NPS *Management Policies 2006* (section 1.4) requires analysis of potential effects to determine whether or not proposed actions would impair a park's resources and values. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values (NPS 2006a).

The NPS has discretion to allow impacts on Park resources and values when necessary and appropriate to fulfill the purposes of a Park (NPS 2006 sec. 1.4.3). However, the NPS cannot allow an adverse impact that would constitute impairment of the affected resources and values (NPS 2006 sec 1.4.3). An action constitutes an impairment when its impacts "harm the integrity of Park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (NPS 2006 sec 1.4.5). To determine impairment, the NPS must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts" (NPS 2006 sec 1.4.5). A determination on impairment for the preferred alternative evaluated in this EIS is provided in appendix B.

NPS Management Policies 2006: Several other sections of the NPS *Management Policies 2006* (NPS 2006a) are relevant to processing applications for electrical power transmission ROWs at the parks, such as section 4, "Resource Management"; section 5, "Cultural Resource Management"; section 8.2.5, "Visitor Safety and Emergency Response"; and section 8.6.1.1, "Requests for Permits." The sections mentioned above are just a few of the NPS *Management Policies 2006* sections relevant to the proposed S-R Line.

Authority for Authorizing Construction Permit: NPS regulations are generally applicable to lands within the national park system in which the United States owns a partial interest or a fee interest subject to an easement (36 CFR § 1.2(a)(5)). Construction within the national park system is generally forbidden without a permit (36 CFR §§ 5.7, 1.6).

Park Service Resource Protection Act (PSRPA): The PSRPA holds liable anyone who destroys or otherwise injures any resource found within the park service system for the response costs and damages resulting from the destruction or loss of the resource.

OTHER APPLICABLE PARK SERVICE EXECUTIVE ORDERS AND DIRECTOR ORDERS

DO 12: *Conservation Planning, Environmental Impact Analysis, and Decision Making*: DO 12 directs the way NPS complies with NEPA, including all aspects of environmental analysis, public involvement,

and resource-based decisions. NPS must follow all sources of NEPA guidance, including, but not limited to, 40 CFR §§ 1500–1508 and 516 DM. DO 12 outlines the responsibilities of the parties accountable for ensuring compliance with NEPA, from the director to project managers and contracting officers (NPS 2001a).

DO 28: *Cultural Resource Management*: DO 28 (NPS 1998a) directs the NPS to protect and manage cultural resources in its custody through effective research, planning, and stewardship in accordance with the policies and principles contained in the NPS *Management Policies 2006.* This DO is carried out through NPS-28: *Cultural Resource Management Guideline*, which provides the fundamental concepts of cultural resource management for the NPS. The cultural resource management guidelines address cultural landscapes, stating: "preservation practices [should be implemented] to enable long-term preservation of a resource's historic features, qualities, and materials [of a cultural landscape]" (NPS 1998a).

DO 47: *Soundscape Preservation and Management*: DO 47 provides guidance for "the protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources" (NPS 2000b). Director's Order 47 notes that NPS has authority to "determine the nature, extent, and acceptability of impacts on park resources and visitors. This includes determining the type, magnitude, duration, and frequency of occurrence of noise that is compatible or incompatible with protecting the resources or the visitor experience for which the park was established and planned, as well as determining the significance of noise levels or impacts. This may also include determining whether certain noise sources are necessary or appropriate" (NPS 2000b).

DO 53: *Special Park Uses*: This Director's Order and the manual derived from it contain NPS policy concerning the processes for issuing permits for special park uses, including right-of-way permits. Special park uses are not initiated by the park; do not necessarily benefit the park or the public; and are managed by the park, to a degree, in order to protect the park resources and public interest. According to this policy, a ROW permit may be issued by the park when no other alternative is feasible and upon a finding that the use is not incompatible with the public interest. Special guidance in issuing right-of-way permits is found in RM-53, Appendix 5.

DO 77-1: NPS has adopted a goal of "no net loss of wetlands." DO 77-1 states that for new actions where impacts to wetlands cannot be avoided, proposals must include plans for compensatory mitigation that restores wetlands on NPS lands, where possible, at a minimum acreage ratio of 1:1. DO 77-1 emphasizes: 1) exploring all practical alternatives to building on, or otherwise adversely affecting, wetlands; 2) reducing impacts to wetlands whenever possible; and 3) providing direct compensation for any unavoidable wetland impacts by restoring degraded or destroyed wetlands on other NPS properties. If a preferred alternative would have adverse impacts on wetlands, a Statement of Findings (SOF) must be prepared that documents the above steps and presents the rationale for choosing an alternative that would have adverse impacts on wetlands.

DO 77-2: NPS policy dictates guidelines to restore and maintain natural floodplains. Guidelines also require avoidance of the environmental impacts of development within floodplains, or modification of floodplains. The guidelines also require that, where practicable alternatives exist, Class I action be avoided within a 100-year floodplain. Class I actions include the location or construction of administration, residential, warehouse, and maintenance buildings, non-excepted parking lots, or other man-made features that by their nature entice or require individuals to occupy the site.

Reference Manual #77: *Natural Resource Management Guideline* (1991): The *Natural Resource Management Guideline* (1991) provides guidance on implementing laws and regulations relevant to natural resources to park managers for all planned and ongoing natural resource management activities.

This document provides the guidance for park management to design, implement, and evaluate a comprehensive natural resource management program in accordance with relevant laws.

NATIONAL PARK SYSTEM UNIT PLANNING DOCUMENTS

The following plans occurring at DEWA, MDSR, and APPA were considered during the development of this EIS. MDSR is contained entirely within DEWA and is managed through DEWA's plans and policies.

DELAWARE WATER GAP NATIONAL RECREATION AREA

Delaware Water Gap National Recreation Area, General Management Plan, 1987: The DEWA GMP guides the overall management and use of the park's resources and helps to ensure the perpetuation of its natural and cultural resources and the scenic setting for present and future public enjoyment (NPS 1987a). The plan also provides the foundation for subsequent detailed implementation plans, programs, and operations. The GMP outlines the following strategies:

- Public outdoor recreation benefits
- Preservation of scenic, scientific, and historic features contributing to public enjoyment
- Such use of natural resources as in the judgment of the Secretary of the Interior is consistent with, and does not significantly impair, public recreation and protection of scenic, scientific, and historic features contributing to public enjoyment

Delaware Water Gap National Recreation Area Resource Management Plan, 1997: The DEWA Resource Management Plan (RMP) documents the park's natural and cultural resources, provides direction and continuity, and establishes priorities for the protection and preservation of these resources (NPS 1997). It defines resource management issues and describes current management, research, and monitoring actions as well as issues or problems that require future action or research to protect park resources, to implement recommendations, or to restore damaged resources. In some cases, this plan recognizes the need for preparation of action plans that deal with specific resource management issues. One of the goals of the plan is to preserve the scenic, scientific, and historic features contributing to public outdoor recreation use and enjoyment and to use these natural resources as long as the primary values of the park are not impaired.

Delaware Water Gap National Recreation Area Business Plan of 2003: The DEWA Business Plan is a tool for the park to communicate its financial status with principal stakeholders. The business plan provides information on the business of the park unit and the funding necessary to operate the park unit within appropriate standards. Funding (park staff needed for S-R Line monitoring during construction and operation) for the S-R Line was not included in the 2003 DEWA Business Plan.

Delaware Water Gap National Recreation Area, Research and Resource Planning Strategic Plan, 2006–2010: The DEWA strategic plan outlines primary work elements currently undertaken by the Division of Research and Resource Planning (R&RP) at DEWA and the role and function of R&RP for projects to be worked on for the duration of the plan, from 2006 to 2010 (NPS n.d.a). The plan identifies goals, objectives and work targets that support overall park management and operations. The R&RP staff collectively synthesized existing management documents to form a logical basis for developing this strategic plan in order to refocus staff time and energy. This plan does not supersede or take the place of any other required document for the management of the park's resources. Planning of park staff needed for S-R Line monitoring during construction and operation was not included in this plan. T

Delaware Water Gap Fire Management Plan, 2003–2004: The fire management plan (FMP) for DEWA is a subsection of the DEWA RMP and will help achieve resource management and fire protection goals as defined in the GMP and the RMP (NPS 1997). The original FMP for DEWA, which was approved in 1992, was revised from 2003 through 2004 to incorporate the revised Wildland Fire Management Terminology (adopted By National Wildfire Coordinating Group 1997) as well as revised NPS wildland fire management policy and guidelines as set forth in the current versions of DO 18 and Reference Manual 18. DO 18: *Wildland Fire Management* mandates that

> Each park with vegetation capable of burning will prepare a fire management plan to guide a fire management program that is responsive to the park's natural and cultural resource objectives and to safety considerations for park visitors, employees, and developed facilities. (NPS 2008a)

The FMP is designed to help meet the objectives of the GMP and RMP by protecting and/or perpetuating the existing natural, cultural, and historic resources; by protecting park structures; and by protecting the health and safety of park visitors and employees.

Delaware Water Gap Landscape-scale Connectivity Proposal, 2009: In many areas of the country there are NPS-administered lands that are geographically and ecologically related to nearby lands owned or administered by other federal, state, county, municipal, or nonprofit organizations. While these various units may have different missions, jurisdictions, ownership patterns, and uses, their overall contiguous nature creates a much greater ecological whole than the sum of their individual parts. This biological principle is well understood and accepted in the scientific community. Overarching goals in this effort include identifying and designing resiliency networks and corridors through collaborative efforts that enhance ecological integrity and biodiversity, increasing native species capacity to recover and retain native biodiversity, and determining how to define success (NPS 2009b).

Delaware Water Gap National Recreation Area Land Protection Plan of 1984 and its 1992 revision: The DEWA Land Protection Plan (LPP) details the minimum actions needed to assure resource protection and provide essential public access to and use of federal lands within DEWA and determines priorities for those actions. Some of the S-R Line alternatives may not meet the goals of the plan.

APPALACHIAN NATIONAL SCENIC TRAIL

Comprehensive Plan for the Protection, Management, Development, and Use of the Appalachian National Scenic Trail: 1981, Abridged Version Published in 1987: The comprehensive plan describes the unique management approach to maintaining the scenic and recreational aspects of APPA. One of the main goals of this plan is to provide Congress with the information it needs to adhere to its oversight responsibility for APPA. Further, the plan organizes policy directions and guidelines in relation to the administration of APPA regarding private, state, and federal organizations that manage the operation of APPA (NPS 1987b). The management approach set forth in the comprehensive plan has many management philosophies, including managing the trail in such a way as to "lie lightly on the land" (NPS 1987b); to maintain APPA as a simple footpath, preserving the natural environment; and to discourage any activities that would degrade APPA's natural or cultural resources or social values.

The comprehensive plan does not specifically describe how projects should be carried out or prioritized and is not intended to be a substitute for more detailed plans, nor does it dictate precisely what other plans must cover. Rather, it is the one document that bridges management and protection topics related to APPA.

The Future Protection of Trailway Values: The comprehensive plan discusses the concern for the continued protection of future trail values. The isolated and scenic character of APPA will be threatened in the future. Extending the length of the eastern seaboard, within a third-day's drive of a third of the nation's populace, the now wild or pastoral areas through which the trail passes will be continuously under pressure for many kinds of development, including recreational homes, ski areas, mining and industrial operations, communications facilities, highways, and energy projects. For example, impacts of major second-home developments on ridgetop land have been averted in more than a dozen cases through federal acquisition, and more such development proposals are probable near the trail. Plans for energy-producing windmills in the high ridges of the Appalachian Mountains are in progress.

The comprehensive plan further states that it is not only the quality of the landscape and visible land uses that affect the Appalachian Trail experience, but noise pollution, degradation of air quality, and the various effects of the human community along APPA all affect the enjoyment of users. Even where APPA seems securely enveloped in national parks, national forests, and state park and forest land, activities on lands adjacent to or within these units may adversely affect APPA.

Long-term protection of APPA rests not so much with acquiring tracts of wild land as with the relationships established with national forests and parks, state and local agencies, and the people who own land or reside along APPA. The APPA values to be perpetuated include more than a narrow footpath, and the scheme for protecting those values must thus be broader than simple ownership of land. Only through the continued and growing recognition of APPA as a valued resource, with actions and policies backing that recognition, will APPA values be perpetuated.

Appalachian National Scenic Trail: Resource Management Plan: The RMP documents the natural and cultural resources of APPA and describes and sets priorities for management, monitoring, and research programs intended to ensure the best use for those resources. This plan provides a 10-year guide to resource management activities conducted by the NPS-Appalachian Trail Park Office (ATPO) and ATC, as well as other organizations who wish to participate. Further, the plan addresses ways to establish priorities for project funding and the need for preparation of future actions regarding specific resource management issues (NPS 2008b). Management objectives are consistent with the Appalachian Trail Comprehensive Plan, the Appalachian Trail Statement of Significance, and the Appalachian Trail Strategic Plan (NPS 1987b, 2000d, 2005c). The plan also presents the current status of resources, including geology and soils, biological resources, air resources, water resources, and cultural resources. The plan describes current resource management capabilities, issues, threats, and program needs for trailwide resource management programs and site-specific resource management needs and issues of land administered by NPS-ATPO (NPS 2008b). Resource monitoring that will be needed for the S-R Line was not included in this RMP.

Appalachian Trail Park Office Strategic Plan: Developed by NPS-ATPO, this plan focuses on the four NPS service goal categories:

- Preserve park resources.
- Provide for the public enjoyment and visitor experience of parks.
- Strengthen and preserve natural and cultural resources and enhance recreational opportunities managed by partners.
- Ensure organizational effectiveness (NPS 2005c).

The NPS-ATPO mission and long-term goals focus on the cooperative management system partner satisfaction. This goal tracks the overall satisfaction of federal, state, local, and private organizations that

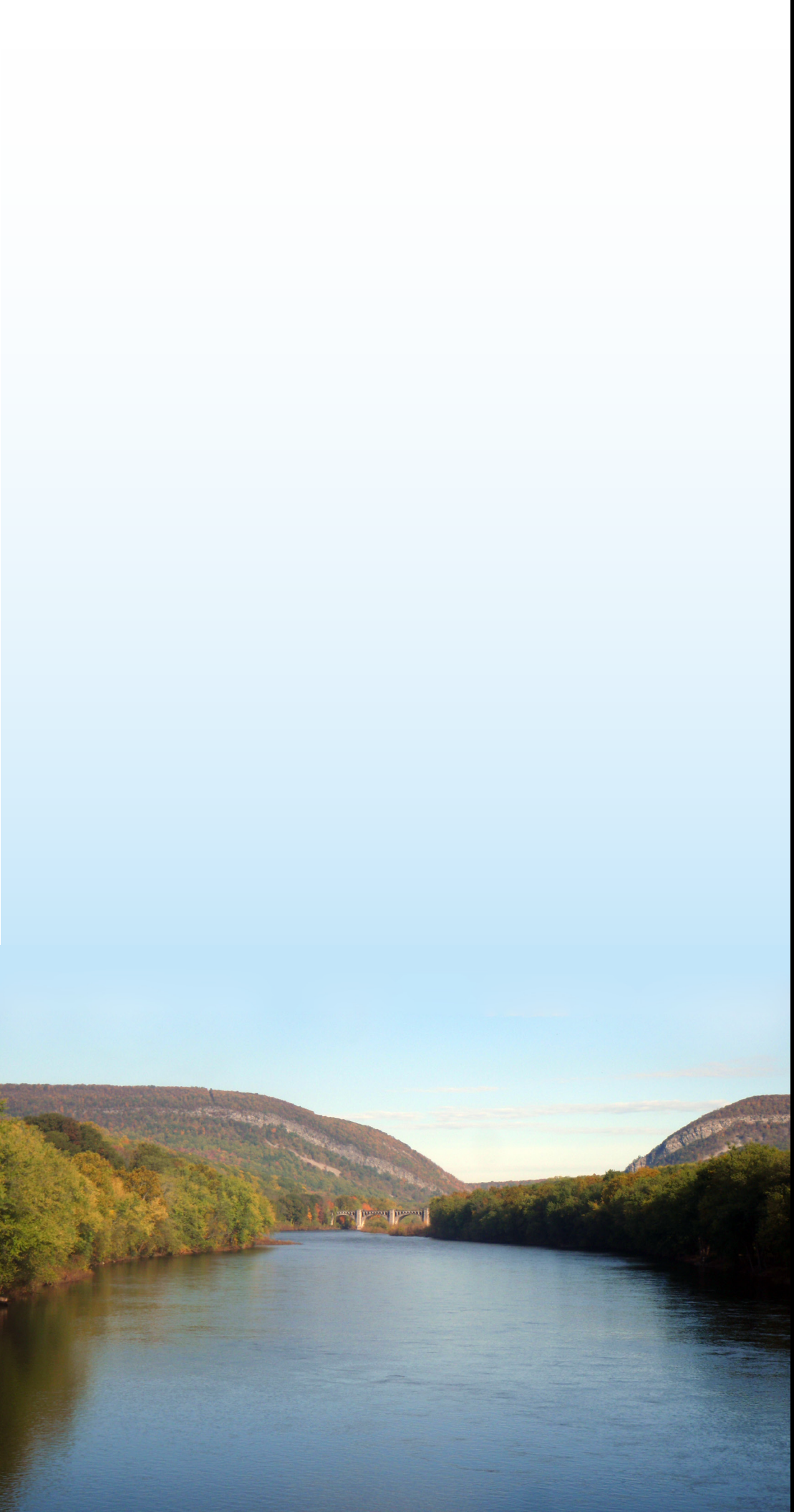
support NPS-ATPO. NPS continues to collect information related to partners' satisfaction with the cooperative management system. Planning of park staff needed for S-R Line monitoring during construction and operation was not included in this strategic plan.

Appalachian Trail Conservancy: 2009 Local Management Planning Guide, Chapter 4(f), "Roads and Utilities": In 1983, the Forest Roads Task Force convened and produced a one-page statement—the first ATC policy on roads. In November 1988, the ATC board of managers adopted a policy statement on utilities and communications facilities. That policy was first amended in 1992 to address utility-line maintenance practices, amended again in April 1994 to include criteria for proposed utility-line crossings of APPA, and amended a third time in April 1996 to address the more specific impacts of communications sites, airport beacons, wind-generation towers, and other mountaintop facilities. In 2000, the ATC board adopted a policy on roads and utility developments that replaces both previous policies, but retains many of the previous provisions. It is the policy of ATC to oppose construction of any such facilities on APPA corridor lands or those facilities on adjacent lands that could have an adverse impact on the viewshed of APPA, unless they meet all the following criteria:

- The proposed development represents the only prudent and feasible alternative to meet an overriding public need, as demonstrated in a thorough and detailed analysis of alternatives;
- Any new impacts associated with the proposed development shall coincide with existing major impacts to the Appalachian Trail experience;
- Any proposed development of linear facilities shall be limited to a single crossing of the APPA corridor;
- Any adverse impacts of a proposed development shall be sufficiently mitigated so as to result in no net loss of recreational values or the quality of the recreation experience provided by APPA. To the extent practicable, mitigation shall occur on site; and
- The proposed development shall avoid, at a minimum: (a) wilderness or wilderness study areas; (b) NPS natural areas; (c) U.S. Forest Service semi-primitive non-motorized or designated backcountry areas; (d) natural heritage sites; (e) cultural resource sites; (f) Trail-related facilities such as shelters and campsites; and (g) alpine zones, balds, and wetlands.

After construction, all impacted areas would be restored to the extent feasible. Restoration measures could include installation of permanent erosion control measures and planting of native vegetation.

Fire Management Plan for the Appalachian National Scenic Trail: The FMP for APPA is guided by DO 18, which requires that all parks with vegetation capable of sustaining fire develop an FMP. Appalachian National Scenic Trail Office management will work with partner agencies to aggressively suppress all wildland fires, taking into account the safety of firefighting personnel, the visiting public, and protection of all resources at risk in the park unit (NPS 2005d). The APPA FMP covers only those portions of the trail corridor that are managed by the NPS-ATPO. These lands total approximately 80,000 acres and are frequently interspersed with lands administered by other agencies (NPS 2005d).



Appendix C

Descriptions of the Alternatives Outside of the Study Area

APPENDIX C:
DESCRIPTIONS OF THE ALTERNATIVES OUTSIDE OF THE STUDY AREA

ALTERNATIVES OUTSIDE THE STUDY AREA OVERVIEW

The alternative routes described below are only hypothetical since the applicant does not have to follow these routes; they can choose any route outside the boundaries of park lands. The routing described below was done by NPS purely to determine if construction on a route beyond the study area was possible, not an attempt to determine the actual location, except for alternative 2, the applicant's proposal, for which the entire route has been proposed by the applicant. The applicant's proposed route, and all other alternatives presented follow existing ROW corridors, and would utilize existing river crossings outside of the study area.

ALTERNATIVE 2: APPLICANT'S PROPOSED ROUTE

From the Western VSL to Berwick, Pennsylvania

The proposed route for alternative 2 is the existing 230 kV line ROW. Outside of the study area, alternative 2 would pass through Pike, Wayne, Lackawanna, and Luzerne counties in Pennsylvania (figure 2). From the Western VSL in Pennsylvania to Berwick, Pennsylvania, the alignment would travel north through Pike County. North of I-84, the alignment could turn west and head toward Wayne County, traveling north of Lake Wallenpaupack. In Lackawanna County, the alignment would turn southwest to the Susquehanna Substation located in Luzerne County.

From the Eastern VSL to Roseland, New Jersey

The proposed route for alternative 2 is the existing 230 kV line ROW. From the Eastern VSL to Roseland, New Jersey, alternative 2 would pass through and Warren, Sussex, and Morris counties. The alignment would generally travel southeast, passing between Lake Mohawk and Lake Hopatcong. In Morris County, the alignment would turn and head due south to the Roseland Substation, located east of Parsippany.

ALTERNATIVE 2b: APPLICANT'S ALTERNATE PROPOSAL

From the Western VSL to Berwick, Pennsylvania

The proposed route for alternative 2b is the existing 230 kV line ROW. Outside of the study area, alternative 2b could pass through Pike, Wayne, Lackawanna, and Luzerne counties in Pennsylvania (figure 2). From the VSL in Pennsylvania, the alignment could travel north through Pike County. North of I-84, the alignment could turn west and head toward Wayne County, traveling north of Lake Wallenpaupack. In Lackawanna County, the alignment could turn southwest to the Susquehanna Substation located in Luzerne County.

From the Eastern VSL to Roseland, New Jersey

The proposed route for alternative 2b is the existing 230 kV line ROW. In New Jersey, alternative 2b could pass through Warren, Sussex, and Morris counties. The alignment could generally travel southeast, passing between Lake Mohawk and Lake Hopatcong. In Morris County, the alignment could turn and head due south to the Roseland Substation, located east of Parsippany.

ALTERNATIVE 3

From the Western VSL to Berwick, Pennsylvania

Outside the study area, alternative 3 would travel the same route as alternative 2 crossing Pike, Monroe, Wayne, Lackawanna, and Luzerne counties in Pennsylvania (figure 2). Beyond the western VSL in Pennsylvania, the route could head northeast to the Bushkill Substation, and then follow the alternative 2 alignment.

From the Eastern VSL to Roseland, New Jersey

From the Eastern VSL on the New Jersey portion, the route would pass through Warren, Sussex, and Morris counties. Alternative 3 would trend northeast, on the east side of Upper and Lower Yards Creek Reservoirs, paralleling the DEWA boundary and APPA for approximately six miles (figure 7, inset box 2). The distance between the trail and the route could vary between about 0.25 mile and 1.0 mile along this six mile stretch. For nearly two miles of this stretch, the route could follow the DEWA boundary. Continuing about two miles north, the route could then reconnect with alternative two, continuing east to the Roseland Substation.

ALTERNATIVE 4

From the Western VSL to Berwick, Pennsylvania

Outside of the study area, alternative 4 would follow nearly the same route as alternative 2 crossing Pike, Monroe, Wayne, Lackawanna, and Luzerne counties in Pennsylvania. Outside of the Western VSL, alternative 4 could travel northeast, generally paralleling the DEWA boundary to the Bushkill Substation. In the portion between the VSL and the Bushkill Substation, alternative 4 could traverse approximately 1.4 miles of Cherry Valley NWR, areas with existing ROWs, and forested areas without existing ROWs outside of DEWA (figure 8). Portions of the alternative 4 alignment come within 50 to 250 feet of houses and businesses. From the substation, the alignment could follow the alternative 2 alignment.

From the Eastern VSL to Roseland, New Jersey

Beyond the Eastern VSL to Roseland, New Jersey, the alignment would pass through Warren, Sussex, and Morris counties. The alignment would turn east, crossing the Delaware River at an existing river crossing. On the east side of the Delaware River in New Jersey, alternative 4 would parallel a railroad corridor with a ROW width of 80 feet with a cleared distinctive path. The ROW has a small clearing, but a distinctive path. Alternative 4 would follow this railroad corridor for 21 miles before turning and traveling a heavily forested path, where houses are 20 to 100 feet from the route. After traveling 2.25 miles in this segment, alternative 4 would reconnect with the alternative 2 route approximately 3.5 miles east of Highway 517, and follow that route to the Roseland Substation in Morris County.

ALTERNATIVE 5

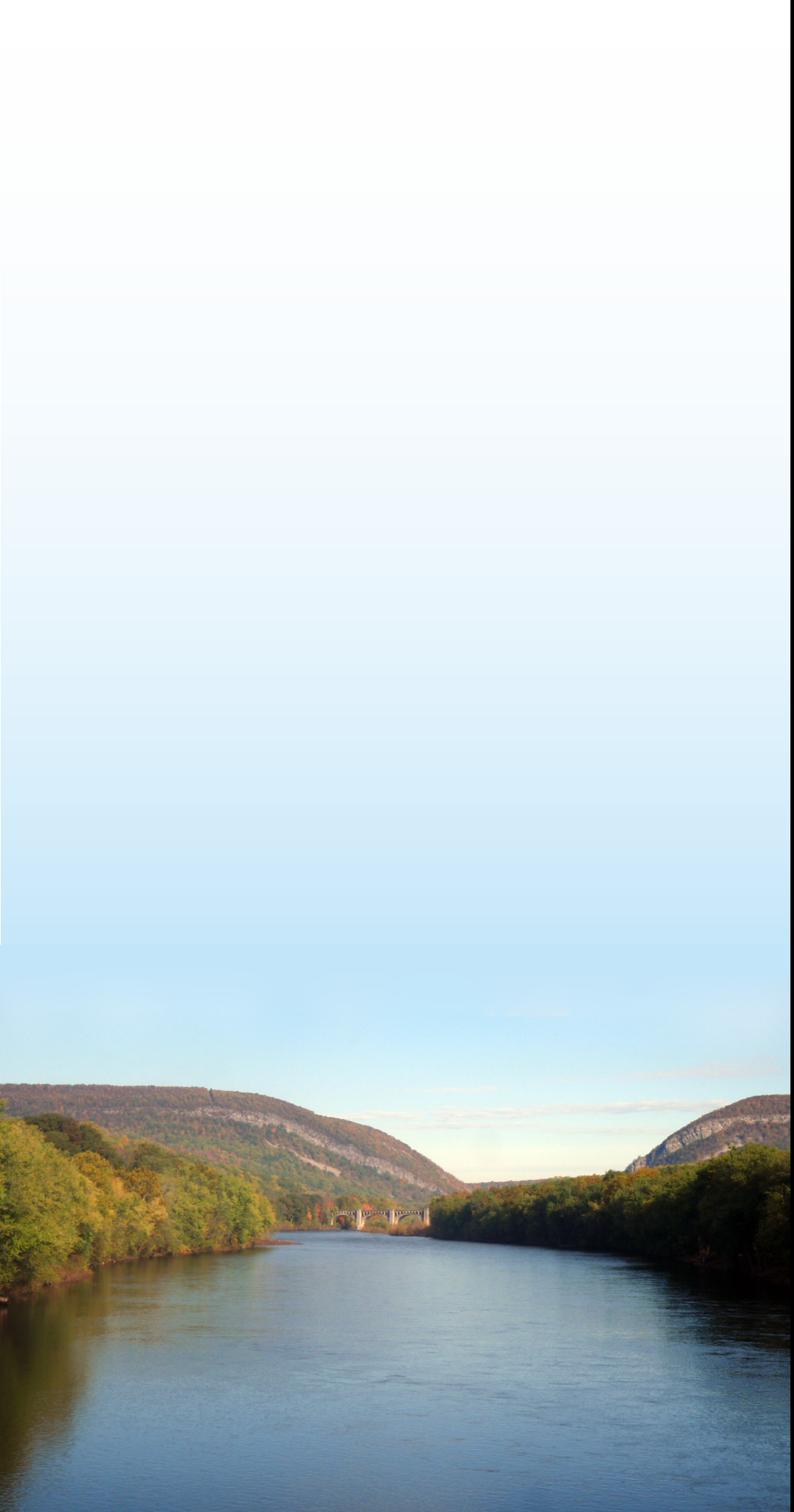
From the Western VSL to Berwick, Pennsylvania

Outside the study area, the alternative 5 alignment would generally follow the I-80 corridor through Monroe, Carbon, Luzerne counties in Pennsylvania (figure 2). From the Susquehanna Substation, alternative 5 would follow an existing transmission line ROW of approximately 150 to 200 feet. The route would proceed south for about 2.5 miles along this existing transmission line corridor and then cross

farmland for 1.6 miles. The route would then parallel a roadway for 0.4 miles to meet an existing transmission line with a 125-foot ROW. Alternative 5 would follow this existing transmission line 2.4 miles to the south to I-80, continuing east adjacent to the interstate ROW to within approximately 1.0 mile of DEWA. Just west of the DEWA boundary, the transmission line would veer off of the I-80 ROW and follow the same route proposed under alternative 4 around the southern end of DEWA, crossing through Cherry Valley NWR.

From the Eastern VSL to Roseland, New Jersey

Beyond the Eastern VSL to Roseland, New Jersey, alternative 5 could pass through Warren, Sussex, and Morris counties. Beyond the southern VSL, the alignment could turn east, crossing the Delaware River at an existing river crossing. On the east side of the Delaware River in New Jersey, the alignment could follow I-80 to the Roseland Substation, crossing large parts of Warren and Morris counties and a small portion of Sussex County. The alignment could follow the I-80 ROW approximately 17 miles after leaving DEWA, where it could leave I-80 to travel over a heavily forested area for 2 miles with no existing ROW. The route could then reconnect with I-80, paralleling the interstate to the intersection with I-280, where it could turn in a southerly direction. This 3.2 mile stretch could follow an existing transmission line ROW with a width of 100 feet, ending at the Roseland Substation.



Appendix D

NPS and Applicant Correspondence Regarding Alternative 2b

APPENDIX D:
NPS AND APPLICANT CORRESPONDENCE REGARDING ALTERNATIVE 2B

Gregory J. Smith
Manager-Transmission Expansion

PPL Electric Utilities
Two North Ninth Street, GENN5
Allentown, PA 18101-1179

June 16, 2010
In regards to: SRLINE EIS 25147

Amanda Stein
Delaware Water Gap National Recreation Area
HQ River Road, Off Route 209
Bushkill, PA 18324

Dear Ms. Stein:

The Applicants have reviewed the NPS consultant's analysis of the Existing ROW Alternative, in particular using the existing 100' ROW for several spans in Pennsylvania. It appears that your consultant used a higher wind loading than is required to calculate the blow-out of the conductors. The wind loading used by the Utilities is a 6 psf load. For a detailed explanation of why a 6 psf wind load is appropriate, and the codes referenced to perform the blow-out calculations, see the attached report.

Furthermore, it should be clarified that the Existing ROW Alternative would use PPL EU's existing land rights. Such rights are only limited to 100 feet in five spans, not throughout the entire park in Pennsylvania Using the structure identifiers in your report, this would equate to the spans between structures 3-4, 5-6, 6-7, 7-8, and 9-10.

Sincerely,

Gregory J. Smith
Manager-Transmission Expansion
Enclosure (1)

CC:
John Donahue, Delaware Water Gap National Recreation Area
Pam Underhill, Appalachian National Scenic Trail

Sargent & Lundy LLC 6/11/2010

Segment B17 100' ROW Feasibility Study

For verifying the feasibility of utilizing PPL EU's existing ROW through the Pennsylvania portion of the Susquehanna – Roseland Project within DEWA, NESC regulations and industry standard guidelines set forth in RUS Bulletin 1724E-200 were followed. This includes the section where the existing ROW is 100'. Included below is a summary of calculations performed and references cited by S&L to make the conclusion that the new 500kV circuit construction was feasible for the existing ROW.

Typical ROW widths are established based on required clearances to objects (usually buildings) that are or may in the future exist along the edge of the ROW. The ROW width is calculated using formulas that account for horizontal wire displacement, horizontal wire spacing, structure deflection and horizontal clearance requirements from the wire. The two figures below are taken from the RUS Bulletin as a recommendation for ROW width of a transmission line.

Bulletin 1724E-200
Page 5-8

5.4.1 First Method: This method provides sufficient width to meet clearance requirements to buildings of undetermined height located directly on the edge of the right-of-way. See Figure 5-7.

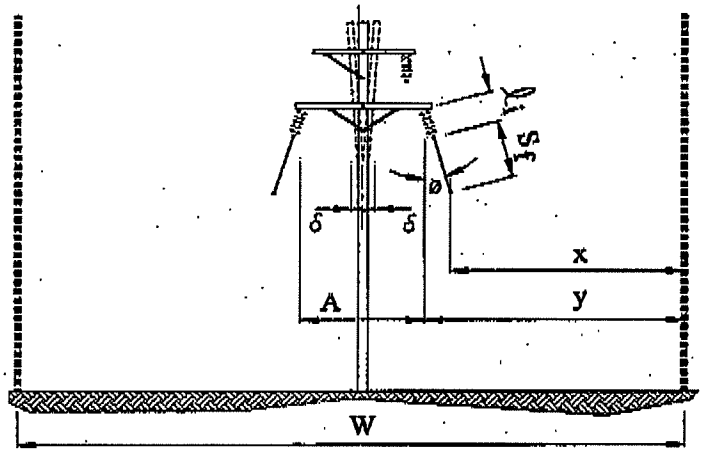


FIGURE 5-8: ROW WIDTH FOR SINGLE LINE OF STRUCTURES (FIRST METHOD)

$$W = A + 2(\ell_i + S_f)\sin\phi + 2\delta + 2x \qquad \text{Eq. 5-3}$$

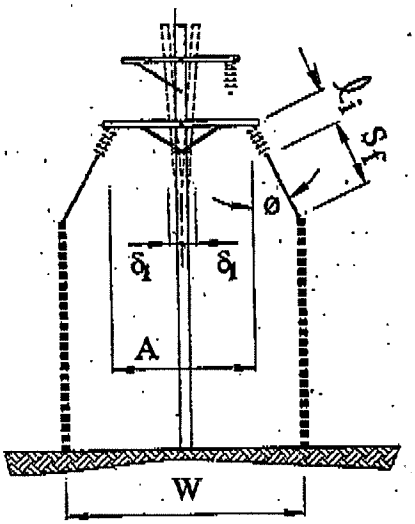


FIGURE 5-9: ROW WIDTH FOR SINGLE LINE OF STRUCTURES (SECOND METHOD)

From Figure 5-9 it can be seen that the formula for the width is:

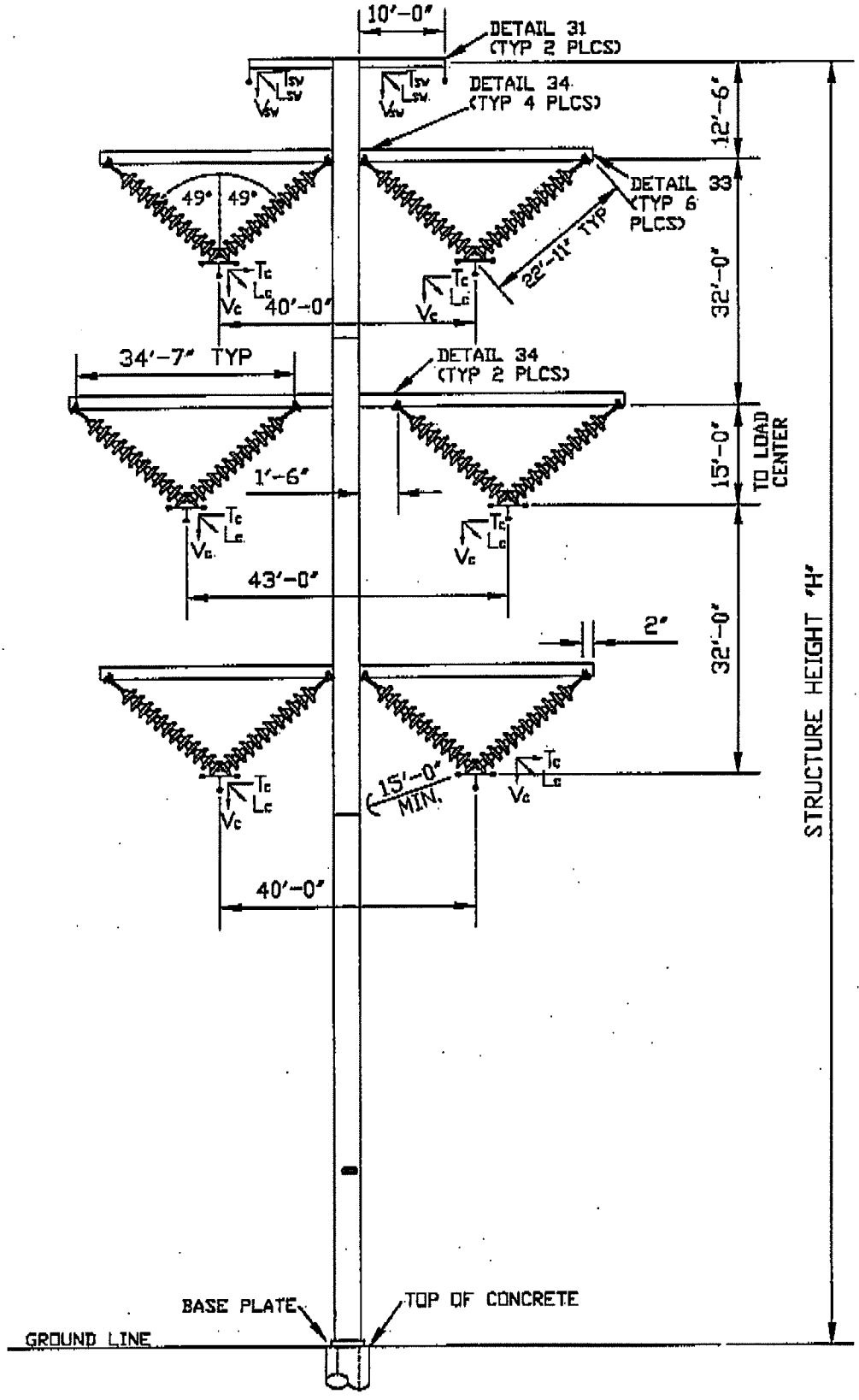
$$W = A + 2(\ell_i + S_f)\sin\phi + 2\delta_1 \qquad \text{Eq. 5-4}$$

As defined in the figures, A represents the horizontal spacing between the outer wires and x represents the required clearance from the conductor to the edge of the ROW. The remaining terms represent the deflection of the structure (δ) and the horizontal displacement of the wire ({ℓ+S}sinΦ). The first figure represents the calculation for the ROW width using the wire displacement and clearance values under 6psf wind loading as defined in Rule 234 of the NESC. The second figure represents an alternative method for determining the ROW using higher wind values. The wind values used in this second method are dependant upon the region the line is located in and is established by the transmission line owner during the design phase of the line. Notice that there is no required clearance beyond the conductor position under this method.

As set forth in the approved Design Basis Document dated March 6, 2009, the Horizontal clearance requirement from a wire/conductor displaced by a 6 psf wind to the edge of the ROW is 17'. The basis for this value is established in Rule 234 of the NESC with an additional margin of safety voluntarily included by PPL Electric Utilities. Included below is a standard structure configuration.

Sargent & Lundy LLC 6/11/2010

Segment B17 100' ROW Feasibility Study



Sargent & Lundy LLC 6/11/2010

Segment B17 100' ROW Feasibility Study

During the analysis, structure locations were modified in order to shorten the spans and reduce the maximum horizontal displacement of the wire to allow the line to fit within the existing 100' ROW. It was determined that the Method 1 calculation would be the controlling case for determining the required ROW width. To calculate the required ROW width using method 1, the following parameters were used:

A – 43'

δ – 1' (This value is established as the deflection limit for the structure)

x – 17' (An additional 3' was added to the required NESC value per PPL EU standard procedure)

$\{\ell+S\}\sin\Phi$ – 10' (The maximum conductor blowout of the line under 6 psf wind)

From this calculation, it is apparent that the required width of ROW for this line is 99'. This is less than the 100' existing ROW limitation and therefore represents a feasible option for the new line.

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

JUL 14 2010

Mr. Gregory Smith
Manager, Transmission Expansion
PPL Electric Utilities
Two North Street, GENN5
Allentown, Pennsylvania 18101-1179

Dear Mr. Smith:

We are writing in response to your correspondence of June 16, 2010, addressed to Ms. Amanda Stein.

Our consultant, EA Engineering, Science and Technology, Inc. and their sub-contractor, David Evans and Associates, Inc. have provided us with additional materials supporting the assertion that the 100 foot right-of-way in the Delaware Water Gap National Recreation Area is insufficient in maintaining compliance with National Electric Safety Code (NESC) for your proposed transmission line expansion and upgrades.

Once you have reviewed the materials provided with this letter, we suggest holding a meeting or conference call between our respective engineers and staff to resolve any differences in opinion.

Thank you for your attention to this matter.

Sincerely,

for John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6278

Cc:
Andrew Tittler
Patrick Lynch
Kara Deutsch
Sarah Bransom
Amanda Stein

Samuel Reynolds, Chief, Application Section II
U.S. Army Corps of Engineers
Philadelphia District, Regulatory Branch
Wanamaker Building, 100 Penn Square East
Philadelphia, Pennsylvania 19107-3390

Wayne Poppich
U.S. Army Corps of Engineers
Pocono Area Field Office
253 State Route 435 STE 4
Clifton Township, Pennsylvania 18424

Denver Service Center - TIC
Attn: SRLINE EIS
12795 W. Alameda Parkway
Denver, CO 80225-0287

Enclosures:

DAVID EVANS
AND ASSOCIATES INC.

June 24, 2010

Amanda Stein
Delaware Water Gap National Recreation Area
HQ River Rd off Route 209
Bushkill, PA 18324-9999

SUBJECT: SRLine EIS 25147

Dear Ms. Stein:

We recently sent a memo to Suzie Boltz in response to Gregory Smith's June 16th letter. The attached binder includes the reference materials and calculations DEA utilized to verify that a 100' ROW within in the Delaware Water Gap Recreation Area is insufficient to meet the National Electric Safety Code (et al).

Please use for any reference needs you might have and do not hesitate to let us know if further questions arise.

Sincerely,

DAVID EVANS AND ASSOCIATES, INC.

Paul Capell
Vice President, Energy

Copies: file
Attachments/Enclosures: Reference Materials Binder
Initials: kaki, mdwi
File Name: C:\Documents and Settings\kaki\Desktop\EAEN Letter.doc
Project Number: EAEN-1

DELAWARE WATER GAP
REFERENCE MATERIALS
INDEX

Memorandum ..... Tab 1

Calculations ..... Tab 2

Design Basic Documents ..... Tab 3

Blowout Reports ..... Tab 4

Structure Models ..... Tab 5

Plan & Profiles (by Others) ..... Tab 6

Southwire Sag 10 ..... Tab 7

Conductor Cut Sheets ..... Tab 8

Bulletin 1724E-200 ..... Tab 9

NESC Minimum Clearance Practices (by Others) ..... Tab 10

Conclusion ..... Tab 11

DAVID EVANS
AND ASSOCIATES INC.

MEMORANDUM

DATE: June 23, 2010

TO: Suzie Boltz, EA Engineering

FROM: Paul Capell

SUBJECT: **SRLINE EIS 25147**

PROJECT: DEWA Transmission Lines

We have the following responses to Gregory Smith's June 16th letter. Please edit with your comments and forward to the other team members.

- The RUS Bulletin 1724E-200 provided by the Applicant as the guide for ROW calculations only references voltages up to 230kV (230,000 volts).
- Please reference the attached table, "Existing PPL ROW Alternative Blowout Report for Spans with 100' ROW". The column entitled "Max. blowout from centerline each side (ft)" fails to represent the required V-string clearance (21.5 feet from the structure's centerline). The actual remaining buffer is 21.5 feet plus blowout, as shown on the DEA edited version of the same table.
- Throughout the ROW width development, the applicant has made reference to ACSR and ACCC conductors. Our models represent the use of Falcon ACSR that was used in the applicant's table, and we have further information and calculations for ACCC, as well.
- NESC minimum clearance from blowout to ROW edge is 17 feet. PJM requires a further 3-foot buffer. Therefore, actual "required clearance to each side of ROW (ft)" should be 17 feet plus 3 feet, or 20 feet.

Ultimately, our findings indicate that constructing the proposed project according to the proposed Plan and Profiles provided by the Applicant for the 100-foot ROW would violate the National Electric Safety Code. Further information is available upon request.

Copies: file
Attachments/Enclosures: Tables
Initials: kaki
File Name: C:\Documents and Settings\kaki\Desktop\EAEN InternalMemorandum.doc
Project Number: EAEN-1

PROVIDED BY JASON C. BTM

Using Existing PPL ROW Alternative
Blowout Report for spans with 100' ROW

Start Str. #	End Str. #	Cable Type	Voltage (kV)	Weather Case	Cable Condition	Proposed ROW Width (ft)	Max. Blowout from centerline, each side (ft)	Required Clearance to each side of ROW (ft)	Structure Deflection, each side (ft)	Remaining Buffer from tree line, each side (ft)	Minimum Vegetation Management Cycle*
B17-2	B17-2A	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	22.06	17	2	8.94	Every Three Years
B17-3	B17-3A	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	23.09	17	2	7.91	Every Three Years
B17-3A	B17-4	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	29.06	17	1	2.94	Every Year
B17-4	B17-5	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	23.33	17	2	7.67	Every Three Years
B17-5	B17-5A	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	22.87	17	2	8.13	Every Three Years
B17-5A	B17-6	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	24.84	17	2	6.16	Every Three Years

*Assumes a 2' growth per year

Recreated: 6/23/2010 by: mdwi DEA cjb DEA
For: National Park Service

Using Existing PPL ROW Alternative
Blowout Report for Spans with 100' ROW

Start Str. #	End Str. #	Cable Type	Voltage (kV)	Weather Case	Cable Condition	Proposed ROW Width (ft)	Max. Blowout from centerline each side (ft)	Blowout from structure centerline + V-string to ROW edge	Required Clearance to each side of ROW (ft)	Structure Deflection each side (ft)	(Applicant) Remaining Buffer from tree line, each side (ft)	Actual Remaining Buffer from tree line, each side (ft)	Minimum Vegetation Management Cycle
B17-2	B17-2A	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	22.06	43.56	17	2	8.94	-10.56	Every three years
B17-3	B17-3A	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	23.09	44.59	17	2	7.91	-11.59	Every three years
B17-3A	B17-4	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	29.06	50.56	17	1	2.94	-17.56	Every year
B17-4	B17-5	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	23.33	44.83	17	2	7.67	-11.83	Every three years
B17-5	B17-5A	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	22.87	44.37	17	2	8.13	-11.37	Every three years
B17-5A	B17-6	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	24.84	46.34	17	2	6.16	-13.34	Every three years

Gregory J. Smith
Manager-Transmission Expansion

PPL Electric Utilities
Two North Ninth Street, GENN5
Allentown, PA 18101-1179

DISCREPANCY:

1. $\delta \cong 1$ but blowout report says $\delta = 2'$
2. CALL OUT ACSR in one report Acec in another
3. Ref 2 diff sets of P&P's
4. RUS Bulletin covers up to 230kV
5. TABLE 5-3 RUS Bulletin for 230kV Typical ROW width 125-200 Sorry?
6. Formula $2\,diff$ $(T_1 + S_2)\sin\phi = 10$?
7.

June 16, 2010
In regards to: SRLINE EIS 25147

Amanda Stein
Delaware Water Gap National Recreation Area
HQ River Road, Off Route 209
Bushkill, PA 18324

Dear Ms. Stein:

The Applicants have reviewed the NPS consultant's analysis of the Existing ROW Alternative, in particular using the existing 100' ROW for several spans in Pennsylvania. It appears that your consultant used a higher wind loading than is required to calculate the blow-out of the conductors. The wind loading used by the Utilities is a 6 psf load. For a detailed explanation of why a 6 psf wind load is appropriate, and the codes referenced to perform the blow-out calculations, see the attached report.

Furthermore, it should be clarified that the Existing ROW Alternative would use PPL EU's existing land rights. Such rights are only limited to 100 feet in five spans, not throughout the entire park in Pennsylvania Using the structure identifiers in your report, this would equate to the spans between structures 3-4, 5-6, 6-7, 7-8, and 9-10.

Sincerely,

Gregory J. Smith
Manager-Transmission Expansion
Enclosure (1)

CC:
John Donahue, Delaware Water Gap National Recreation Area
Pam Underhill, Appalachian National Scenic Trail

Sargent & Lundy LLC 6/11/2010

Segment B17 100' ROW Feasibility Study

For verifying the feasibility of utilizing PPL EU's existing ROW through the Pennsylvania portion of the Susquehanna – Roseland Project within DEWA, NESC regulations and industry standard guidelines set forth in RUS Bulletin 1724E-200 were followed. This includes the section where the existing ROW is 100'. Included below is a summary of calculations performed and references cited by S&L to make the conclusion that the new 500kV circuit construction was feasible for the existing ROW.

Typical ROW widths are established based on required clearances to objects (usually buildings) that are or may in the future exist along the edge of the ROW. The ROW width is calculated using formulas that account for horizontal wire displacement, horizontal wire spacing, structure deflection and horizontal clearance requirements from the wire. The two figures below are taken from the RUS Bulletin as a recommendation for ROW width of a transmission line.

Bulletin 1724E-200
Page 5-8

5.4.1 First Method: This method provides sufficient width to meet clearance requirements to buildings of undetermined height located directly on the edge of the right-of-way. See Figure 5-7.

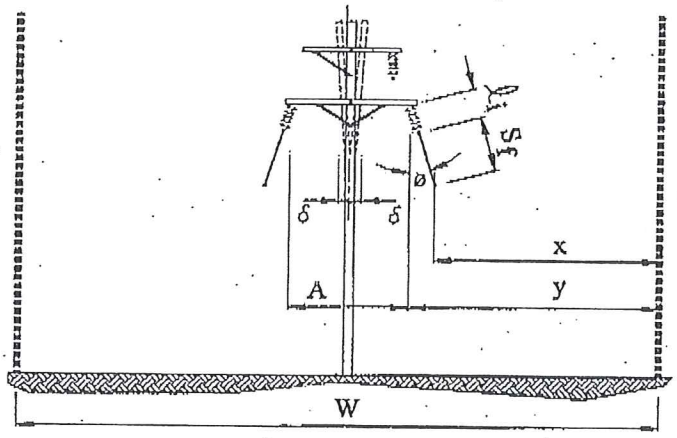


FIGURE 5-8: ROW WIDTH FOR SINGLE LINE OF STRUCTURES (FIRST METHOD)

$$W = A + 2(\ell_i + S_f)\sin\phi + 2\delta + 2x \qquad \text{Eq. 5-3}$$

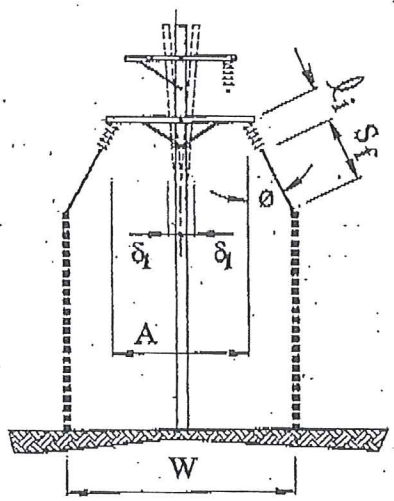


FIGURE 5-9: ROW WIDTH FOR SINGLE LINE OF STRUCTURES (SECOND METHOD)

From Figure 5-9 it can be seen that the formula for the width is:

$$W = A + 2(\ell_1 + S_f)\sin\phi + 2\delta_1 \qquad \text{Eq. 5-4}$$

As defined in the figures, A represents the horizontal spacing between the outer wires and x represents the required clearance from the conductor to the edge of the ROW. The remaining terms represent the deflection of the structure (δ) and the horizontal displacement of the wire ({ℓ+S}sinΦ). The first figure represents the calculation for the ROW width using the wire displacement and clearance values under 6psf wind loading as defined in Rule 234 of the NESC. The second figure represents an alternative method for determining the ROW using higher wind values. The wind values used in this second method are dependant upon the region the line is located in and is established by the transmission line owner during the design phase of the line. Notice that there is no required clearance beyond the conductor position under this method.

As set forth in the approved Design Basis Document dated March 6, 2009, the Horizontal clearance requirement from a wire/conductor displaced by a 6 psf wind to the edge of the ROW is 17'. The basis for this value is established in Rule 234 of the NESC with an additional margin of safety voluntarily included by PPL Electric Utilities. Included below is a standard structure configuration.

Sargent & Lundy LLC 6/11/2010

Segment B17 100' ROW Feasibility Study

During the analysis, structure locations were modified in order to shorten the spans and reduce the maximum horizontal displacement of the wire to allow the line to fit within the existing 100' ROW. It was determined that the Method 1 calculation would be the controlling case for determining the required ROW width. To calculate the required ROW width using method 1, the following parameters were used:

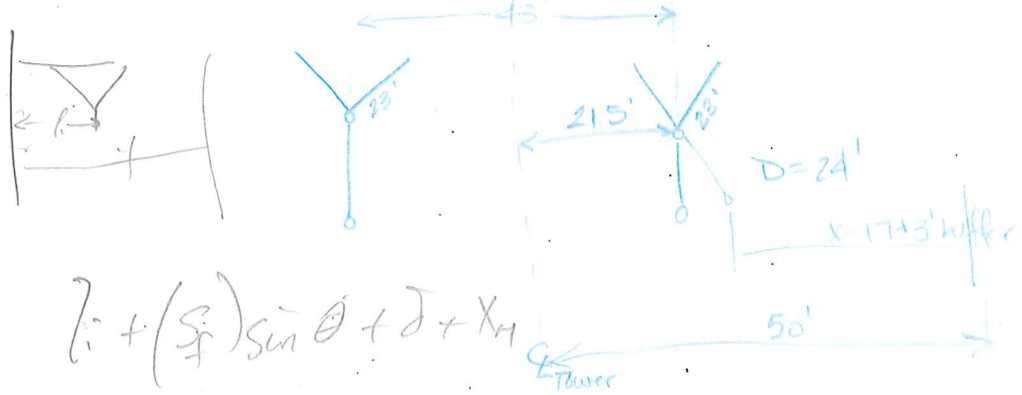
A – 43'

δ – 1' (This value is established as the deflection limit for the structure)

x – 17' (An additional 3' was added to the required NESC value per PPL EU standard procedure)

{ℓ+S}sinΦ – 10' (The maximum conductor blowout of the line under 6 psf wind)

From this calculation, it is apparent that the required width of ROW for this line is 99'. This is less than the 100' existing ROW limitation and therefore represents a feasible option for the new line.



$$W = A(\ell_i + S_f)\sin\theta + x + 2\delta$$

CALCULATIONS

Table:

Wind = 6psf
S_f = 13.5' – 34' (conductor sag)
L_i = 23' (length of insulator)
D_c = 1.545 in (1590 kcmil ACSR "Falcon" 54/19)
W_c = 2.044 lb/ft (1590 kcmil ACSR "Falcon" 54/19)

D_c = 1.361 in (1594 kcmil ACCC "Falcon" 36/7)
W_c = 1.79 lb/ft (1594 kcmil ACCC "Falcon" 36/7)

δ = 2' (1' for deadends)

DAVID EVANS AND ASSOCIATES INC.

JOB DESCRIPTION S-R LINE
CALCULATION FOR 100' ROW

JN. EAEN 01
BY MdW DATE 4/22 2010
SHEET 1 OF ____ SHEETS
CHECKED BY ____ DATE ____

WIND = 6 PSF $\delta = 2'$

S_f = SEE SAG REPORTS

$\gamma_i = 23'$ USE: $\frac{5}{12}$"

$d_c = 1.545$ in $W_c = 2.044$ lb/ft ACSR

$d_c = 1.361$ in $W_c = 1.79$ lb/ft ACCC

ACSR

$$\theta = \tan^{-1}\left(\frac{(d_c)(F)}{12\,W_c}\right)$$

$$= \tan^{-1}\left(\frac{(1.545)(6)}{12(2.044)}\right)$$

$$= 20.7°$$

ACCC

$$\theta = \tan^{-1}\left(\frac{(d_c)(F)}{12\,W_c}\right)$$

$$= \tan^{-1}\left(\frac{(1.361)(6)}{12(1.79)}\right)$$

$$= 20.8°$$

RUS Bulletin 1724E-200

$W = A + 2(\gamma_i + S_f)\sin\theta + 2\delta + 2x$

$= 13 + 2\left(\frac{5}{12}" + 24.19\right)\sin 20.7 + 2(2) + 2(20)$

$= 104.4'$ fails @ 1218' SPAN

$W = A + 2(\gamma_i + S_f)\sin\theta + 2\delta + 2x$

$= 13 + 2\left(\frac{5}{12} + 27.88\right)\sin 20.8 + 2(2) + 2(20)$

$= 107.1'$ fails @ 1218' SPAN

DAVID EVANS AND ASSOCIATES INC.

JOB DESCRIPTION SR Line Calc

CALCULATION FOR 100' ROW additional spans

JN. EAEN 01

BY mdw DATE 4/22 2010

SHEET 2 OF _____ SHEETS

CHECKED BY _____ DATE _____

ACSR

Span = 839'
S_f = 13.23'
θ = 20.7°

$W = 43 + 2\left(\frac{5}{12} + 13.23\right)\sin 20.7 + 4 + 40$

$= 96.65'$ ok

Span = 1058'
S_f = 21.02'

$W = 43 + 2\left(\frac{5}{12} + 21.02\right)\sin 20.7 + 4 + 40$

$= 102.2'$ fails

ACCC

839
11.47'
20.8°

$W = 43 + 2\left(\frac{5}{12} + 11.47\right)\sin 20.8 + 4 + 40$

$= 95.4'$ ok

1058'
18.24'

$W = 43 + 2\left(\frac{5}{12} + 18.24\right)\sin 20.8 + 4 + 40$

$= 100.25'$ fails

5.3.1 Conductor Blowout

Transmission lines must be designed not only to provide a adequate vertical clearance for electrical and safety considerations, but also to allow for adequate horizontal clearance to tall objects and buildings at the edge of the right-of-way (ROW) under high wind conditions. Conductor displacement as a result of high winds is termed conductor blowout. The maximum displacement of the outermost conductors from the center of the ROW under high wind conditions can be one of the most important variables in determining ROW width. Conductor blowout is primarily a function of conductor weight and the wind force perpendicular to the conductor. However, the calculation of conductor blowout should also include the lateral movement of the suspension insulators. The horizontal wind force acting on a conductor may be estimated by the following equation:

$$F_H = 0.00256 \left(\frac{d}{12}\right) (V_w)^2 \qquad (5\text{-}9)$$

where:

d = *conductor diameter, in*

V_w = *wind speed, mph*

F_H = *horizontal wind force, lbs/ft*

Assuming equilibrium of the moments resulting from the conductor weight and wind force about the attachment point, the angle of conductor blowout, θ, can be determined by:

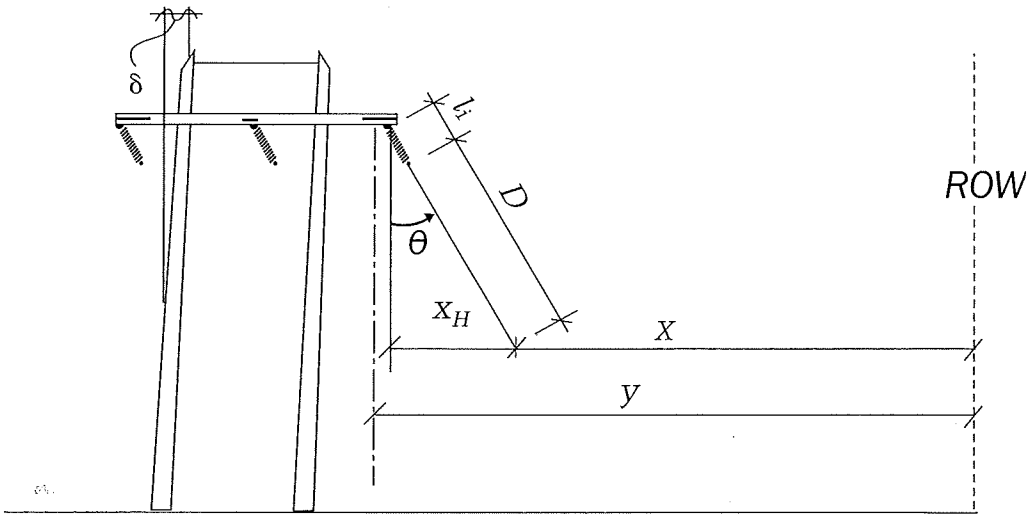
$$\theta = tan^{-1} \frac{F_H}{w_c} \qquad (5\text{-}10)$$

where:

w_c = *conductor weight per unit length, lbs/ft*

The blowout angle of the conductor catenary and any suspension insulator are assumed to be the same as those indicated in Figure 5-6[23]. This figure demonstrates how the clearance to the edge of ROW must include structure deflection.

FIGURE 5-6
CALCULATION OF CONDUCTOR BLOWOUT



y = total horizontal distance from insulator suspension point to edge of ROW (under still air)

x = required minimum horizontal clearance to edge of ROW under high wind conditions

The total horizontal blowout of the conductor at the midpoint of the span is:

$$X_H = (l_i + D)\,(\sin\theta) + \delta \qquad (5\text{-}11)$$

where:

X_H = *horizontal deflection at midpoint of span, ft*

l_i = *length of insulator string, ft*

D = *midpoint sag of conductor at specified wind and conductor temperature, ft*

δ = *structure deflection, ft*

At lower voltage levels, ROW width may be determined by the need to maintain adequate horizontal clearance. However, at higher voltage levels, the ROW width is typically determined by minimum requirements for environmental effects.

5.3.2 Aeolian Vibration

Aeolian vibration typically occurs in response to low velocity wind (2 mph to 15 mph) blowing steadily perpendicular to the line, as noted in Table 5-3. The resulting conductor vibration, generally less than a conductor diameter in amplitude, is difficult to detect with the bare eye. Vibration amplitudes of less than an inch however, can result in conductor strand fatigue near attachment points for steel, aluminum and copper conductors. To control aeolian vibration, the design everyday tension (EDS) of the conductor is kept as low as possible, and dampers are added when required. While the cost of dampers is typically small, the cost of using low tension levels as a control technique can be expensive in some design situations. Since aeolian vibration leads to conductor failure through the mechanism of strand fatigue, it can be a major factor in line reliability. Lines exhibiting high vibration levels can be very expensive to operate because of the need to inspect and replace conductors and the need to add reinforcing armor rods or other repair hardware. Factors affiliated with aeolian vibration are described in the following sub-sections.

String Mode Vibration of Conductor

An overhead span (catenary) is supported at each end by suspension or dead-end hardware. This hardware is attached to and supported by ceramic or composite insulator strings, which are supported by wood, metal, concrete or steel structures. The aeolian vibration phenomena of this very complex mechanical system is typically represented by ignoring the hardware, insulators and structures, and assuming that the location of the suspension points are fixed. The vibration of the bare conductor may be represented by the vibrating string equation:

$$m\left(\frac{d^2y}{dt^2}\right) - T\left(\frac{d^2y}{dx^2}\right) = 0 \qquad (5\text{-}12)$$

where:

m = *mass per unit length of conductor, lbs/ft*

T = *conductor tension, lbs*

x,y = *horizontal and vertical displacement, respectively, of cable along span, ft*

t = *time, sec*

Using standard mathematical methods, the solutions to this equation consist of traveling waves (transverse disturbances) which propagate along the conductor with a velocity of:

$$V = \sqrt{\frac{T(N)}{m\,(kg/m)}} = \sqrt{\frac{T(lbs)\;[32.2\;(ft/sec^2)]}{w\,(lbs/ft)}} \qquad (5\text{-}13$$

For a typical bare overhead transmission conductor installed to typical tension levels, this mechanical wave velocity is on the order of 400 ft/sec (120 m/sec). For example, if a 795 kcmil – 26/7 ACSR "Drake" conductor is installed to 4725 lbs (15% RBS), the wave velocity is:

$$\sqrt{\frac{(4725)(32.2)}{1.094}} = 373\ ft/sec$$

Combinations of traveling waves on the conductor can lead to standing waves or string modes having certain discrete frequencies. These natural frequencies are related to both the span length, L, and the wave velocity, V:

$$f_n = \left(\frac{n}{2L}\right)V \qquad (5\text{-}14$$

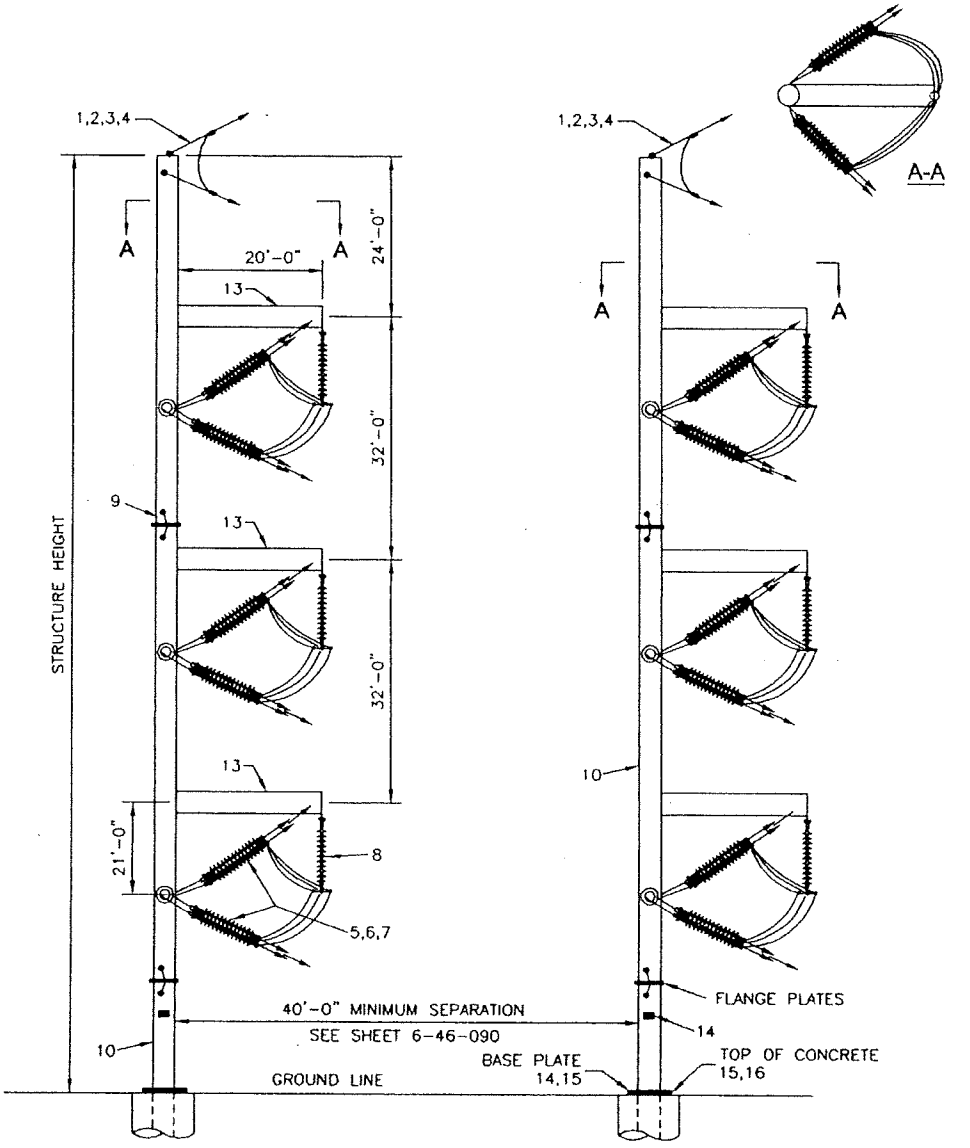
where:

the modal number, n, is a positive whole number

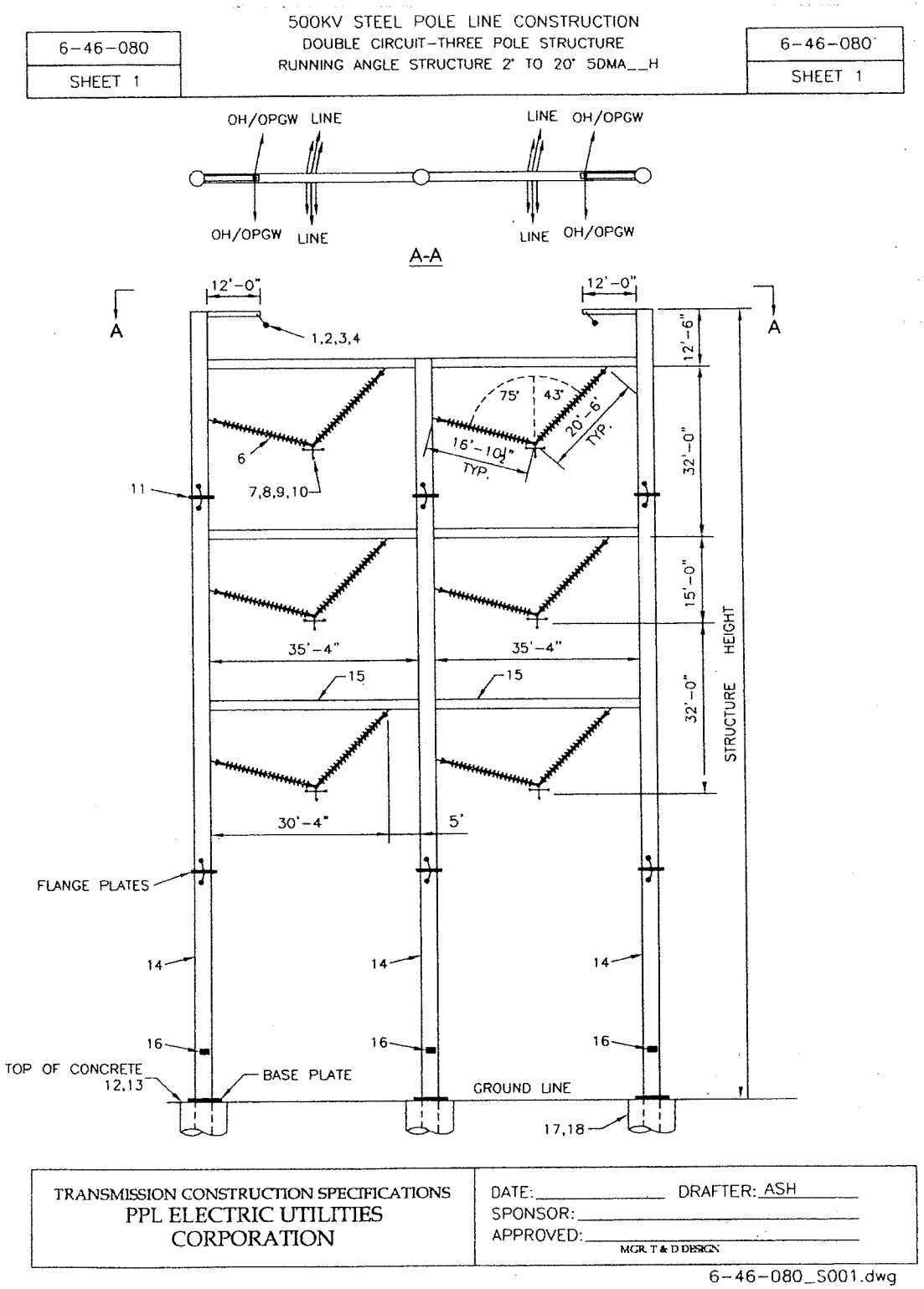
DESIGN BASICS DOCUMENT

The information in this section was used to create the models for calculating the clearances within the 100' proposed ROW and the PLS CADD models for the blowout reports herein.

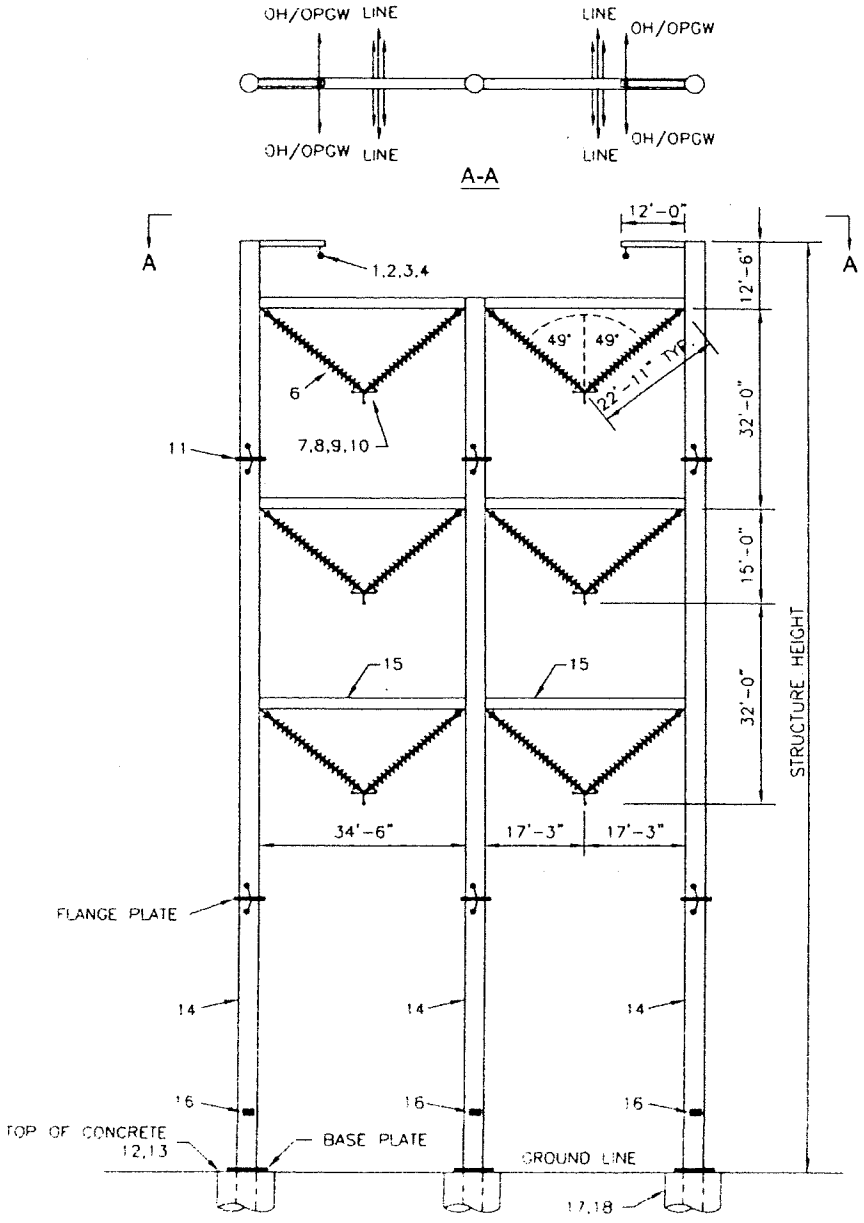
6-46-084	500KV STEEL POLE LINE CONSTRUCTION DOUBLE CIRCUIT – TWO POLE DEADEND STRUCTURE	6-46-084
SHEET 1	TYPE 5DMD__ L/R	SHEET 1



TRANSMISSION CONSTRUCTION SPECIFICATIONS PPL ELECTRIC UTILITIES CORPORATION	DATE:_____ DRAFTER: ASH SPONSOR:_____ APPROVED:_____ MGR. T & D DESIGN

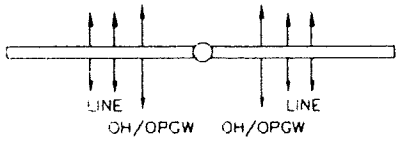

6-46-080
SHEET 1
500KV STEEL POLE LINE CONSTRUCTION
DOUBLE CIRCUIT-THREE POLE STRUCTURE
RUNNING ANGLE STRUCTURE 2° TO 20° 5DMA__H
6-46-080
SHEET 1
OH/OPGW LINE
LINE OH/OPGW
OH/OPGW LINE
LINE OH/OPGW
A-A
12'-0"
12'-0"
A
A
1,2,3,4
75°
43°
20'-6" TYP.
16'-10½" TYP.
6
7,8,9,10
11
12'-6"
32'-0"
15'-0"
32'-0"
STRUCTURE HEIGHT
35'-4"
35'-4"
15
15
30'-4"
5'
FLANGE PLATES
14
14
14
16
16
16
TOP OF CONCRETE
12,13
BASE PLATE
GROUND LINE
17,18
TRANSMISSION CONSTRUCTION SPECIFICATIONS
PPL ELECTRIC UTILITIES
CORPORATION
DATE:
DRAFTER: ASH
SPONSOR:
APPROVED:
MGR T & D DESIGN
6-46-080_S001.dwg

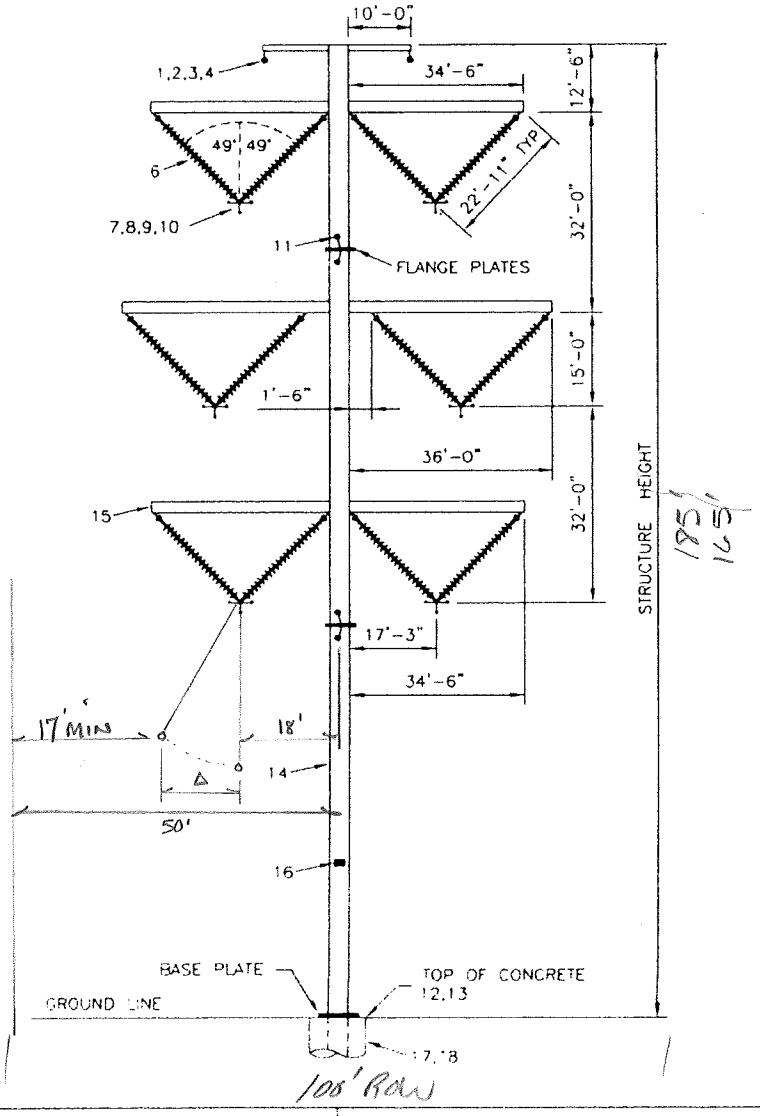
6-46-078	500KV STEEL POLE LINE CONSTRUCTION DOUBLE CIRCUIT– THREE POLE STRUCTURE TANGENT AND LIGHT ANGLE 0° TO 2° 5DMT__H FOR SPANS GREATER THAN 700 FEET	6-46-078
SHEET 1		SHEET 1



TRANSMISSION CONSTRUCTION SPECIFICATIONS PPL ELECTRIC UTILITIES CORPORATION	DATE: _____ DRAFTER: ASH SPONSOR: _____ APPROVED: _____ MGR. T & D DESIGN

6-46-076	500KV STEEL POLE LINE CONSTRUCTION DOUBLE CIRCUIT – SINGLE POLE – STRAIGHT ARMS TANGENT AND LIGHT ANGLE 0°-2° 50PT__H FOR SPANS UP TO 700 FEET	6-46-076
SHEET 1		SHEET 1





* NESC +3' | u/Buffer
6yr ice/wind 17' | 20'
Final Sag 20' | 23'
1' | 7'

Wire to Str
235-6 | 18'

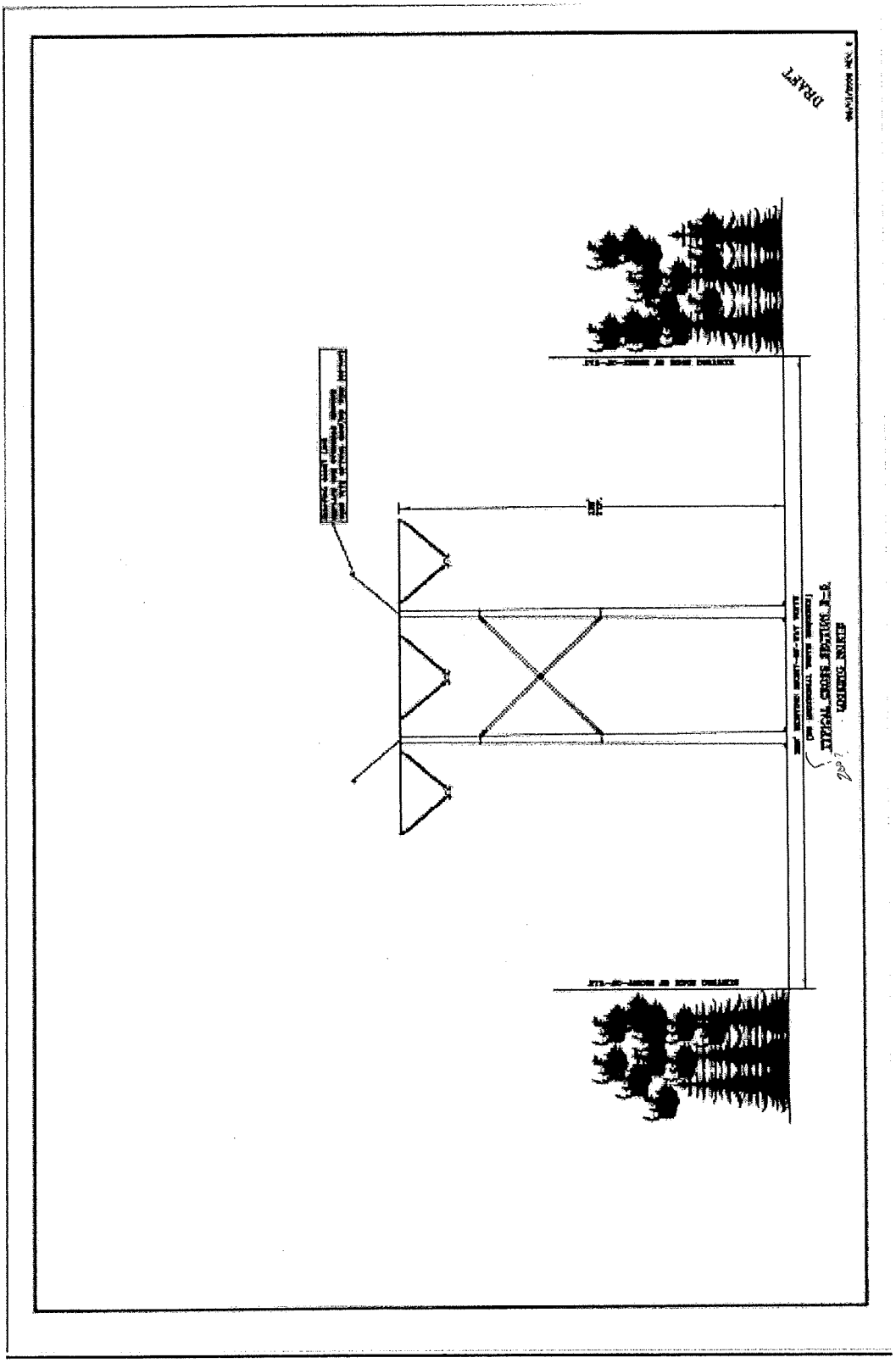
wire to wire
NESC 232 235 | 25'

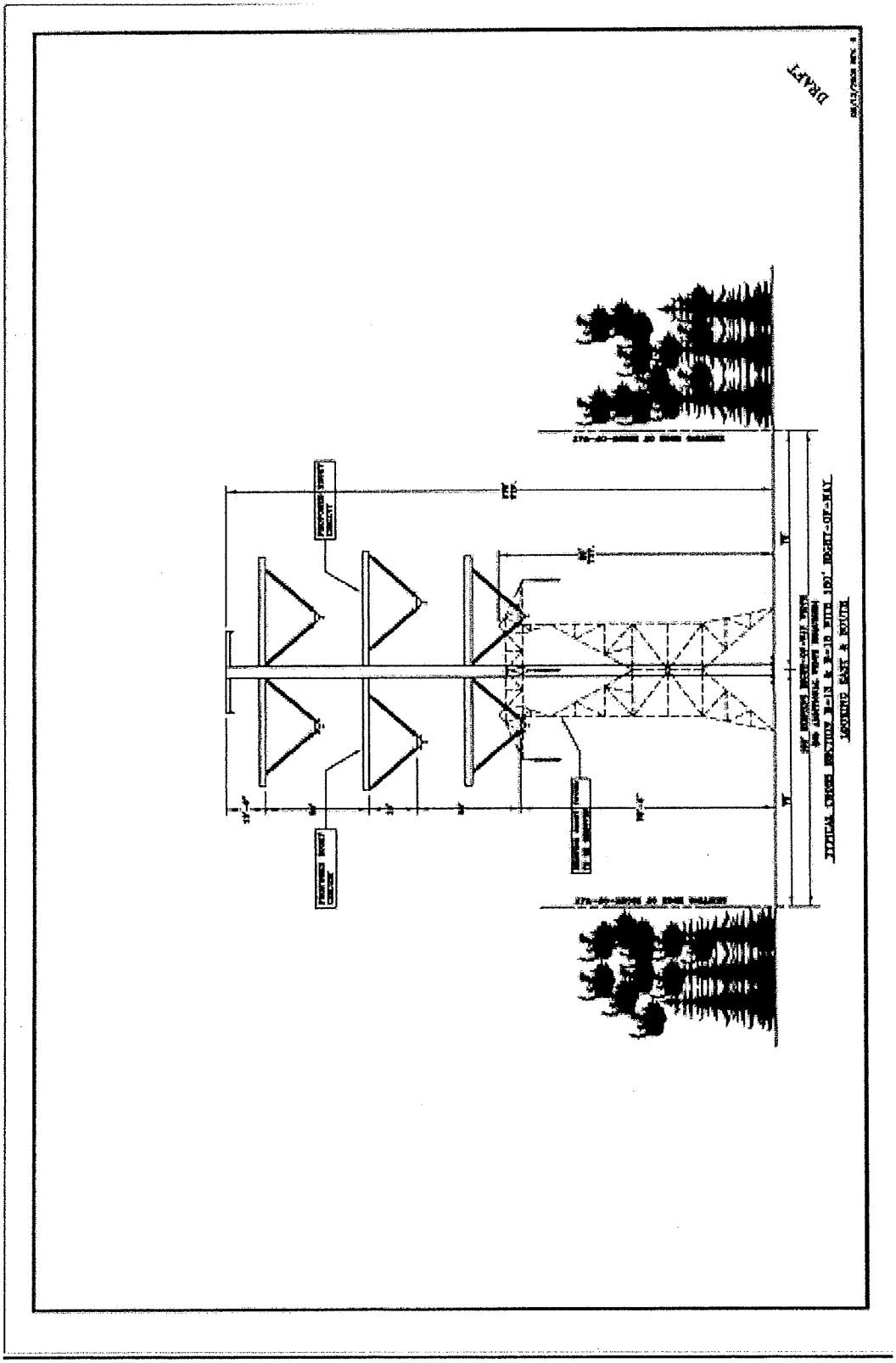
wire to ground wire to str/pole/tbr
NESC 232-1 234

50' - 17' - 18' = 15'
50' - 22' (Blowout) = 28' - 18' = 10' < 17' min

185'
165'
100' ROW

TRANSMISSION CONSTRUCTION SPECIFICATIONS PPL ELECTRIC UTILITIES CORPORATION	DATE: _____ DRAFTER: ASH SPONSOR: _____ APPROVED: _____ MGR. T&D DESIGN


DRAFT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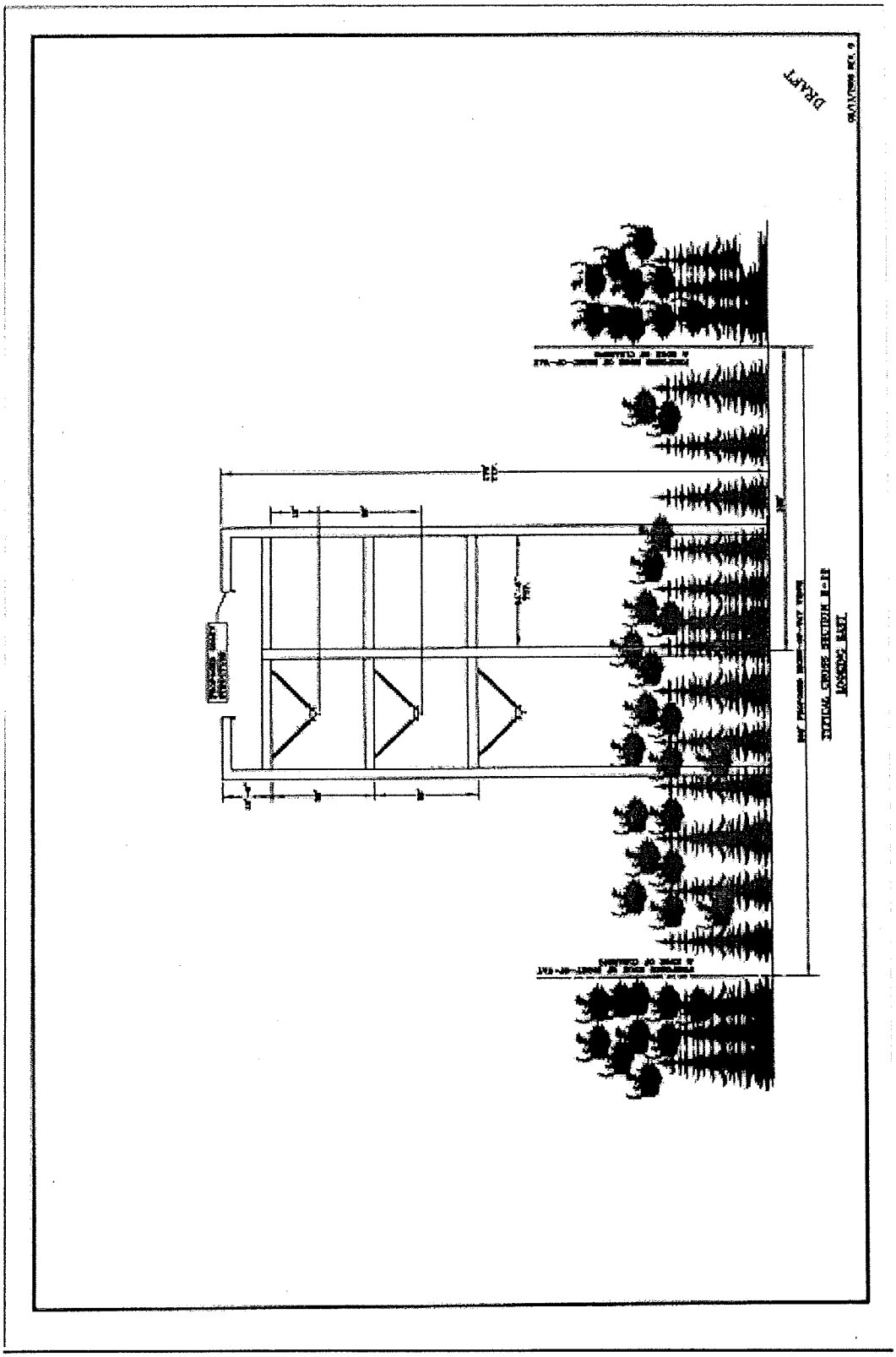
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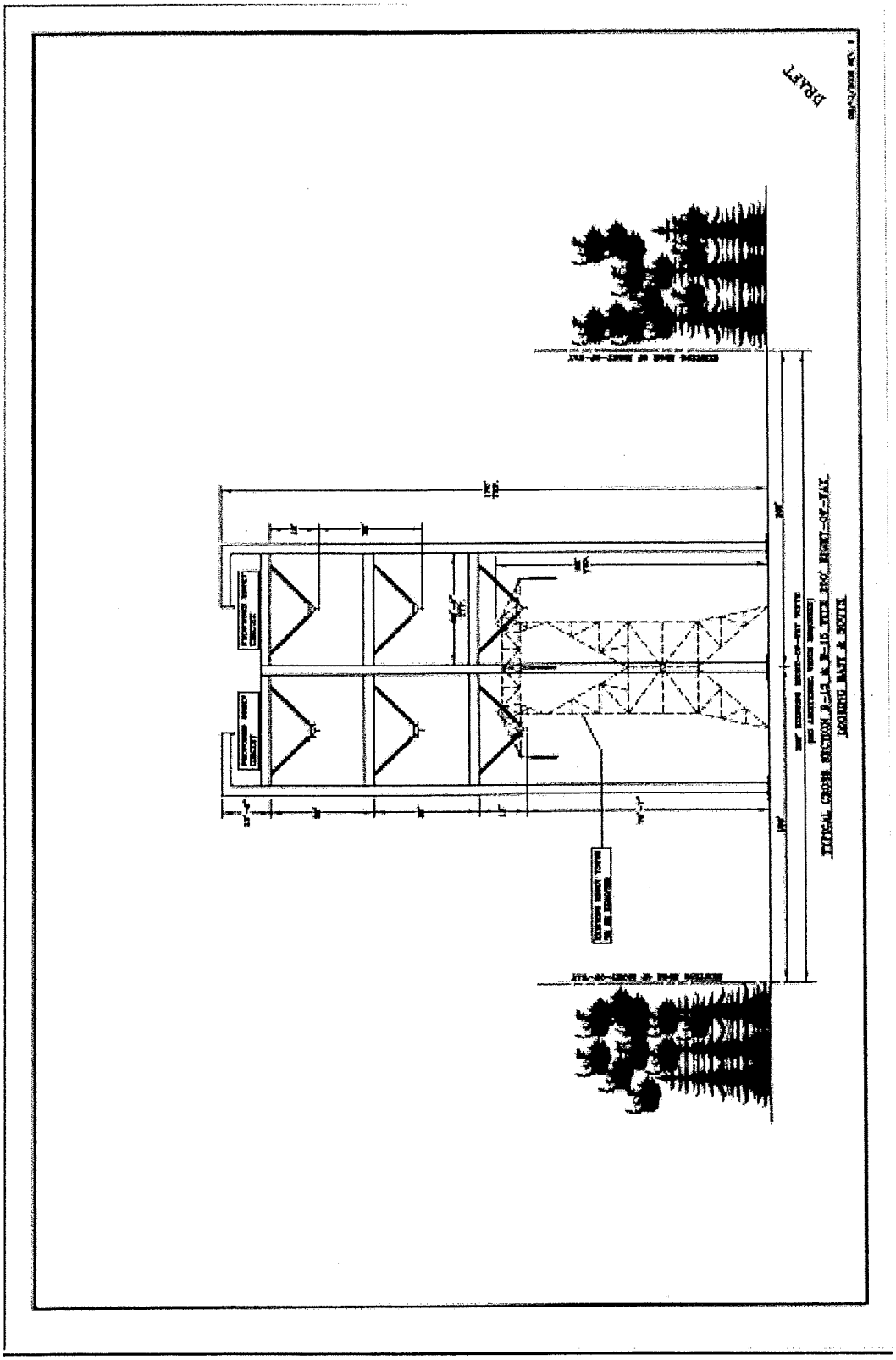
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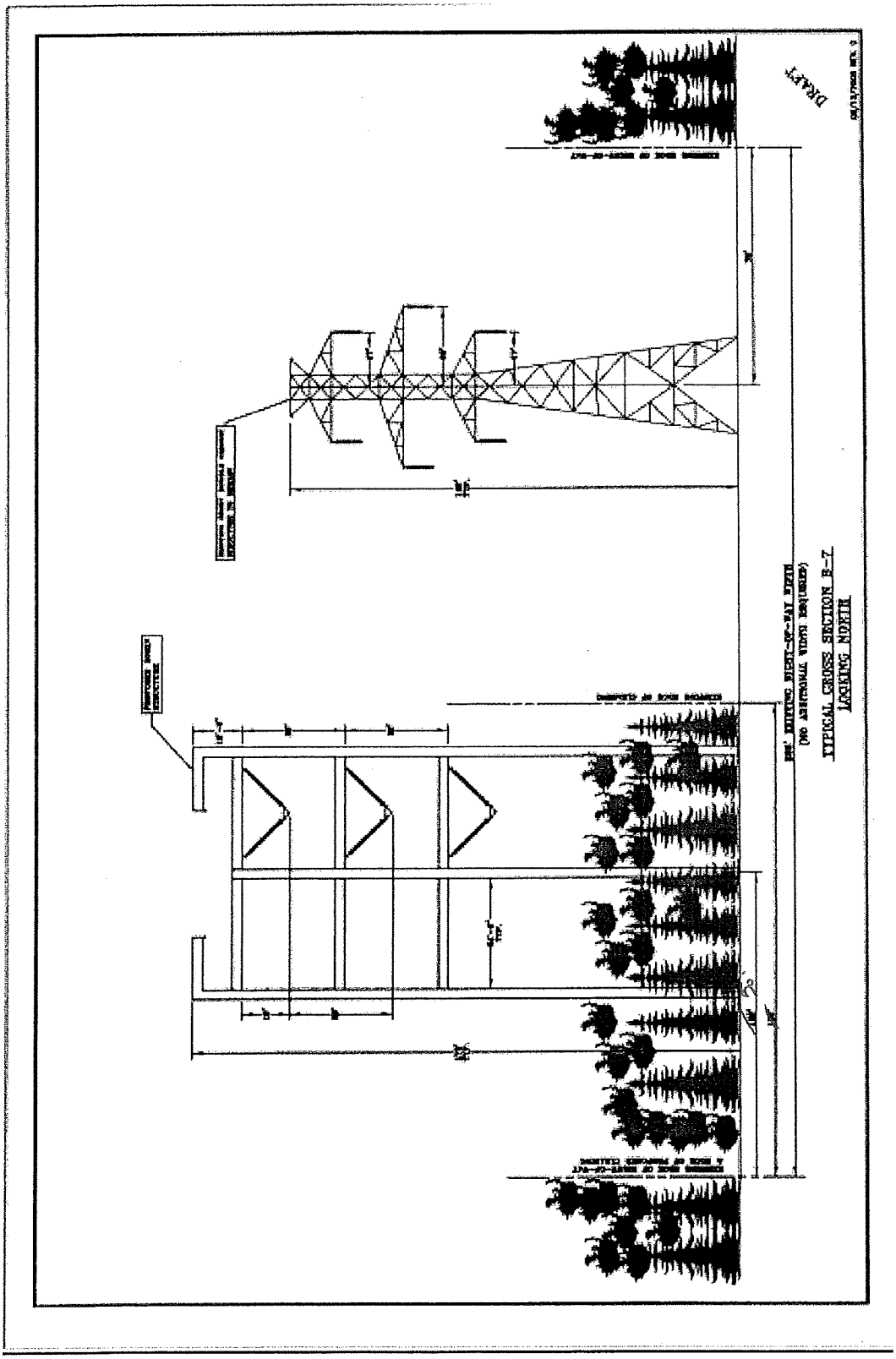

TYPICAL CROSS SECTION E-Z
LOOKING NORTH

BLOWOUT REPORTS

PLS-CADD Version 10.40 9:25:24 AM Thursday, June 24, 2010
David Evans & Associates
Project Name: 'c:\documents and settings\gabl\desktop\dewa elevations\dewa_alt_bb.DON'

Blowout Report

Offset measured relative to alignment center line.

Start Struct Num	Start Struct Set	Start Struct Phase	End Struct Number	End Struct Set	End Struct Phase	Ahead Span -age Cable File Name (kV)	Weather Case Description	Cable Condition	Wind From	--------Max------- Station (ft)	--------Max------- Offset (ft)	-------Leftmost--------- -----Blowout----- Station (ft)	-------Leftmost--------- -----Blowout----- Offset (ft)	---------Leftmost------- ---------Blowout-------- Station (ft)	---------Leftmost------- ---------Blowout-------- Offset (ft)
1	1	1	2	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	571.28	28.09	1173.54	19.06	571.28	28.09
1	1	2	2	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	597.26	28.85	12.49	20.37	597.26	28.85
1	1	3	2	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	584.27	28.47	1173.54	19.83	584.27	28.47
1	1	1	2	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	12.49	19.63	603.25	10.97	12.49	19.63
1	1	2	2	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	1173.54	20.58	577.28	11.73	1173.54	20.58
1	1	3	2	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	1173.54	19.83	590.27	11.36	1173.54	19.83
1	11	1	2	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	12.49	-19.63	12.49	-19.63	603.25	-10.97
1	11	2	2	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	1173.54	-20.58	1173.54	-20.58	577.28	-11.73
1	11	3	2	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	1173.54	-19.83	1173.54	-19.83	590.27	-11.36
1	11	1	2	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	571.28	-28.09	571.28	-28.09	1173.54	-19.06
1	11	2	2	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	597.26	-28.85	597.26	-28.85	12.49	-20.37
1	11	3	2	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	584.27	-28.47	584.27	-28.47	1173.54	-19.83
2	2	1	3	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	1765.97	27.80	1173.54	19.06	1765.97	27.80
2	2	2	3	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	1765.97	29.32	1173.54	20.58	1765.97	29.32
2	2	3	3	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	1765.97	28.56	1173.54	19.83	1765.97	28.56
2	2	1	3	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	2356.90	19.06	1765.97	10.33	2356.90	19.06
2	2	2	3	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	2356.90	20.58	1765.97	11.84	2356.90	20.58
2	2	3	3	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	2356.90	19.83	1765.97	11.09	2356.90	19.83
2	3	1	3	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	1173.54	-19.06	1173.54	-19.06	1765.97	-10.33
2	3	2	3	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	1173.54	-20.58	1173.54	-20.58	1765.97	-11.84
2	3	3	3	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Left	1173.54	-19.83	1173.54	-19.83	1765.97	-11.09
2	3	1	3	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	1765.97	-27.80	1765.97	-27.80	2356.90	-19.06
2	3	2	3	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	1765.97	-29.32	1765.97	-29.32	2356.90	-20.58
2	3	3	3	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS		Right	1765.97	-28.56	1765.97	-28.56	2356.90	-19.83

3	2	1	4	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	3012.68	29.78	2356.90	19.06	3012.68	29.78
3	2	2	4	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	3012.68	31.30	2356.90	20.58	3012.68	31.30
3	2	3	4	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	3012.68	30.54	2356.90	19.83	3012.68	30.54
3	2	1	4	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	3669.96	19.06	3012.68	8.34	3669.96	19.06
3	2	2	4	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	3669.96	20.58	3012.68	9.86	3669.96	20.58
3	2	3	4	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	3669.96	19.83	3012.68	9.11	3669.96	19.83
3	3	1	4	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	2356.90	-19.06	2356.90	-19.06	3012.68	-8.34
3	3	2	4	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	2356.90	-20.58	2356.90	-20.58	3012.68	-9.86
3	3	3	4	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	2356.90	-19.83	2356.90	-19.83	3012.68	-9.11
3	3	1	4	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	3012.68	-29.78	3012.68	-29.78	3669.96	-19.06
3	3	2	4	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	3012.68	-31.30	3012.68	-31.30	3669.96	-20.58
3	3	3	4	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	3012.68	-30.54	3012.68	-30.54	3669.96	-19.83
4	2	1	5	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	4226.41	26.80	4780.86	19.06	4226.41	26.80
4	2	2	5	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	4226.41	28.32	4780.86	20.58	4226.41	28.32
4	2	3	5	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	4226.41	27.56	4780.86	19.83	4226.41	27.56
4	2	1	5	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	3669.96	19.06	4226.41	11.32	3669.96	19.06
4	2	2	5	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	3669.96	20.58	4226.41	12.84	3669.96	20.58
4	2	3	5	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	3669.96	19.83	4226.41	12.09	3669.96	19.83
4	3	1	5	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	4780.86	-19.06	4780.86	-19.06	4226.41	-11.32
4	3	2	5	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	4780.86	-20.58	4780.86	-20.58	4226.41	-12.84
4	3	3	5	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	4780.86	-19.83	4780.86	-19.83	4226.41	-12.09
4	3	1	5	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	4226.41	-26.80	4226.41	-26.80	3669.96	-19.06
4	3	2	5	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	4226.41	-28.32	4226.41	-28.32	3669.96	-20.58
4	3	3	5	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	4226.41	-27.56	4226.41	-27.56	3669.96	-19.83
5	2	1	6	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	5265.65	24.91	4780.86	19.06	5265.65	24.91
5	2	2	6	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	5232.68	25.66	5697.99	20.29	5232.68	25.66
5	2	3	6	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	5249.17	25.28	4780.86	19.83	5249.17	25.28
5	2	1	6	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	5697.99	19.70	5225.18	14.15	5697.99	19.70
5	2	2	6	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	4780.86	20.58	5258.16	14.92	4780.86	20.58
5	2	3	6	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	4780.86	19.83	5241.67	14.54	4780.86	19.83
5	3	1	6	11	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	5697.99	-19.70	5697.99	-19.70	5225.18	-14.15
5	3	2	6	11	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	4780.86	-20.58	4780.86	-20.58	5258.16	-14.92
5	3	3	6	11	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	4780.86	-19.83	4780.86	-19.83	5241.67	-14.54
5	3	1	6	11	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	5265.65	-24.91	5265.65	-24.91	4780.86	-19.06
5	3	2	6	11	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	5232.68	-25.66	5232.68	-25.66	5697.99	-20.29
5	3	3	6	11	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	5249.17	-25.28	5249.17	-25.28	4780.86	-19.83

6	1	1	7	1	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	6630.41	39.48	5722.53	20.51	6630.41	39.48
6	1	2	7	1	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	6630.41	39.48	5722.53	20.51	6630.41	39.48
6	1	3	7	1	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	6630.41	39.48	5722.53	20.51	6630.41	39.48
6	1	1	7	1	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	5722.53	19.49	6630.41	0.52	5722.53	19.49
6	1	2	7	1	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	5722.53	19.49	6630.41	0.52	5722.53	19.49
6	1	3	7	1	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	5722.53	19.49	6630.41	0.52	5722.53	19.49
6	11	1	7	11	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	5722.53	-19.49	5722.53	-19.49	6630.41	-0.52
6	11	2	7	11	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	5722.53	-19.49	5722.53	-19.49	6630.41	-0.52
6	11	3	7	11	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	5722.53	-19.49	5722.53	-19.49	6630.41	-0.52
6	11	1	7	11	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	6630.41	-39.48	6630.41	-39.48	5722.53	-20.51
6	11	2	7	11	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	6630.41	-39.48	6630.41	-39.48	5722.53	-20.51
6	11	3	7	11	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	6630.41	-39.48	6630.41	-39.48	5722.53	-20.51
7	1	1	8	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	8255.10	31.42	8982.42	19.06	8255.10	31.42
7	1	2	8	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	8278.08	32.18	7567.75	20.42	8278.08	32.18
7	1	3	8	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	8266.59	31.80	8982.42	19.83	8266.59	31.80
7	1	1	8	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	7567.75	19.58	8283.58	7.64	7567.75	19.58
7	1	2	8	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	8982.42	20.58	8260.60	8.40	8982.42	20.58
7	1	3	8	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	8982.42	19.83	8272.09	8.03	8982.42	19.83
7	11	1	8	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	7567.75	-19.58	7567.75	-19.58	8283.58	-7.64
7	11	2	8	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	8982.42	-20.58	8982.42	-20.58	8260.60	-8.40
7	11	3	8	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	8982.42	-19.83	8982.42	-19.83	8272.09	-8.03
7	11	1	8	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	8255.10	-31.42	8255.10	-31.42	8982.42	-19.06
7	11	2	8	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	8278.08	-32.18	8278.08	-32.18	7567.75	-20.42
7	11	3	8	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	8266.59	-31.80	8266.59	-31.80	8982.42	-19.83
8	2	1	9	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	9750.75	32.95	8982.42	19.06	9750.75	32.95
8	2	2	9	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	9750.75	34.47	8982.42	20.58	9750.75	34.47
8	2	3	9	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	9750.75	33.72	8982.42	19.83	9750.75	33.72
8	2	1	9	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	10515.07	19.06	9750.75	5.17	10515.07	19.06
8	2	2	9	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	10515.07	20.58	9750.75	6.69	10515.07	20.58
8	2	3	9	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	10515.07	19.83	9750.75	5.93	10515.07	19.83
8	3	1	9	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	8982.42	-19.06	8982.42	-19.06	9750.75	-5.17
8	3	2	9	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	8982.42	-20.58	8982.42	-20.58	9750.75	-6.69
8	3	3	9	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	8982.42	-19.83	8982.42	-19.83	9750.75	-5.93
8	3	1	9	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	9750.75	-32.95	9750.75	-32.95	10515.07	-19.06
8	3	2	9	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	9750.75	-34.47	9750.75	-34.47	10515.07	-20.58
8	3	3	9	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	9750.75	-33.72	9750.75	-33.72	10515.07	-19.83

9	2	1	10	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	11263.45	32.11	12011.34	19.06	11263.45	32.11
9	2	2	10	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	11263.45	33.63	12011.34	20.58	11263.45	33.63
9	2	3	10	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	11263.45	32.87	12011.34	19.83	11263.45	32.87
9	2	1	10	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	10515.07	19.06	11263.45	6.01	10515.07	19.06
9	2	2	10	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	10515.07	20.58	11263.45	7.53	10515.07	20.58
9	2	3	10	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	10515.07	19.83	11263.45	6.78	10515.07	19.83
9	3	1	10	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	12011.34	-19.06	12011.34	-19.06	11263.45	-6.01
9	3	2	10	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	12011.34	-20.58	12011.34	-20.58	11263.45	-7.53
9	3	3	10	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	12011.34	-19.83	12011.34	-19.83	11263.45	-6.78
9	3	1	10	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	11263.45	-32.11	11263.45	-32.11	10515.07	-19.06
9	3	2	10	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	11263.45	-33.63	11263.45	-33.63	10515.07	-20.58
9	3	3	10	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	11263.45	-32.87	11263.45	-32.87	10515.07	-19.83
10	2	1	11	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	12758.10	32.15	13506.87	19.06	12758.10	32.15
10	2	2	11	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	12758.10	33.67	13506.87	20.58	12758.10	33.67
10	2	3	11	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	12758.10	32.91	13506.87	19.83	12758.10	32.91
10	2	1	11	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	12011.34	19.06	12758.10	5.98	12011.34	19.06
10	2	2	11	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	12011.34	20.58	12758.10	7.49	12011.34	20.58
10	2	3	11	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	12011.34	19.83	12758.10	6.74	12011.34	19.83
10	3	1	11	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	13506.87	-19.06	13506.87	-19.06	12758.10	-5.98
10	3	2	11	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	13506.87	-20.58	13506.87	-20.58	12758.10	-7.49
10	3	3	11	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	13506.87	-19.83	13506.87	-19.83	12758.10	-6.74
10	3	1	11	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	12758.10	-32.15	12758.10	-32.15	12011.34	-19.06
10	3	2	11	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	12758.10	-33.67	12758.10	-33.67	12011.34	-20.58
10	3	3	11	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	12758.10	-32.91	12758.10	-32.91	12011.34	-19.83
11	2	1	12	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	14238.28	31.52	13506.87	19.06	14238.28	31.52
11	2	2	12	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	14238.28	33.04	13506.87	20.58	14238.28	33.04
11	2	3	12	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	14238.28	32.28	13506.87	19.83	14238.28	32.28
11	2	1	12	2	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	14968.19	19.06	14238.28	6.60	14968.19	19.06
11	2	2	12	2	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	14968.19	20.58	14238.28	8.12	14968.19	20.58
11	2	3	12	2	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	14968.19	19.83	14238.28	7.37	14968.19	19.83
11	3	1	12	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	13506.87	-19.06	13506.87	-19.06	14238.28	-6.60
11	3	2	12	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	13506.87	-20.58	13506.87	-20.58	14238.28	-8.12
11	3	3	12	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Left	13506.87	-19.83	13506.87	-19.83	14238.28	-7.37
11	3	1	12	3	1 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	14238.28	-31.52	14238.28	-31.52	14968.19	-19.06
11	3	2	12	3	2 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	14238.28	-33.04	14238.28	-33.04	14968.19	-20.58
11	3	3	12	3	3 falcon_acsr.wir 500 NESC Blowout 6PSF Max Sag RS	Right	14238.28	-32.28	14238.28	-32.28	14968.19	-19.83

12	2	1	13	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	15830.12	36.57	16686.56	19.06	15830.12	36.57
12	2	2	13	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	15830.12	38.09	16686.56	20.58	15830.12	38.09
12	2	3	13	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	15830.12	37.33	16686.56	19.83	15830.12	37.33
12	2	1	13	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	14968.19	19.06	15830.12	1.55	14968.19	19.06
12	2	2	13	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	14968.19	20.58	15830.12	3.07	14968.19	20.58
12	2	3	13	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	14968.19	19.83	15830.12	2.32	14968.19	19.83
12	3	1	13	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	16686.56	-19.06	16686.56	-19.06	15830.12	-1.55
12	3	2	13	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	16686.56	-20.58	16686.56	-20.58	15830.12	-3.07
12	3	3	13	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	16686.56	-19.83	16686.56	-19.83	15830.12	-2.32
12	3	1	13	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	15830.12	-36.57	15830.12	-36.57	14968.19	-19.06
12	3	2	13	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	15830.12	-38.09	15830.12	-38.09	14968.19	-20.58
12	3	3	13	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	15830.12	-37.33	15830.12	-37.33	14968.19	-19.83
13	2	1	14	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	17596.92	38.60	18500.78	19.06	17596.92	38.60
13	2	2	14	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	17596.92	40.12	18500.78	20.58	17596.92	40.12
13	2	3	14	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	17596.92	39.37	18500.78	19.83	17596.92	39.37
13	2	1	14	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	16686.56	19.06	17596.92	-0.48	16686.56	19.06
13	2	2	14	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	16686.56	20.58	17596.92	1.04	16686.56	20.58
13	2	3	14	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	16686.56	19.83	17596.92	0.28	16686.56	19.83
13	3	1	14	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	18500.78	-19.06	18500.78	-19.06	17596.92	0.48
13	3	2	14	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	18500.78	-20.58	18500.78	-20.58	17596.92	-1.04
13	3	3	14	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	18500.78	-19.83	18500.78	-19.83	17596.92	-0.28
13	3	1	14	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	17596.92	-38.60	17596.92	-38.60	16686.56	-19.06
13	3	2	14	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	17596.92	-40.12	17596.92	-40.12	16686.56	-20.58
13	3	3	14	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	17596.92	-39.37	17596.92	-39.37	16686.56	-19.83
14	2	1	15	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	19185.70	30.07	18500.78	19.06	19185.70	30.07
14	2	2	15	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	19185.70	31.59	18500.78	20.58	19185.70	31.59
14	2	3	15	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	19185.70	30.84	18500.78	19.83	19185.70	30.84
14	2	1	15	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	19868.11	19.06	19185.70	8.05	19868.11	19.06
14	2	2	15	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	19868.11	20.58	19185.70	9.57	19868.11	20.58
14	2	3	15	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	19868.11	19.83	19185.70	8.81	19868.11	19.83
14	3	1	15	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	18500.78	-19.06	18500.78	-19.06	19185.70	-8.05
14	3	2	15	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	18500.78	-20.58	18500.78	-20.58	19185.70	-9.57
14	3	3	15	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	18500.78	-19.83	18500.78	-19.83	19185.70	-8.81
14	3	1	15	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	19185.70	-30.07	19185.70	-30.07	19868.11	-19.06
14	3	2	15	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	19185.70	-31.59	19185.70	-31.59	19868.11	-20.58
14	3	3	15	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	19185.70	-30.84	19185.70	-30.84	19868.11	-19.83

15	2	1	16	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	20572.92	31.43	19868.11	19.06	20572.92	31.43
15	2	2	16	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	20572.92	32.95	19868.11	20.58	20572.92	32.95
15	2	3	16	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	20572.92	32.20	19868.11	19.83	20572.92	32.20
15	2	1	16	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	21284.23	19.06	20572.92	6.69	21284.23	19.06
15	2	2	16	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	21284.23	20.58	20572.92	8.21	21284.23	20.58
15	2	3	16	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	21284.23	19.83	20572.92	7.45	21284.23	19.83
15	3	1	16	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	19868.11	-19.06	19868.11	-19.06	20572.92	-6.69
15	3	2	16	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	19868.11	-20.58	19868.11	-20.58	20572.92	-8.21
15	3	3	16	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	19868.11	-19.83	19868.11	-19.83	20572.92	-7.45
15	3	1	16	3	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	20572.92	-31.43	20572.92	-31.43	21284.23	-19.06
15	3	2	16	3	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	20572.92	-32.95	20572.92	-32.95	21284.23	-20.58
15	3	3	16	3	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	20572.92	-32.20	20572.92	-32.20	21284.23	-19.83
16	2	1	17	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	22195.63	38.43	21284.23	19.06	22195.63	38.43
16	2	2	17	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	22177.65	39.18	23072.07	20.52	22177.65	39.18
16	2	3	17	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	22186.64	38.80	21284.23	19.83	22186.64	38.80
16	2	1	17	2	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	23072.07	19.48	22173.66	0.64	23072.07	19.48
16	2	2	17	2	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	21284.23	20.58	22191.64	1.40	21284.23	20.58
16	2	3	17	2	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	21284.23	19.83	22182.65	1.02	21284.23	19.83
16	3	1	17	11	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	23072.07	-19.48	23072.07	-19.48	22173.66	-0.64
16	3	2	17	11	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	21284.23	-20.58	21284.23	-20.58	22191.64	-1.40
16	3	3	17	11	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Left	21284.23	-19.83	21284.23	-19.83	22182.65	-1.02
16	3	1	17	11	1 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	22195.63	-38.43	22195.63	-38.43	21284.23	-19.06
16	3	2	17	11	2 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	22177.65	-39.18	22177.65	-39.18	23072.07	-20.52
16	3	3	17	11	3 falcon_acsr.wir	500 NESC Blowout 6PSF Max Sag RS	Right	22186.64	-38.80	22186.64	-38.80	21284.23	-19.83

For 500kV wires between structures 1 and 17, maximum offset is 40.12 (ft), the leftmost offset is -40.12 (ft), rightmost offset is 40.12 (ft)

Recreated: 6/23/2010 by: mdwi DEA cjb DEA

For: ***National Park Service***

Using Existing PPL ROW Alternative
Blowout Report for Spans with 100' ROW

Start Str. #	End Str. #	Cable Type	Voltage (kV)	Weather Case	Cable Condition	Proposed ROW Width (ft)	Max. Blowout from centerline each side (ft)	Blowout from structure centerline + V-string to ROW edge	Required Clearance to each side of ROW (ft)	Structure Deflection each side (ft)	(Applicant) Remaining Buffer from tree line, each side (ft)	Actual Remaining Buffer from tree line, each side (ft)	Minimum Vegetation Management Cycle
B17-2	B17-2A	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	22.06	**43.56**	17	2	8.94	**-10.56**	Every three years
B17-3	B17-3A	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	23.09	**44.59**	17	2	7.91	**-11.59**	Every three years
B17-3A	B17-4	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	29.06	**50.56**	17	1	2.94	**-17.56**	Every year
B17-4	B17-5	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	23.33	**44.83**	17	2	7.67	**-11.83**	Every three years
B17-5	B17-5A	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	22.87	**44.37**	17	2	8.13	**-11.37**	Every three years
B17-5A	B17-6	FALCON ACSR	500	NESC HORIZ CLEAR-6 psf	Max Sag FE	100	24.84	**46.34**	17	2	6.16	**-13.34**	Every three years

Notes: The column above titled: "Max. Blowout from centerline each side (ft)" fails to represent the required V-strings clearance which is 21.5' from structure centerline. 21.5'+ blowout equals actual remaining buffer.

NESC minimum clearance from blowout to ROW edge is 17' and PJM requires a 3' buffer, therefore actual "Required Clearance to each side of ROW (ft)" is 17'+ 3' = 20'

Throughout the ROW width development, the applicant has made reference to ACSR and ACCC conductor. Our models represent what is provided here, and we have information and calculations for ACCC as well.

Applicant has provided two different Plan & Profiles; one from Seargant & Lundy and Burns & McDonald. Each plan & profile were prepared with different spans and structure types.

RUS Bulletin 1724E-200 only references voltages upto 230kV (230,000 volts).

No consideration for "Broken Insulators" per NESC 2007

Several Geometry errors in structure provided by applicant. May cause an error in ROW clearance calculation.

PROVIDED BY JASON @ BTM

Using Existing PPL ROW Alternative
Blowout Report for spans with 100' ROW

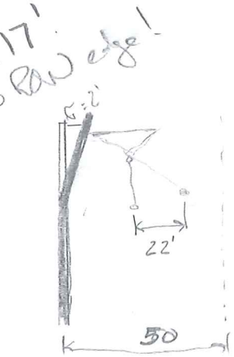
Start Str. #	End Str. #	Cable Type	Voltage (kV)	Weather Case	Cable Condition	Proposed ROW Width (ft)	Max. Blowout from centerline, each side (ft)	Required Clearance to each side of ROW (ft)	Structure Deflection, each side (ft)	Remaining Buffer from tree line, each side (ft)	Minimum Vegetation Management Cycle*
B17-2	B17-2A	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	22.06	17	2	8.94	Every Three Years
B17-3	B17-3A	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	23.09	17	2	7.91	Every Three Years
B17-3A	B17-4	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	29.06	17	1	2.94	Every Year
B17-4	B17-5	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	23.33	17	2	7.67	Every Three Years
B17-5	B17-5A	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	22.87	17	2	8.13	Every Three Years
B17-5A	B17-6	FALCON ACSR	500	NESC HORZ CLEAR-6psf	Max Sag FE	100	24.84	17	2	6.16	Every Three Years

*Assumes a 2' growth per year

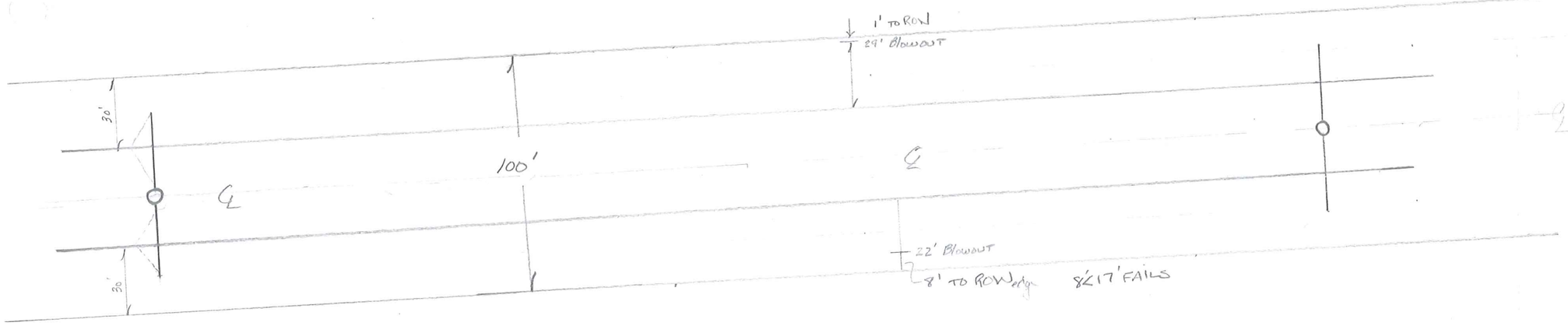
3' BUFFER PJM! pg 18

x/o from ROW ≥ 17' max ϕ TO ROW edge!

17'+3' = 20'



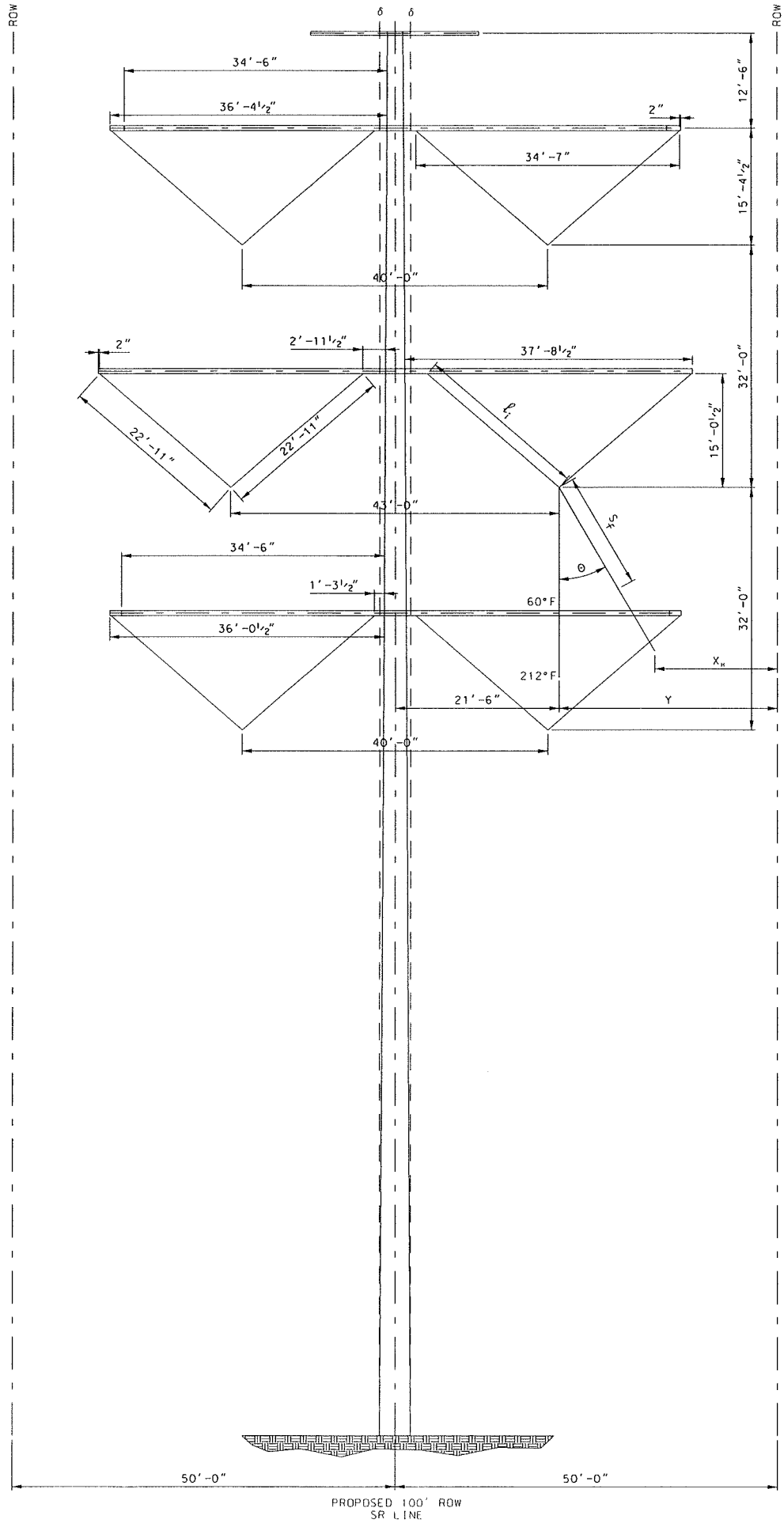
Swind
29.06 +8.94
25.09
30.06
25.33
24.87
26.84

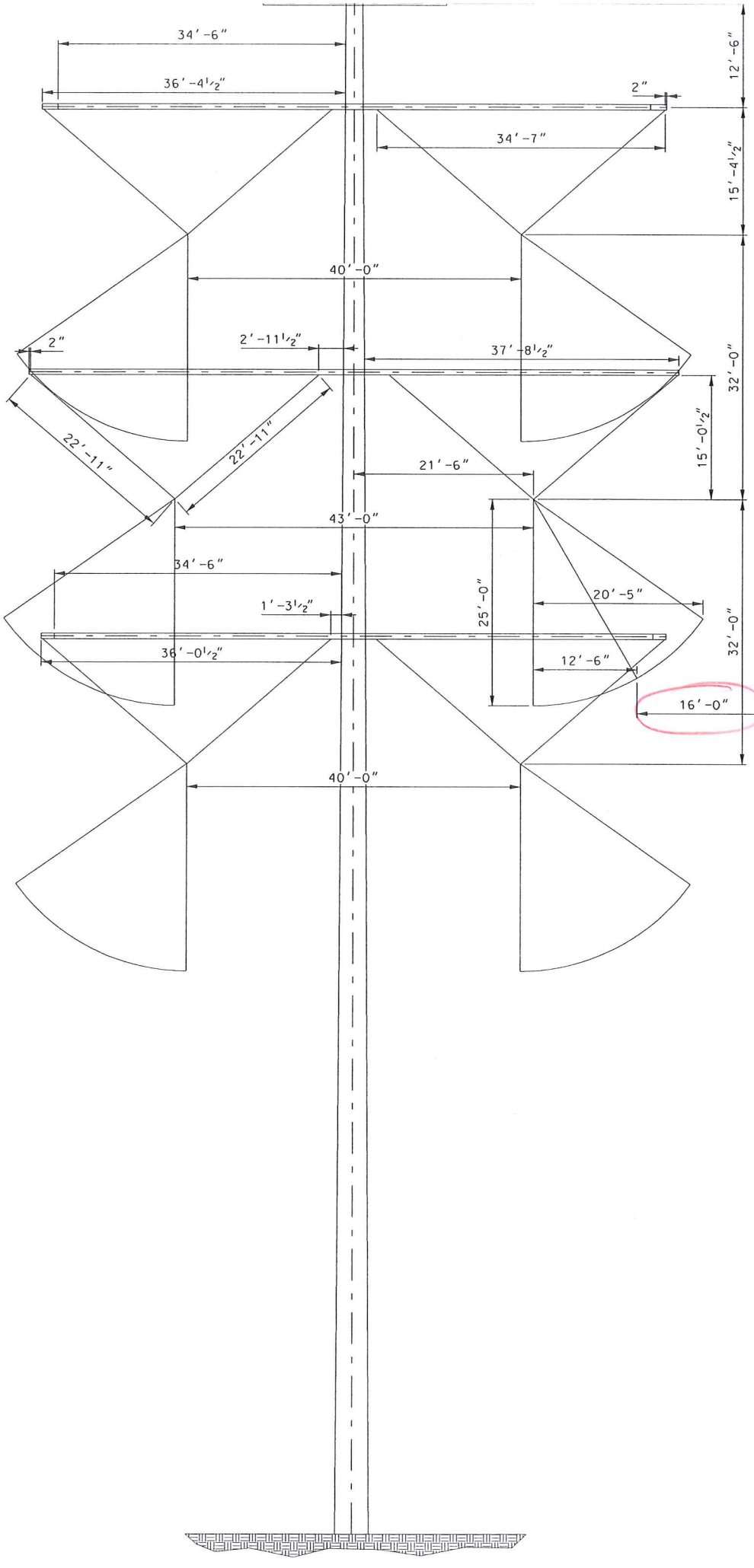


MIN NESC ϕ TO ROW edge

MIN NESC ϕ TO ROW edge

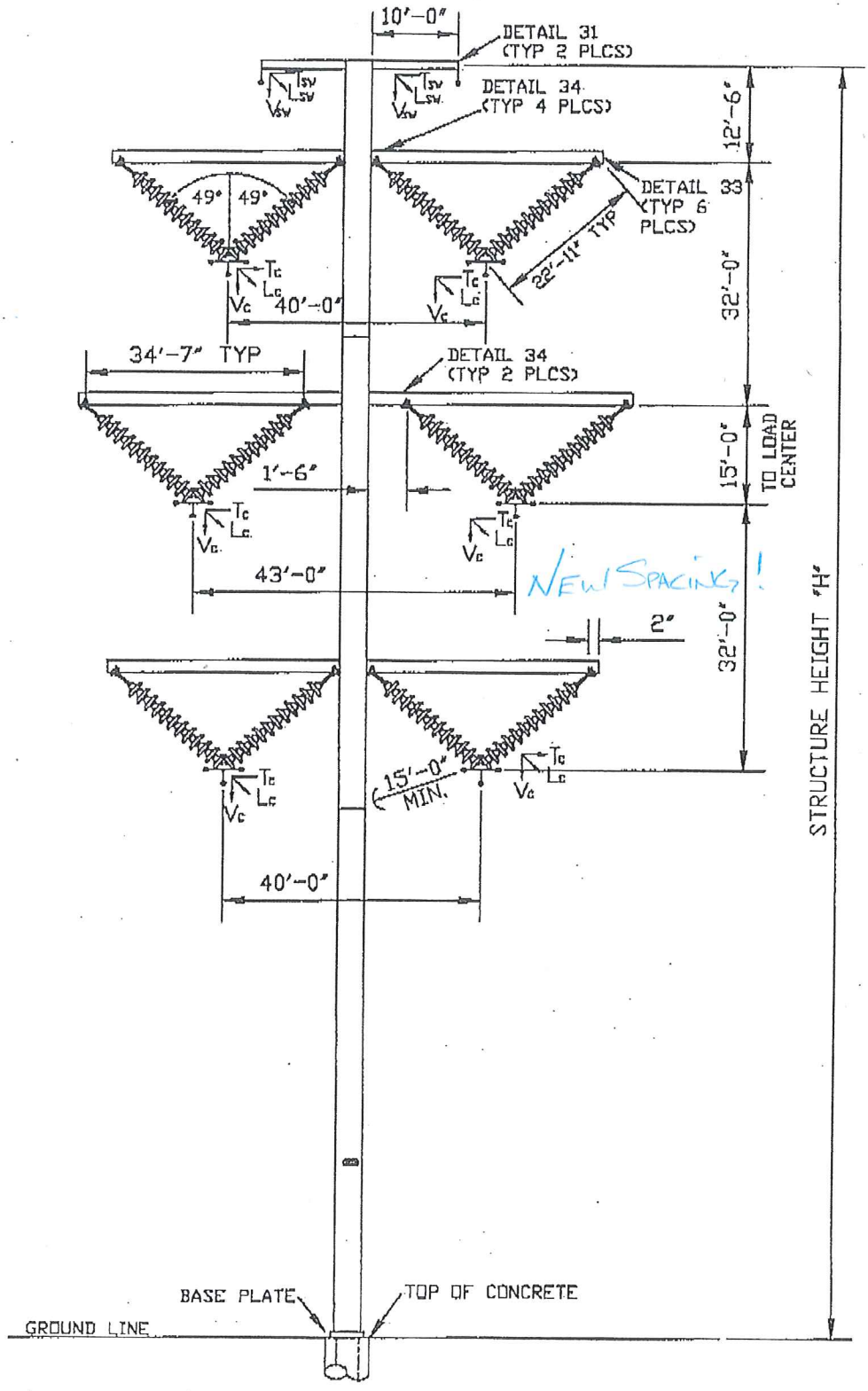
STRUCTURE MODELS


ROW
ROW
δ
δ
34'-6"
36'-4½"
2"
34'-7"
12'-6"
15'-4½"
40'-0"
2"
2'-11½"
37'-8½"
32'-0"
15'-0½"
22'-11"
22'-11"
43'-0"
34'-6"
1'-3½"
60°F
36'-0½"
212°F
21'-6"
Y
40'-0"
50'-0"
50'-0"
PROPOSED 100' ROW
SR LINE


34'-6"
36'-4½"
2"
12'-6"
34'-7"
15'-4½"
40'-0"
2"
2'-11½"
37'-8½"
32'-0"
15'-0½"
22'-11"
22'-11"
21'-6"
43'-0"
34'-6"
25'-0"
20'-5"
1'-3½"
36'-0½"
12'-6"
16'-0"
NO GOOD!
40'-0"

Sargent & Lundy LLC 6/11/2010

Segment B17 100' ROW Feasibility Study



PLAN AND PROFILES
By others

The plan & profiles by S&L and B&M attached in this section were used to verify span lengths, conductor sag and distance to edge of ROW.

BUSHKILL SUB - B17-1, .752" OPGW
BUSHKILL SUB - B17-1, 1590 KCMIL 54/19 STRANDS FALCON ACSR
B17-1 - 3A, .752" OPGW
B17-1 - 3A, 1590 KCMIL 54/19 STRANDS FALCON ACSR
3A - B17-4, .752" OPGW
3A - B17-4, 1590 KCMIL 54/19 STRANDS FALCON ACSR
B17-4 - B17-6, .752" OPGW
B17-4 - B17-6, 1590 KCMIL 54/19 STRANDS FALCON ACSR
B17-6 - B17-7, .752" OPGW
B17-6 - B17-7, 1590 KCMIL 54/19 STRANDS FALCON ACSR
B17-7 - B17-16, .752" OPGW
B17-7 - B17-16, 1590 KCMIL 54/19 STRANDS FALCON ACSR

BUSHKILL SUB
B17-1
B17-2
2A
B17-3
3A
B17-4
B17-5
5A
B17-6
B17-7
B17-8
B17-9
B17-10
B17-11
B17-12
B17-13

DELAWARE RIVER

Temperature?

PRELIMINARY - NOT FOR CONSTRUCTION

400.0 ft. Horiz. Scale
40.0 ft. Vert. Scale

LEGEND
- NEW POLE
- EXISTING TOWER TO BE REMOVED
- WETLAND

500 kV TRANSMISSION LINE
BUSHKILL – KITTATINY (500 kV)
BUSHKILL – ROSELAND (500kV)
PLAN & PROFILE

PPL ELECTRIC UTILITIES

PPL DRAWING NO. E-374752 | SHEET NO. 1 OF 2 | REV. 0

Sargent & Lundy LLC, 55 EAST MONROE ST., CHICAGO, ILLINOIS

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PROJ. No. 12397-016

11/4/09 ISSUED FOR INFORMATION

PRINTED: 10/17/2008

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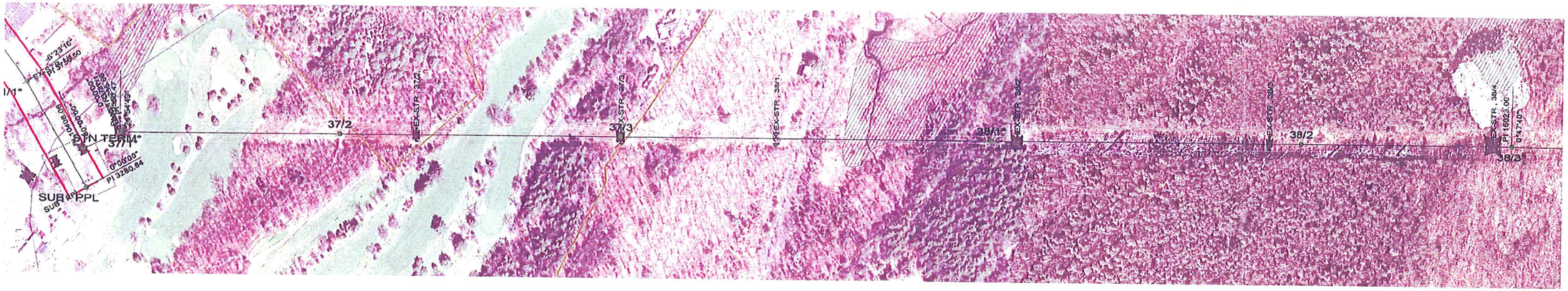

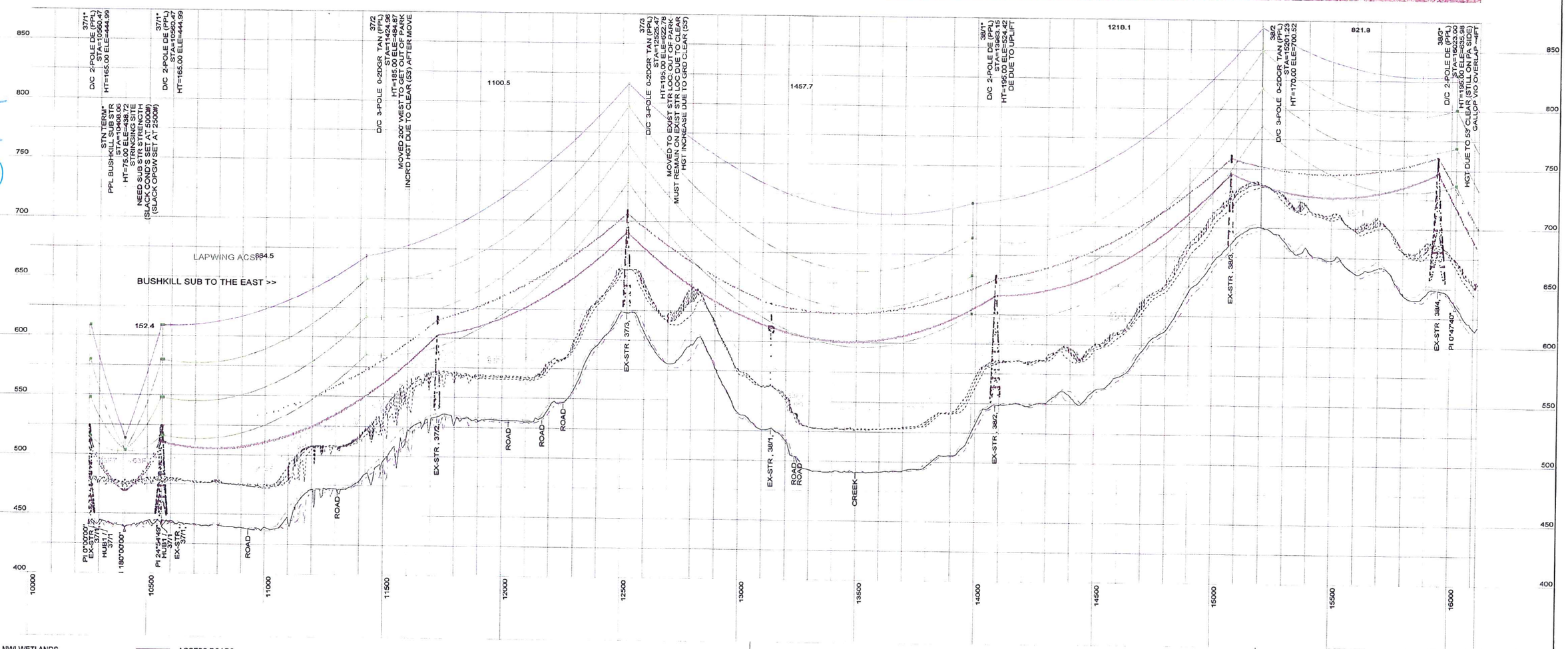

B&M

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NWI WETLANDS
MORRIS CO RIP BUFFER
RIP BUFFER FOR CAT 1
RIP BUFFER FOR TROUT
SUSSEX CO RIP BUFFER
WETLAND BUFFER
SUSSEX CO T&E RIP BUFFER
WARREN CO T&E RIP BUFFER

ACCESS ROADS
TAX LOTS
T-LINE R.O.W.
EXIST. 230KV
COUNTIES
NPS BOUNDARIES
PARCELS
RIVERS

200.0 FT. HORIZ. SCALE

40.0 FT. VERT. SCALE

NORTH

PENNSYLVANIA POWER AND LIGHT / PUBLIC SERVICE ELECTRIC & GAS CO.

PROPOSED FOR PERMIT 9/19/2008

DATE 10/17/2008

500 KV TRANSMISSION LINES

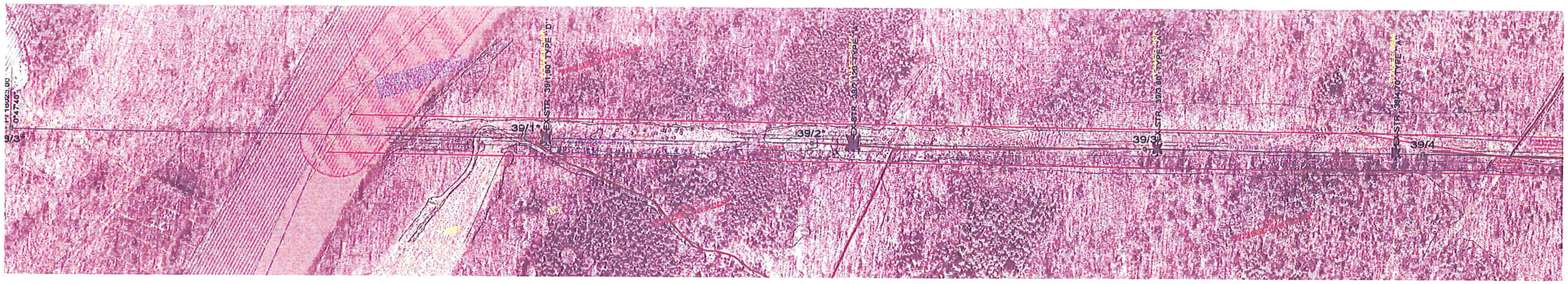
SUSQUEHANNA RIVER TO ROSELAND
CROSSING THE DELWARE WATER GAP
NATIONAL RECREATION AREA
K-1019

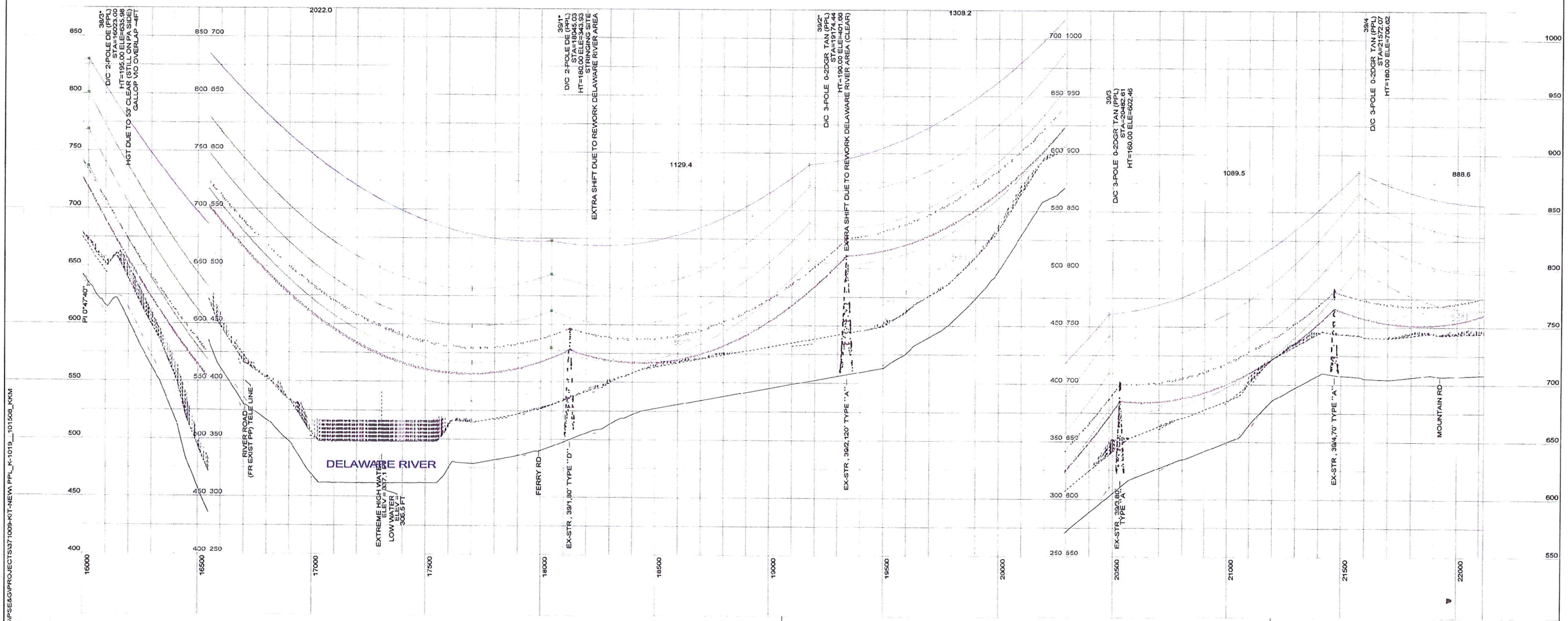
PLAN AND PROFILE

SHEET 3

PRINTED: 10/17/2008

PLS-CADD DRAWING





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- NWI WETLANDS
- MORRIS CO RIP BUFFER
- RIP BUFFER FOR CAT 1
- RIP BUFFER FOR TROUT
- SUSSEX CO RIP BUFFER
- WETLAND BUFFER
- SUSSEX CO T&E RIP BUFFER
- WARREN CO T&E RIP BUFFER
- ACCESS ROADS
- TAX LOTS
- T-LINE R.O.W.
- EXIST. 230KV
- COUNTIES
- NPS BOUNDARIES
- PARCELS
- RIVERS

200.0 FT. HORIZ. SCALE

40.0 FT. VERT. SCALE

NORTH

PENNSYLVANIA POWER AND LIGHT / PUBLIC SERVICE ELECTRIC & GAS CO.

PROPOSED FOR PERMIT 9/19/2008

DATE 10/17/2008

500 KV TRANSMISSION LINES

SUSQUEHANNA RIVER TO ROSELAND
CROSSING THE DELWARE WATER GAP
NATIONAL RECREATION AREA
K-1019

PLAN AND PROFILE

SHEET 4

PRINTED: 10/17/2008

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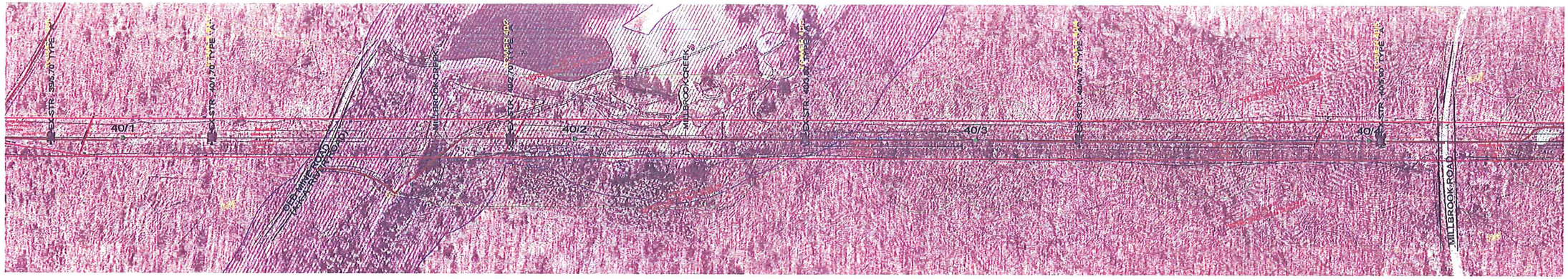

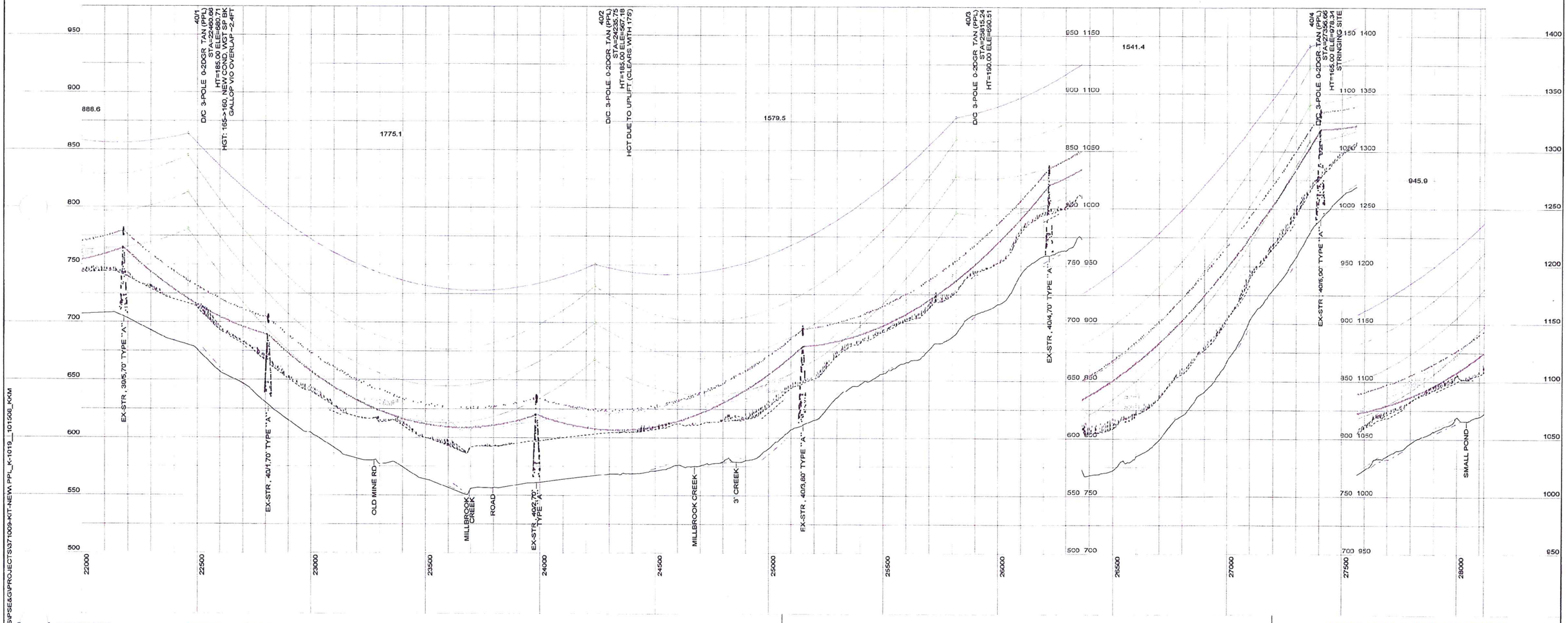

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NWI WETLANDS
MORRIS CO RIP BUFFER
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200.0 FT. HORIZ. SCALE

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NORTH

PENNSYLVANIA POWER AND LIGHT / PUBLIC SERVICE ELECTRIC & GAS CO.

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SUSQUEHANNA RIVER TO ROSELAND
CROSSING THE DELWARE WATER GAP
NATIONAL RECREATION AREA
K-1019

PLAN AND PROFILE

SHEET 5

PRINTED: 10/17/2008

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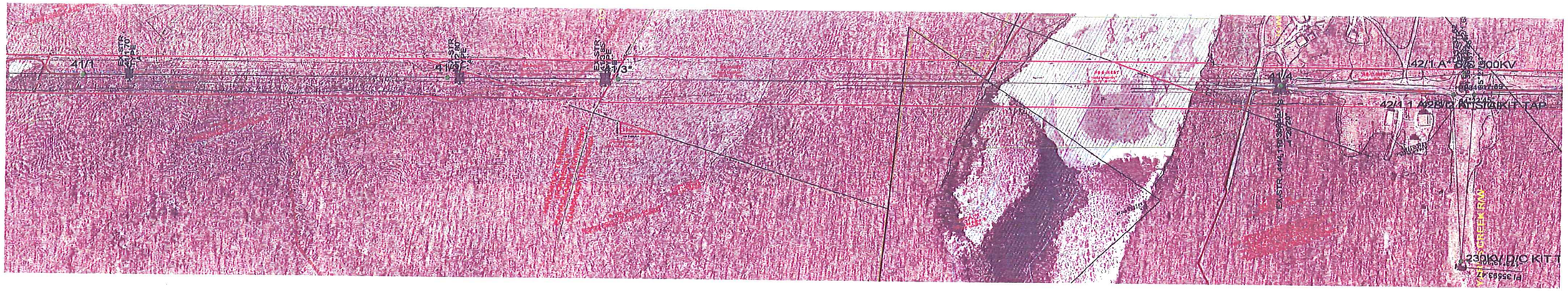

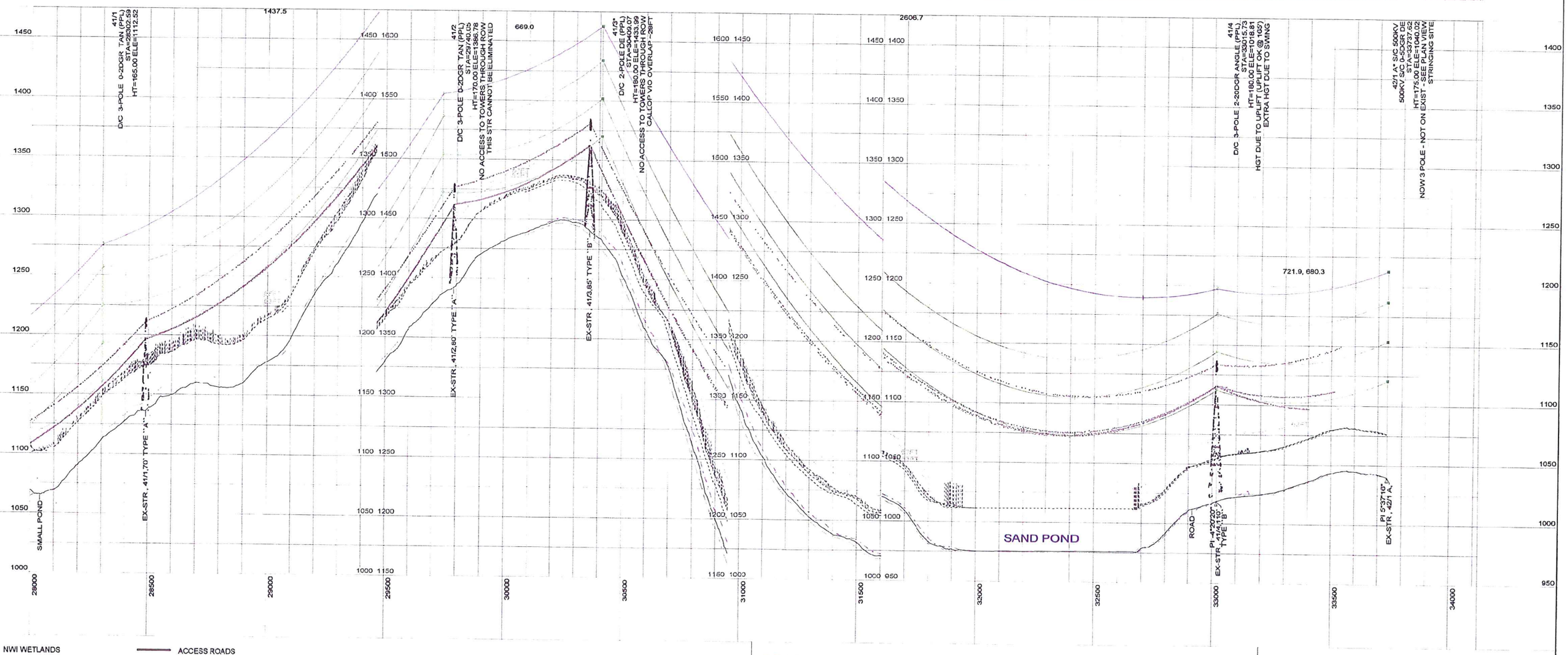

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200.0 FT. HORIZ. SCALE

40.0 FT. VERT. SCALE

NORTH

PENNSYLVANIA POWER AND LIGHT / PUBLIC SERVICE ELECTRIC & GAS CO.

PROPOSED FOR PERMIT 9/19/2008

DATE 10/17/2008

500 KV TRANSMISSION LINES

SUSQUEHANNA RIVER TO ROSELAND
CROSSING THE DELWARE WATER GAP
NATIONAL RECREATION AREA
K-1019

PLAN AND PROFILE

SHEET 6

PRINTED: 10/17/2008

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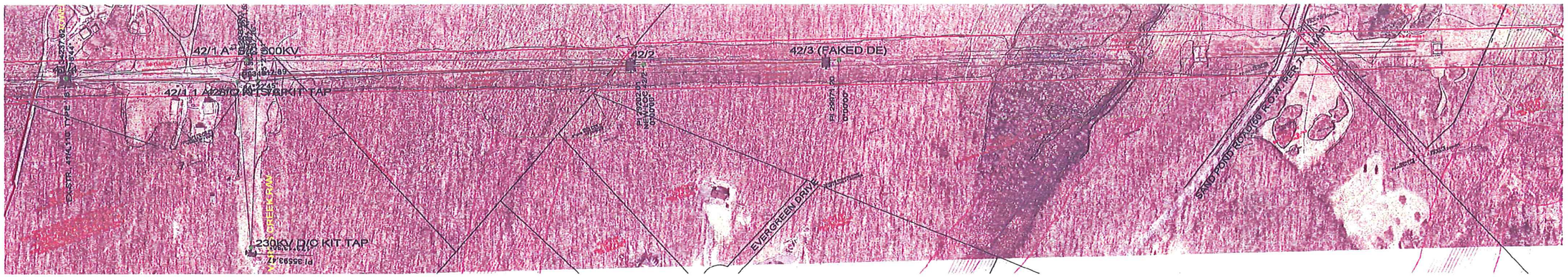

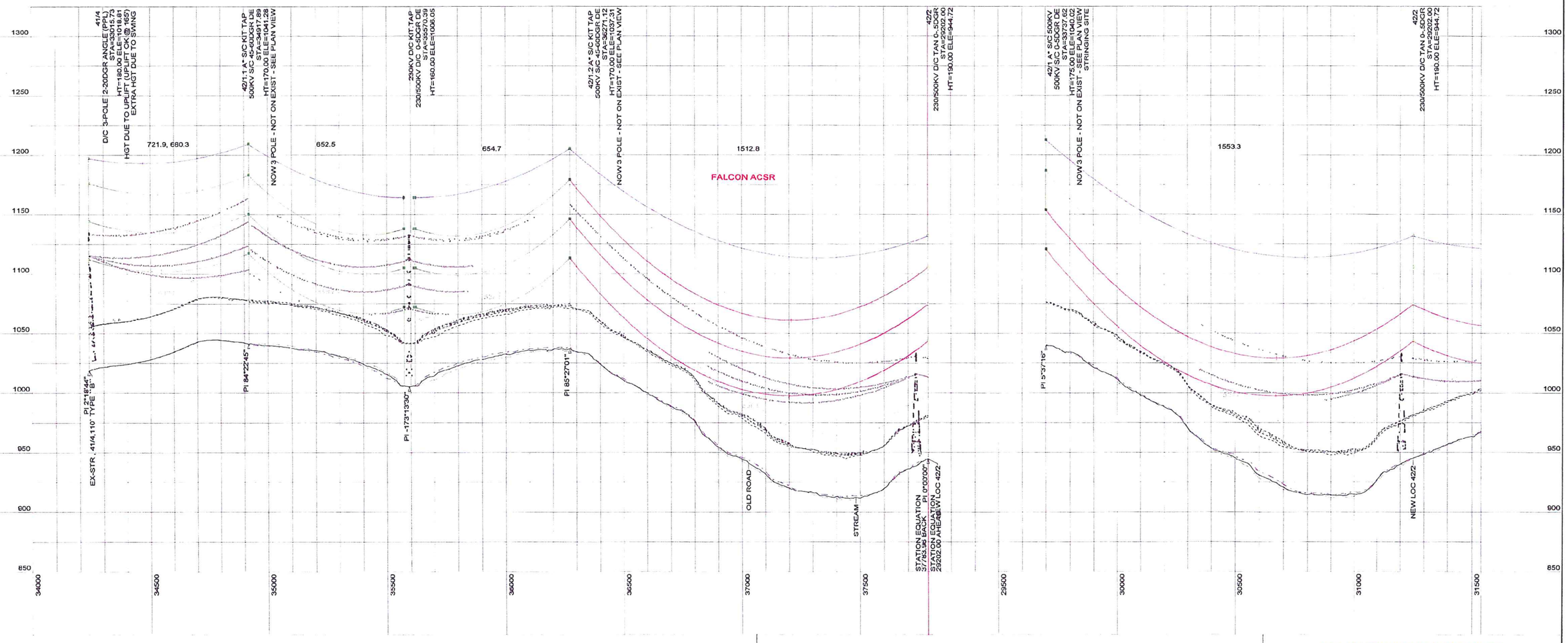

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NWI WETLANDS
MORRIS CO RIP BUFFER
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PARCELS
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40.0 FT. VERT. SCALE

NORTH

PENNSYLVANIA POWER AND LIGHT / PUBLIC SERVICE ELECTRIC & GAS CO.

PROPOSED FOR PERMIT 9/19/2008

DATE 10/17/2008

500 KV TRANSMISSION LINES

SUSQUEHANNA RIVER TO ROSELAND
CROSSING THE DELWARE WATER GAP
NATIONAL RECREATION AREA
K-1019

PLAN AND PROFILE

SHEET 7

SOUTHWIRE SAG 10

The Southwire Sag 10 reports provided alternate verification to the PLS CADD sag reports to assure accuracy in the blowout calculations.

Southwire SAG10™

6/22/2010

David Evans and Associates

Susquehanna - Roseland 500kV
B&M P&P

Conductor: 1594.0 Kcmil 54/19 Stranding ACCR "FALCON"

Area = 1.4110 Sq. in Diameter = 1.547 in Weight = 1.745 lb/ft RTS = 53600 lb
Data from Chart No. 4-1100
English Units
Limits and Outputs in Average Tensions.

Span = 152.4 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	0.37	20230	0.34	22495
32.0	0.25	0.00	0.00	2.304	0.38	17655	0.32	21064
0.0	0.00	0.00	0.00	1.745	0.23	22348	0.21	23629
15.0	0.00	0.00	0.00	1.745	0.25	20091	0.23	22421
30.0	0.00	0.00	0.00	1.745	0.28	17843	0.24	21180
60.0	0.00	0.00	0.00	1.745	0.38	13399*	0.27	18603
90.0	0.00	0.00	0.00	1.745	0.55	9142	0.32	15907
120.0	0.00	0.00	0.00	1.745	0.68	7491	0.39	13112
167.0	0.00	0.00	0.00	1.745	0.76	6648	0.59	8653
212.0	0.00	0.00	0.00	1.745	0.86	5871	0.83	6101

* Design Condition

Span = 864.5 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	12.09	20123	11.21	21697
32.0	0.25	0.00	0.00	2.304	12.19	17672	10.81	19924
0.0	0.00	0.00	0.00	1.745	8.81	18505	7.92	20588
15.0	0.00	0.00	0.00	1.745	9.58	17027	8.33	19573
30.0	0.00	0.00	0.00	1.745	10.40	15682	8.78	18572
60.0	0.00	0.00	0.00	1.745	12.18	13400*	9.80	16639
90.0	0.00	0.00	0.00	1.745	14.04	11622	10.99	14848
120.0	0.00	0.00	0.00	1.745	15.92	10256	12.32	13247
167.0	0.00	0.00	0.00	1.745	17.34	9414	14.61	11173
212.0	0.00	0.00	0.00	1.745	18.06	9040	16.91	9657

* Design Condition

Span = 1100.5 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	19.63	20092	18.44	21392
32.0	0.25	0.00	0.00	2.304	19.76	17676	17.91	19497
0.0	0.00	0.00	0.00	1.745	15.40	17168	13.79	19167
15.0	0.00	0.00	0.00	1.745	16.46	16068	14.44	18308

30.0	0.00	0.00	0.00	1.745	17.54	15079	15.13	17478
60.0	0.00	0.00	0.00	1.745	19.74	13400*	16.61	15920
90.0	0.00	0.00	0.00	1.745	21.94	12059	18.22	14518
120.0	0.00	0.00	0.00	1.745	24.10	10983	19.92	13282
167.0	0.00	0.00	0.00	1.745	26.28	10075	22.68	11669
212.0	0.00	0.00	0.00	1.745	27.14	9757	25.35	10445

* Design Condition

Span = 1457.7 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	34.54	20059	32.96	21018
32.0	0.25	0.00	0.00	2.304	34.69	17680	32.29	18986
0.0	0.00	0.00	0.00	1.745	29.41	15786	26.77	17340
15.0	0.00	0.00	0.00	1.745	30.74	15105	27.73	16739
30.0	0.00	0.00	0.00	1.745	32.06	14485	28.71	16167
60.0	0.00	0.00	0.00	1.745	34.67	13400*	30.73	15109
90.0	0.00	0.00	0.00	1.745	37.21	12489	32.79	14162
120.0	0.00	0.00	0.00	1.745	39.68	11716	34.88	13319
167.0	0.00	0.00	0.00	1.745	42.89	10843	38.15	12183
212.0	0.00	0.00	0.00	1.745	43.93	10589	41.24	11275

* Design Condition

Span = 1218.1 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	24.08	20080	22.74	21257
32.0	0.25	0.00	0.00	2.304	24.21	17678	22.16	19310
0.0	0.00	0.00	0.00	1.745	19.48	16630	17.50	18505
15.0	0.00	0.00	0.00	1.745	20.65	15692	18.27	17733
30.0	0.00	0.00	0.00	1.745	21.83	14846	19.06	16993
60.0	0.00	0.00	0.00	1.745	24.19	13400*	20.75	15615
90.0	0.00	0.00	0.00	1.745	26.52	12226	22.53	14383
120.0	0.00	0.00	0.00	1.745	28.80	11264	24.38	13296
167.0	0.00	0.00	0.00	1.745	31.34	10355	27.33	11865
212.0	0.00	0.00	0.00	1.745	32.26	10061	30.16	10759

* Design Condition

Span = 821.8 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	10.92	20129	10.11	21755
32.0	0.25	0.00	0.00	2.304	11.01	17671	9.73	20007
0.0	0.00	0.00	0.00	1.745	7.85	18777	7.07	20845
15.0	0.00	0.00	0.00	1.745	8.55	17227	7.44	19807
30.0	0.00	0.00	0.00	1.745	9.32	15811	7.85	18778
60.0	0.00	0.00	0.00	1.745	11.00	13400*	8.78	16781
90.0	0.00	0.00	0.00	1.745	12.79	11525	9.88	14916
120.0	0.00	0.00	0.00	1.745	14.61	10096	11.13	13240
167.0	0.00	0.00	0.00	1.745	15.90	9279	13.33	11066
212.0	0.00	0.00	0.00	1.745	16.59	8893	15.55	9487

* Design Condition

Span = 2022.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb

15.0	0.25	4.00	0.20	2.603	66.69	20030	64.72	20635
32.0	0.25	0.00	0.00	2.304	66.86	17684	63.95	18483
0.0	0.00	0.00	0.00	1.745	60.93	14690	57.35	15601
15.0	0.00	0.00	0.00	1.745	62.44	14338	58.57	15277
30.0	0.00	0.00	0.00	1.745	63.93	14006	59.79	14967
60.0	0.00	0.00	0.00	1.745	66.84	13400*	62.24	14384
90.0	0.00	0.00	0.00	1.745	69.68	12859	64.67	13847
120.0	0.00	0.00	0.00	1.745	72.45	12372	67.09	13352
167.0	0.00	0.00	0.00	1.745	76.65	11702	70.84	12652
212.0	0.00	0.00	0.00	1.745	78.19	11473	74.37	12057

* Design Condition

Span = 1129.4 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	20.68	20089	19.45	21358
32.0	0.25	0.00	0.00	2.304	20.81	17677	18.91	19450
0.0	0.00	0.00	0.00	1.745	16.35	17028	14.65	19000
15.0	0.00	0.00	0.00	1.745	17.44	15970	15.33	18163
30.0	0.00	0.00	0.00	1.745	18.55	15018	16.04	17355
60.0	0.00	0.00	0.00	1.745	20.79	13400*	17.58	15842
90.0	0.00	0.00	0.00	1.745	23.03	12103	19.23	14483
120.0	0.00	0.00	0.00	1.745	25.21	11056	20.97	13286
167.0	0.00	0.00	0.00	1.745	27.49	10147	23.78	11720
212.0	0.00	0.00	0.00	1.745	28.36	9835	26.49	10527

* Design Condition

Span = 1308.2 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	27.79	20071	26.35	21161
32.0	0.25	0.00	0.00	2.304	27.93	17679	25.74	19179
0.0	0.00	0.00	0.00	1.745	22.96	16276	20.72	18035
15.0	0.00	0.00	0.00	1.745	24.20	15446	21.56	17330
30.0	0.00	0.00	0.00	1.745	25.44	14695	22.44	16656
60.0	0.00	0.00	0.00	1.745	27.91	13400*	24.26	15407
90.0	0.00	0.00	0.00	1.745	30.33	12335	26.16	14292
120.0	0.00	0.00	0.00	1.745	32.68	11451	28.11	13306
167.0	0.00	0.00	0.00	1.745	35.48	10551	31.19	11996
212.0	0.00	0.00	0.00	1.745	36.45	10273	34.12	10970

* Design Condition

Span = 1089.5 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	19.24	20093	18.06	21406
32.0	0.25	0.00	0.00	2.304	19.36	17676	17.53	19515
0.0	0.00	0.00	0.00	1.745	15.05	17223	13.47	19231
15.0	0.00	0.00	0.00	1.745	16.09	16107	14.11	18365
30.0	0.00	0.00	0.00	1.745	17.16	15103	14.78	17526
60.0	0.00	0.00	0.00	1.745	19.35	13400*	16.25	15950
90.0	0.00	0.00	0.00	1.745	21.54	12042	17.84	14531
120.0	0.00	0.00	0.00	1.745	23.68	10954	19.52	13281
167.0	0.00	0.00	0.00	1.745	25.83	10047	22.26	11649
212.0	0.00	0.00	0.00	1.745	26.68	9727	24.92	10413

* Design Condition

Span = 888.6 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Final Sag Ft	Final Tension lb	Initial Sag Ft	Initial Tension lb
15.0	0.25	4.00	0.20	2.603	12.78	20119	11.87	21664
32.0	0.25	0.00	0.00	2.304	12.88	17672	11.45	19878
0.0	0.00	0.00	0.00	1.745	9.39	18354	8.43	20442
15.0	0.00	0.00	0.00	1.745	10.19	16917	8.86	19441
30.0	0.00	0.00	0.00	1.745	11.04	15612	9.34	18456
60.0	0.00	0.00	0.00	1.745	12.86	13400*	10.41	16561
90.0	0.00	0.00	0.00	1.745	14.77	11674	11.64	14811
120.0	0.00	0.00	0.00	1.745	16.68	10342	13.01	13251
167.0	0.00	0.00	0.00	1.745	18.18	9488	15.35	11231
212.0	0.00	0.00	0.00	1.745	18.92	9121	17.69	9749

* Design Condition

Span = 1775.1 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Final Sag Ft	Final Tension lb	Initial Sag Ft	Initial Tension lb
15.0	0.25	4.00	0.20	2.603	51.32	20040	49.49	20776
32.0	0.25	0.00	0.00	2.304	51.48	17683	48.76	18665
0.0	0.00	0.00	0.00	1.745	45.76	15059	42.50	16210
15.0	0.00	0.00	0.00	1.745	47.22	14598	43.64	15789
30.0	0.00	0.00	0.00	1.745	48.65	14170	44.78	15387
60.0	0.00	0.00	0.00	1.745	51.46	13400*	47.09	14638
90.0	0.00	0.00	0.00	1.745	54.20	12728	49.40	13958
120.0	0.00	0.00	0.00	1.745	56.86	12138	51.70	13340
167.0	0.00	0.00	0.00	1.745	60.85	11348	55.27	12483
212.0	0.00	0.00	0.00	1.745	62.01	11138	58.64	11772

* Design Condition

Span = 1579.5 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Final Sag Ft	Final Tension lb	Initial Sag Ft	Initial Tension lb
15.0	0.25	4.00	0.20	2.603	40.58	20051	38.90	20916
32.0	0.25	0.00	0.00	2.304	40.74	17681	38.20	18850
0.0	0.00	0.00	0.00	1.745	35.26	15464	32.34	16853
15.0	0.00	0.00	0.00	1.745	36.65	14881	33.39	16329
30.0	0.00	0.00	0.00	1.745	38.02	14346	34.44	15829
60.0	0.00	0.00	0.00	1.745	40.72	13400*	36.59	14905
90.0	0.00	0.00	0.00	1.745	43.34	12593	38.76	14073
120.0	0.00	0.00	0.00	1.745	45.89	11898	40.94	13328
167.0	0.00	0.00	0.00	1.745	49.42	11053	44.34	12312
212.0	0.00	0.00	0.00	1.745	50.51	10818	47.55	11487

* Design Condition

Span = 1541.4 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Final Sag Ft	Final Tension lb	Initial Sag Ft	Initial Tension lb
15.0	0.25	4.00	0.20	2.603	38.64	20054	36.99	20947
32.0	0.25	0.00	0.00	2.304	38.79	17681	36.30	18890
0.0	0.00	0.00	0.00	1.745	33.37	15558	30.54	16998
15.0	0.00	0.00	0.00	1.745	34.74	14947	31.56	16450
30.0	0.00	0.00	0.00	1.745	36.10	14387	32.59	15929
60.0	0.00	0.00	0.00	1.745	38.77	13400*	34.70	14965
90.0	0.00	0.00	0.00	1.745	41.37	12562	36.84	14100
120.0	0.00	0.00	0.00	1.745	43.90	11844	38.99	13325
167.0	0.00	0.00	0.00	1.745	47.33	10990	42.35	12274

212.0	0.00	0.00	0.00	1.745	48.40	10749	45.52	11424

* Design Condition

Span = 945.9 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	14.49	20111	13.49	21588
32.0	0.25	0.00	0.00	2.304	14.59	17673	13.04	19770
0.0	0.00	0.00	0.00	1.745	10.84	18008	9.72	20093
15.0	0.00	0.00	0.00	1.745	11.72	16666	10.21	19128
30.0	0.00	0.00	0.00	1.745	12.64	15452	10.74	18182
60.0	0.00	0.00	0.00	1.745	14.58	13400*	11.92	16377
90.0	0.00	0.00	0.00	1.745	16.57	11791	13.26	14725
120.0	0.00	0.00	0.00	1.745	18.55	10535	14.73	13260
167.0	0.00	0.00	0.00	1.745	20.24	9658	17.20	11362
212.0	0.00	0.00	0.00	1.745	21.01	9305	19.64	9956

* Design Condition

Span = 1437.5 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	33.58	20061	32.02	21036
32.0	0.25	0.00	0.00	2.304	33.73	17680	31.36	19010
0.0	0.00	0.00	0.00	1.745	28.49	15846	25.90	17427
15.0	0.00	0.00	0.00	1.745	29.81	15147	26.85	16813
30.0	0.00	0.00	0.00	1.745	31.12	14510	27.82	16228
60.0	0.00	0.00	0.00	1.745	33.71	13400*	29.81	15146
90.0	0.00	0.00	0.00	1.745	36.24	12470	31.85	14178
120.0	0.00	0.00	0.00	1.745	38.69	11684	33.92	13317
167.0	0.00	0.00	0.00	1.745	41.85	10806	37.17	12160
212.0	0.00	0.00	0.00	1.745	42.88	10549	40.24	11237

* Design Condition

Span = 669.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	7.23	20153	6.63	21965
32.0	0.25	0.00	0.00	2.304	7.30	17667	6.35	20306
0.0	0.00	0.00	0.00	1.745	4.94	19785	4.49	21726
15.0	0.00	0.00	0.00	1.745	5.43	17990	4.74	20618
30.0	0.00	0.00	0.00	1.745	5.99	16315	5.01	19505
60.0	0.00	0.00	0.00	1.745	7.29	13400*	5.65	17298
90.0	0.00	0.00	0.00	1.745	8.78	11122	6.44	15173
120.0	0.00	0.00	0.00	1.745	10.36	9431	7.39	13211
167.0	0.00	0.00	0.00	1.745	11.16	8754	9.19	10629
212.0	0.00	0.00	0.00	1.745	11.75	8318	11.12	8792

* Design Condition

Span = 2606.7 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	111.26	20014	109.06	20411
32.0	0.25	0.00	0.00	2.304	111.44	17686	108.24	18201
0.0	0.00	0.00	0.00	1.745	105.22	14177	101.23	14730
15.0	0.00	0.00	0.00	1.745	106.80	13971	102.55	14543
30.0	0.00	0.00	0.00	1.745	108.35	13773	103.86	14361

60.0	0.00	0.00	0.00	1.745	111.42	13400*	106.48	14012
90.0	0.00	0.00	0.00	1.745	114.42	13054	109.09	13682
120.0	0.00	0.00	0.00	1.745	117.36	12731	111.68	13369
167.0	0.00	0.00	0.00	1.745	121.86	12269	115.70	12911
212.0	0.00	0.00	0.00	1.745	124.17	12044	119.50	12507

* Design Condition

Span = 721.9 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	8.42	20145	7.75	21892
32.0	0.25	0.00	0.00	2.304	8.50	17668	7.43	20202
0.0	0.00	0.00	0.00	1.745	5.85	19433	5.31	21430
15.0	0.00	0.00	0.00	1.745	6.42	17720	5.59	20343
30.0	0.00	0.00	0.00	1.745	7.05	16134	5.90	19258
60.0	0.00	0.00	0.00	1.745	8.49	13400*	6.64	17119
90.0	0.00	0.00	0.00	1.745	10.09	11272	7.54	15082
120.0	0.00	0.00	0.00	1.745	11.76	9679	8.60	13221
167.0	0.00	0.00	0.00	1.745	12.73	8943	10.54	10790
212.0	0.00	0.00	0.00	1.745	13.35	8526	12.58	9049

* Design Condition

Certain information such as the data, opinions or recommendations set forth herein or given by Southwire representatives, is intended as a general guide only. Each installation of overhead electrical conductor, underground electrical conductor, and/or conductor accessories involves special conditions creating problems that require individual solutions and, therefore, the recipient of this information has the sole responsibility in connection with the use of the information. Southwire does not assume any liability in connection with such information.

Southwire SAG10™

6/24/2010

David Evans and Associates

Susquehanna - Roseland 500kV
S&L P&P

Conductor: 1590.0 Kcmil 54/19 Stranding ACSR "FALCON"

Area = 1.4070 Sq. in Diameter = 1.545 in Weight = 2.044 lb/ft RTS = 54500 lb
Data from Chart No. 1-1009
English Units
Limits and Outputs in Average Tensions.

Span = 152.4 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	0.44	18860	0.37	22902
32.0	0.25	0.00	0.00	2.602	0.47	16232	0.35	21520
0.0	0.00	0.00	0.00	2.044	0.28	21011	0.25	23991
15.0	0.00	0.00	0.00	2.044	0.32	18699	0.26	22840
30.0	0.00	0.00	0.00	2.044	0.36	16403	0.27	21639
60.0	0.00	0.00	0.00	2.044	0.50	11905	0.31	19074*
90.0	0.00	0.00	0.00	2.044	0.76	7768	0.36	16279
120.0	0.00	0.00	0.00	2.044	1.07	5561	0.45	13246
167.0	0.00	0.00	0.00	2.044	1.31	4529	0.73	8171
212.0	0.00	0.00	0.00	2.044	1.61	3697	1.39	4277

* Design Condition

Span = 864.5 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	13.54	19964	11.43	23628
32.0	0.25	0.00	0.00	2.602	13.78	17653	11.04	22025
0.0	0.00	0.00	0.00	2.044	10.37	18421	8.30	23018
15.0	0.00	0.00	0.00	2.044	11.23	17022	8.68	22017
30.0	0.00	0.00	0.00	2.044	12.13	15758	9.09	21006
60.0	0.00	0.00	0.00	2.044	14.03	13625*	10.07	18979
90.0	0.00	0.00	0.00	2.044	15.99	11958	11.24	16998
120.0	0.00	0.00	0.00	2.044	17.94	10663	12.62	15141
167.0	0.00	0.00	0.00	2.044	20.88	9168	15.13	12636
212.0	0.00	0.00	0.00	2.044	22.52	8504	17.75	10776

* Design Condition

Span = 1105.5 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	22.34	19790	19.35	22845
32.0	0.25	0.00	0.00	2.602	22.66	17574	18.85	21116
0.0	0.00	0.00	0.00	2.044	18.35	17032	14.73	21214
15.0	0.00	0.00	0.00	2.044	19.49	16040	15.37	20327

30.0	0.00	0.00	0.00	2.044	20.64	15147	16.07	19451
60.0	0.00	0.00	0.00	2.044	22.96	13625*	17.60	17759
90.0	0.00	0.00	0.00	2.044	25.24	12395	19.32	16185
120.0	0.00	0.00	0.00	2.044	27.47	11394	21.18	14765
167.0	0.00	0.00	0.00	2.044	30.82	10163	24.29	12881
212.0	0.00	0.00	0.00	2.044	33.51	9352	27.34	11448

* Design Condition

Span = 1455.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	39.09	19621	35.03	21880
32.0	0.25	0.00	0.00	2.602	39.47	17499	34.46	20029
0.0	0.00	0.00	0.00	2.044	34.42	15749	28.76	18836
15.0	0.00	0.00	0.00	2.044	35.79	15149	29.79	18186
30.0	0.00	0.00	0.00	2.044	37.15	14598	30.86	17562
60.0	0.00	0.00	0.00	2.044	39.82	13625*	33.06	16393
90.0	0.00	0.00	0.00	2.044	42.41	12797	35.35	15337
120.0	0.00	0.00	0.00	2.044	44.93	12085	37.69	14391
167.0	0.00	0.00	0.00	2.044	48.72	11153	41.37	13116
212.0	0.00	0.00	0.00	2.044	52.17	10421	44.88	12099

* Design Condition

Span = 1218.1 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	27.23	19727	23.85	22506
32.0	0.25	0.00	0.00	2.602	27.56	17545	23.31	20730
0.0	0.00	0.00	0.00	2.044	22.96	16534	18.61	20389
15.0	0.00	0.00	0.00	2.044	24.19	15694	19.39	19573
30.0	0.00	0.00	0.00	2.044	25.43	14934	20.21	18776
60.0	0.00	0.00	0.00	2.044	27.88	13625*	21.99	17259
90.0	0.00	0.00	0.00	2.044	30.29	12548	23.93	15869
120.0	0.00	0.00	0.00	2.044	32.62	11655	25.97	14624
167.0	0.00	0.00	0.00	2.044	36.13	10531	29.30	12970
212.0	0.00	0.00	0.00	2.044	39.29	9688	32.52	11693

* Design Condition

Span = 821.8 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	12.26	19914	10.32	23652
32.0	0.25	0.00	0.00	2.602	12.50	17590	9.96	22069
0.0	0.00	0.00	0.00	2.044	9.28	18605	7.44	23192
15.0	0.00	0.00	0.00	2.044	10.08	17136	7.78	22177
30.0	0.00	0.00	0.00	2.044	10.93	15805	8.16	21149
60.0	0.00	0.00	0.00	2.044	12.74	13557	9.05	19075*
90.0	0.00	0.00	0.00	2.044	14.63	11808	10.14	17033
120.0	0.00	0.00	0.00	2.044	16.52	10462	11.43	15105
167.0	0.00	0.00	0.00	2.044	19.37	8928	13.83	12494
212.0	0.00	0.00	0.00	2.044	20.83	8306	16.36	10563

* Design Condition

Span = 2022.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb

15.0	0.25	4.00	0.20	2.890	76.28	19471	71.17	20854
32.0	0.25	0.00	0.00	2.602	76.72	17433	70.60	18929
0.0	0.00	0.00	0.00	2.044	71.16	14752	63.79	16441
15.0	0.00	0.00	0.00	2.044	72.68	14447	65.15	16100
30.0	0.00	0.00	0.00	2.044	74.18	14158	66.52	15772
60.0	0.00	0.00	0.00	2.044	77.11	13625*	69.25	15155
90.0	0.00	0.00	0.00	2.044	79.98	13143	71.98	14587
120.0	0.00	0.00	0.00	2.044	82.78	12704	74.68	14063
167.0	0.00	0.00	0.00	2.044	87.02	12093	78.88	13324
212.0	0.00	0.00	0.00	2.044	90.95	11579	82.82	12698

* Design Condition

Span = 1129.4 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	23.34	19776	20.26	22771
32.0	0.25	0.00	0.00	2.602	23.66	17568	19.75	21032
0.0	0.00	0.00	0.00	2.044	19.28	16919	15.50	21036
15.0	0.00	0.00	0.00	2.044	20.45	15961	16.18	20163
30.0	0.00	0.00	0.00	2.044	21.62	15099	16.90	19304
60.0	0.00	0.00	0.00	2.044	23.96	13625*	18.49	17649
90.0	0.00	0.00	0.00	2.044	26.28	12430	20.25	16115
120.0	0.00	0.00	0.00	2.044	28.53	11453	22.15	14733
167.0	0.00	0.00	0.00	2.044	31.91	10246	25.31	12901
212.0	0.00	0.00	0.00	2.044	34.71	9426	28.40	11504

* Design Condition

Span = 1308.2 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	31.48	19682	27.83	22253
32.0	0.25	0.00	0.00	2.602	31.84	17526	27.27	20445
0.0	0.00	0.00	0.00	2.044	27.04	16198	22.15	19763
15.0	0.00	0.00	0.00	2.044	28.34	15460	23.03	19009
30.0	0.00	0.00	0.00	2.044	29.62	14790	23.95	18279
60.0	0.00	0.00	0.00	2.044	32.17	13625*	25.91	16900
90.0	0.00	0.00	0.00	2.044	34.65	12653	28.00	15647
120.0	0.00	0.00	0.00	2.044	37.06	11835	30.17	14526
167.0	0.00	0.00	0.00	2.044	40.69	10789	33.64	13031
212.0	0.00	0.00	0.00	2.044	43.98	9988	36.98	11862

* Design Condition

Span = 1089.5 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	21.69	19800	18.75	22895
32.0	0.25	0.00	0.00	2.602	22.00	17579	18.25	21174
0.0	0.00	0.00	0.00	2.044	17.74	17111	14.23	21335
15.0	0.00	0.00	0.00	2.044	18.87	16095	14.85	20438
30.0	0.00	0.00	0.00	2.044	20.00	15181	15.52	19551
60.0	0.00	0.00	0.00	2.044	22.30	13625*	17.02	17835
90.0	0.00	0.00	0.00	2.044	24.56	12371	18.70	16234
120.0	0.00	0.00	0.00	2.044	26.78	11353	20.54	14787
167.0	0.00	0.00	0.00	2.044	30.10	10107	23.61	12868
212.0	0.00	0.00	0.00	2.044	32.72	9301	26.64	11411

* Design Condition

Span = 888.6 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	14.32	19944	12.12	23549
32.0	0.25	0.00	0.00	2.602	14.57	17644	11.72	21931
0.0	0.00	0.00	0.00	2.044	11.05	18263	8.84	22842
15.0	0.00	0.00	0.00	2.044	11.94	16909	9.24	21850
30.0	0.00	0.00	0.00	2.044	12.87	15687	9.68	20850
60.0	0.00	0.00	0.00	2.044	14.82	13625*	10.71	18851
90.0	0.00	0.00	0.00	2.044	16.82	12010	11.94	16910
120.0	0.00	0.00	0.00	2.044	18.80	10749	13.37	15099
167.0	0.00	0.00	0.00	2.044	21.79	9283	15.95	12665
212.0	0.00	0.00	0.00	2.044	23.53	8597	18.62	10854

* Design Condition

Span = 1775.1 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	58.56	19523	53.82	21227
32.0	0.25	0.00	0.00	2.602	58.97	17456	53.23	19322
0.0	0.00	0.00	0.00	2.044	53.58	15081	46.74	17271
15.0	0.00	0.00	0.00	2.044	55.05	14680	48.01	16819
30.0	0.00	0.00	0.00	2.044	56.50	14306	49.28	16387
60.0	0.00	0.00	0.00	2.044	59.35	13625*	51.85	15579
90.0	0.00	0.00	0.00	2.044	62.12	13023	54.44	14844
120.0	0.00	0.00	0.00	2.044	64.82	12487	57.02	14176
167.0	0.00	0.00	0.00	2.044	68.90	11756	61.04	13251
212.0	0.00	0.00	0.00	2.044	72.65	11156	64.82	12486

* Design Condition

Span = 1579.5 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	46.19	19578	41.84	21600
32.0	0.25	0.00	0.00	2.602	46.58	17480	41.25	19723
0.0	0.00	0.00	0.00	2.044	41.38	15447	35.18	18153
15.0	0.00	0.00	0.00	2.044	42.80	14938	36.32	17587
30.0	0.00	0.00	0.00	2.044	44.20	14467	37.48	17045
60.0	0.00	0.00	0.00	2.044	46.95	13625*	39.86	16034
90.0	0.00	0.00	0.00	2.044	49.62	12897	42.28	15119
120.0	0.00	0.00	0.00	2.044	52.22	12261	44.73	14296
167.0	0.00	0.00	0.00	2.044	56.13	11414	48.56	13175
212.0	0.00	0.00	0.00	2.044	59.71	10737	52.19	12268

* Design Condition

Span = 1541.4 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	43.95	19590	39.69	21682
32.0	0.25	0.00	0.00	2.602	44.34	17485	39.11	19812
0.0	0.00	0.00	0.00	2.044	39.18	15533	33.14	18351
15.0	0.00	0.00	0.00	2.044	40.59	14998	34.25	17760
30.0	0.00	0.00	0.00	2.044	41.98	14504	35.38	17194
60.0	0.00	0.00	0.00	2.044	44.70	13625*	37.71	16137
90.0	0.00	0.00	0.00	2.044	47.35	12868	40.09	15181
120.0	0.00	0.00	0.00	2.044	49.93	12210	42.51	14323
167.0	0.00	0.00	0.00	2.044	53.80	11338	46.30	13158

212.0	0.00	0.00	0.00	2.044	57.34	10645	49.89	12219

* Design Condition

Span = 945.9 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points				Final			Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	16.26	19899	13.85	23359
32.0	0.25	0.00	0.00	2.602	16.53	17623	13.42	21710
0.0	0.00	0.00	0.00	2.044	12.78	17903	10.20	22416
15.0	0.00	0.00	0.00	2.044	13.74	16652	10.66	21447
30.0	0.00	0.00	0.00	2.044	14.74	15526	11.17	20475
60.0	0.00	0.00	0.00	2.044	16.80	13625*	12.33	18551
90.0	0.00	0.00	0.00	2.044	18.88	12125	13.70	16705
120.0	0.00	0.00	0.00	2.044	20.94	10940	15.25	15002
167.0	0.00	0.00	0.00	2.044	24.02	9541	17.99	12728
212.0	0.00	0.00	0.00	2.044	26.02	8812	20.77	11030

* Design Condition

Span = 1437.5 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points				Final			Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	38.14	19627	34.13	21921
32.0	0.25	0.00	0.00	2.602	38.51	17502	33.55	20075
0.0	0.00	0.00	0.00	2.044	33.49	15797	27.92	18939
15.0	0.00	0.00	0.00	2.044	34.86	15182	28.93	18277
30.0	0.00	0.00	0.00	2.044	36.21	14618	29.98	17641
60.0	0.00	0.00	0.00	2.044	38.86	13625*	32.16	16449
90.0	0.00	0.00	0.00	2.044	41.45	12781	34.43	15370
120.0	0.00	0.00	0.00	2.044	43.95	12058	36.75	14406
167.0	0.00	0.00	0.00	2.044	47.72	11113	40.41	13106
212.0	0.00	0.00	0.00	2.044	51.16	10373	43.89	12073

* Design Condition

Span = 669.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points				Final			Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	8.28	19532	6.90	23431
32.0	0.25	0.00	0.00	2.602	8.49	17166	6.65	21908
0.0	0.00	0.00	0.00	2.044	6.00	19075	4.88	23450
15.0	0.00	0.00	0.00	2.044	6.59	17367	5.11	22388
30.0	0.00	0.00	0.00	2.044	7.24	15799	5.37	21301
60.0	0.00	0.00	0.00	2.044	8.72	13128	6.00	19075*
90.0	0.00	0.00	0.00	2.044	10.33	11078	6.80	16830
120.0	0.00	0.00	0.00	2.044	11.99	9553	7.80	14659
167.0	0.00	0.00	0.00	2.044	14.35	7986	9.80	11683
212.0	0.00	0.00	0.00	2.044	15.32	7478	12.01	9534

* Design Condition

Span = 2606.8 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points				Final			Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	127.79	19394	122.12	20277
32.0	0.25	0.00	0.00	2.602	128.25	17400	121.58	18338
0.0	0.00	0.00	0.00	2.044	122.49	14300	114.48	15283
15.0	0.00	0.00	0.00	2.044	124.06	14122	115.95	15093
30.0	0.00	0.00	0.00	2.044	125.61	13951	117.41	14907

60.0	0.00	0.00	0.00	2.044	128.67	13625*	120.33	14552
90.0	0.00	0.00	0.00	2.044	131.67	13320	123.22	14216
120.0	0.00	0.00	0.00	2.044	134.63	13034	126.09	13898
167.0	0.00	0.00	0.00	2.044	139.15	12619	130.54	13434
212.0	0.00	0.00	0.00	2.044	143.37	12256	134.73	13024

* Design Condition

Certain information such as the data, opinions or recommendations set forth herein or given by Southwire representatives, is intended as a general guide only. Each installation of overhead electrical conductor, underground electrical conductor, and/or conductor accessories involves special conditions creating problems that require individual solutions and, therefore, the recipient of this information has the sole responsibility in connection with the use of the information. Southwire does not assume any liability in connection with such information.

Southwire SAG10™

6/22/2010

David Evans and Associates

Susquehanna - Roseland 500kV
B&M P&P

Conductor: 1594.0 Kcmil 54/19 Stranding ACCR "FALCON"

Area = 1.4110 Sq. in Diameter = 1.547 in Weight = 1.745 lb/ft RTS = 53600 lb
Data from Chart No. 4-1100
English Units
Limits and Outputs in Average Tensions.

Span = 152.4 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	0.37	20230	0.34	22495
32.0	0.25	0.00	0.00	2.304	0.38	17655	0.32	21064
0.0	0.00	0.00	0.00	1.745	0.23	22348	0.21	23629
15.0	0.00	0.00	0.00	1.745	0.25	20091	0.23	22421
30.0	0.00	0.00	0.00	1.745	0.28	17843	0.24	21180
60.0	0.00	0.00	0.00	1.745	0.38	13399*	0.27	18603
90.0	0.00	0.00	0.00	1.745	0.55	9142	0.32	15907
120.0	0.00	0.00	0.00	1.745	0.68	7491	0.39	13112
167.0	0.00	0.00	0.00	1.745	0.76	6648	0.59	8653
212.0	0.00	0.00	0.00	1.745	0.86	5871	0.83	6101

* Design Condition

Span = 839.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	11.39	20126	10.54	21731
32.0	0.25	0.00	0.00	2.304	11.48	17671	10.15	19973
0.0	0.00	0.00	0.00	1.745	8.23	18666	7.40	20742
15.0	0.00	0.00	0.00	1.745	8.96	17145	7.79	19713
30.0	0.00	0.00	0.00	1.745	9.75	15758	8.22	18695
60.0	0.00	0.00	0.00	1.745	11.47	13400*	9.19	16723
90.0	0.00	0.00	0.00	1.745	13.29	11565	10.32	14888
120.0	0.00	0.00	0.00	1.745	15.13	10162	11.60	13243
167.0	0.00	0.00	0.00	1.745	16.47	9334	13.84	11109
212.0	0.00	0.00	0.00	1.745	17.18	8953	16.09	9556

* Design Condition

Span = 418.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	2.82	20196	2.55	22280
32.0	0.25	0.00	0.00	2.304	2.85	17660	2.42	20757
0.0	0.00	0.00	0.00	1.745	1.79	21324	1.66	22913
15.0	0.00	0.00	0.00	1.745	1.98	19224	1.75	21734

30.0	0.00	0.00	0.00	1.745	2.22	17186	1.86	20534
60.0	0.00	0.00	0.00	1.745	2.84	13400*	2.11	18080
90.0	0.00	0.00	0.00	1.745	3.72	10243	2.44	15596
120.0	0.00	0.00	0.00	1.745	4.56	8371	2.90	13157
167.0	0.00	0.00	0.00	1.745	4.92	7747	3.92	9722
212.0	0.00	0.00	0.00	1.745	5.30	7194	5.19	7353

* Design Condition

Span = 708.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	8.10	20147	7.45	21912
32.0	0.25	0.00	0.00	2.304	8.17	17668	7.14	20230
0.0	0.00	0.00	0.00	1.745	5.60	19526	5.08	21509
15.0	0.00	0.00	0.00	1.745	6.15	17791	5.36	20416
30.0	0.00	0.00	0.00	1.745	6.76	16181	5.66	19323
60.0	0.00	0.00	0.00	1.745	8.16	13400*	6.37	17166
90.0	0.00	0.00	0.00	1.745	9.74	11234	7.24	15106
120.0	0.00	0.00	0.00	1.745	11.38	9616	8.28	13218
167.0	0.00	0.00	0.00	1.745	12.31	8894	10.18	10749
212.0	0.00	0.00	0.00	1.745	12.92	8473	12.19	8983

* Design Condition

Span = 574.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	5.32	20169	4.85	22092
32.0	0.25	0.00	0.00	2.304	5.37	17665	4.63	20487
0.0	0.00	0.00	0.00	1.745	3.52	20404	3.23	22222
15.0	0.00	0.00	0.00	1.745	3.89	18476	3.41	21081
30.0	0.00	0.00	0.00	1.745	4.32	16649	3.61	19929
60.0	0.00	0.00	0.00	1.745	5.37	13400*	4.08	17612
90.0	0.00	0.00	0.00	1.745	6.64	10823	4.69	15337
120.0	0.00	0.00	0.00	1.745	8.05	8932	5.45	13190
167.0	0.00	0.00	0.00	1.745	8.57	8392	6.97	10314
212.0	0.00	0.00	0.00	1.745	9.08	7920	8.69	8280

* Design Condition

Span = 1058.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	18.14	20097	17.00	21444
32.0	0.25	0.00	0.00	2.304	18.26	17675	16.49	19569
0.0	0.00	0.00	0.00	1.745	14.06	17384	12.58	19417
15.0	0.00	0.00	0.00	1.745	15.06	16221	13.19	18528
30.0	0.00	0.00	0.00	1.745	16.11	15174	13.83	17665
60.0	0.00	0.00	0.00	1.745	18.24	13400*	15.24	16040
90.0	0.00	0.00	0.00	1.745	20.39	11991	16.77	14571
120.0	0.00	0.00	0.00	1.745	22.50	10869	18.41	13276
167.0	0.00	0.00	0.00	1.745	24.55	9966	21.10	11591
212.0	0.00	0.00	0.00	1.745	25.39	9639	23.71	10320

* Design Condition

Span = 588.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb

15.0	0.25	4.00	0.20	2.603	5.58	20167	5.10	22073
32.0	0.25	0.00	0.00	2.304	5.64	17665	4.87	20461
0.0	0.00	0.00	0.00	1.745	3.71	20314	3.40	22153
15.0	0.00	0.00	0.00	1.745	4.10	18405	3.59	21016
30.0	0.00	0.00	0.00	1.745	4.54	16600	3.80	19868
60.0	0.00	0.00	0.00	1.745	5.63	13400*	4.29	17567
90.0	0.00	0.00	0.00	1.745	6.94	10869	4.93	15313
120.0	0.00	0.00	0.00	1.745	8.38	9011	5.72	13194
167.0	0.00	0.00	0.00	1.745	8.94	8447	7.28	10363
212.0	0.00	0.00	0.00	1.745	9.46	7980	9.03	8360

* Design Condition

Span = 528.0 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	4.50	20177	4.10	22150
32.0	0.25	0.00	0.00	2.304	4.55	17663	3.90	20571
0.0	0.00	0.00	0.00	1.745	2.94	20691	2.71	22444
15.0	0.00	0.00	0.00	1.745	3.25	18707	2.86	21290
30.0	0.00	0.00	0.00	1.745	3.62	16812	3.02	20121
60.0	0.00	0.00	0.00	1.745	4.54	13400*	3.42	17758
90.0	0.00	0.00	0.00	1.745	5.71	10663	3.95	15416
120.0	0.00	0.00	0.00	1.745	6.94	8766	4.61	13181
167.0	0.00	0.00	0.00	1.745	7.41	8208	6.00	10148
212.0	0.00	0.00	0.00	1.745	7.89	7715	7.60	8007

* Design Condition

Span = 750.0 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	9.09	20140	8.38	21854
32.0	0.25	0.00	0.00	2.304	9.17	17669	8.04	20147
0.0	0.00	0.00	0.00	1.745	6.38	19247	5.77	21269
15.0	0.00	0.00	0.00	1.745	6.98	17579	6.08	20194
30.0	0.00	0.00	0.00	1.745	7.65	16040	6.42	19124
60.0	0.00	0.00	0.00	1.745	9.16	13400*	7.21	17023
90.0	0.00	0.00	0.00	1.745	10.82	11347	8.16	15034
120.0	0.00	0.00	0.00	1.745	12.53	9802	9.28	13226
167.0	0.00	0.00	0.00	1.745	13.59	9041	11.30	10871
212.0	0.00	0.00	0.00	1.745	14.23	8633	13.39	9178

* Design Condition

Span = 2024.0 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.603	66.83	20030	64.85	20634
32.0	0.25	0.00	0.00	2.304	67.00	17684	64.08	18482
0.0	0.00	0.00	0.00	1.745	61.06	14687	57.48	15597
15.0	0.00	0.00	0.00	1.745	62.57	14336	58.70	15274
30.0	0.00	0.00	0.00	1.745	64.06	14005	59.92	14964
60.0	0.00	0.00	0.00	1.745	66.98	13400*	62.37	14382
90.0	0.00	0.00	0.00	1.745	69.82	12859	64.80	13846
120.0	0.00	0.00	0.00	1.745	72.59	12374	67.22	13352
167.0	0.00	0.00	0.00	1.745	76.78	11705	70.97	12653
212.0	0.00	0.00	0.00	1.745	78.33	11476	74.50	12059

* Design Condition

Span = 1129.0 Feet NESC Medium Load Zone

Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	20.67	20089	19.44	21358
32.0	0.25	0.00	0.00	2.304	20.79	17676	18.89	19450
0.0	0.00	0.00	0.00	1.745	16.34	17029	14.64	19002
15.0	0.00	0.00	0.00	1.745	17.42	15971	15.32	18165
30.0	0.00	0.00	0.00	1.745	18.53	15019	16.03	17356
60.0	0.00	0.00	0.00	1.745	20.78	13400*	17.57	15843
90.0	0.00	0.00	0.00	1.745	23.01	12102	19.22	14483
120.0	0.00	0.00	0.00	1.745	25.20	11055	20.96	13286
167.0	0.00	0.00	0.00	1.745	27.47	10146	23.77	11719
212.0	0.00	0.00	0.00	1.745	28.34	9834	26.47	10525

* Design Condition

Span = 1308.0 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	27.78	20072	26.34	21161
32.0	0.25	0.00	0.00	2.304	27.92	17679	25.73	19179
0.0	0.00	0.00	0.00	1.745	22.96	16277	20.71	18036
15.0	0.00	0.00	0.00	1.745	24.19	15446	21.56	17331
30.0	0.00	0.00	0.00	1.745	25.43	14695	22.43	16657
60.0	0.00	0.00	0.00	1.745	27.90	13400*	24.25	15408
90.0	0.00	0.00	0.00	1.745	30.32	12335	26.15	14292
120.0	0.00	0.00	0.00	1.745	32.67	11451	28.10	13306
167.0	0.00	0.00	0.00	1.745	35.47	10551	31.18	11996
212.0	0.00	0.00	0.00	1.745	36.44	10273	34.11	10970

* Design Condition

Span = 1089.0 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	19.22	20094	18.04	21407
32.0	0.25	0.00	0.00	2.304	19.34	17676	17.52	19517
0.0	0.00	0.00	0.00	1.745	15.03	17225	13.46	19234
15.0	0.00	0.00	0.00	1.745	16.07	16109	14.09	18368
30.0	0.00	0.00	0.00	1.745	17.14	15104	14.77	17529
60.0	0.00	0.00	0.00	1.745	19.33	13400*	16.23	15952
90.0	0.00	0.00	0.00	1.745	21.52	12041	17.82	14532
120.0	0.00	0.00	0.00	1.745	23.66	10953	19.50	13281
167.0	0.00	0.00	0.00	1.745	25.81	10046	22.24	11649
212.0	0.00	0.00	0.00	1.745	26.66	9726	24.90	10412

* Design Condition

Span = 869.0 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	12.22	20122	11.33	21691
32.0	0.25	0.00	0.00	2.304	12.32	17672	10.93	19916
0.0	0.00	0.00	0.00	1.745	8.92	18476	8.01	20560
15.0	0.00	0.00	0.00	1.745	9.69	17006	8.43	19548
30.0	0.00	0.00	0.00	1.745	10.52	15668	8.88	18550
60.0	0.00	0.00	0.00	1.745	12.30	13400*	9.91	16624
90.0	0.00	0.00	0.00	1.745	14.18	11632	11.11	14841
120.0	0.00	0.00	0.00	1.745	16.06	10272	12.44	13248
167.0	0.00	0.00	0.00	1.745	17.50	9428	14.75	11184

212.0	0.00	0.00	0.00	1.745	18.22	9056	17.05	9674

* Design Condition

Span = 1795.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	52.49	20040	50.64	20763
32.0	0.25	0.00	0.00	2.304	52.65	17683	49.91	18649
0.0	0.00	0.00	0.00	1.745	46.91	15024	43.61	16154
15.0	0.00	0.00	0.00	1.745	48.37	14573	44.76	15741
30.0	0.00	0.00	0.00	1.745	49.81	14154	45.91	15348
60.0	0.00	0.00	0.00	1.745	52.63	13400*	48.23	14614
90.0	0.00	0.00	0.00	1.745	55.37	12740	50.55	13947
120.0	0.00	0.00	0.00	1.745	58.04	12159	52.86	13341
167.0	0.00	0.00	0.00	1.745	62.07	11377	56.45	12499
212.0	0.00	0.00	0.00	1.745	63.24	11168	59.83	11798

* Design Condition

Span = 1410.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	32.30	20063	30.77	21062
32.0	0.25	0.00	0.00	2.304	32.45	17680	30.12	19044
0.0	0.00	0.00	0.00	1.745	27.26	15930	24.74	17550
15.0	0.00	0.00	0.00	1.745	28.57	15206	25.67	16917
30.0	0.00	0.00	0.00	1.745	29.86	14547	26.62	16314
60.0	0.00	0.00	0.00	1.745	32.43	13400*	28.58	15198
90.0	0.00	0.00	0.00	1.745	34.94	12443	30.60	14201
120.0	0.00	0.00	0.00	1.745	37.37	11637	32.64	13315
167.0	0.00	0.00	0.00	1.745	40.46	10754	35.85	12127
212.0	0.00	0.00	0.00	1.745	41.47	10493	38.89	11184

* Design Condition

Span = 669.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	7.23	20153	6.63	21965
32.0	0.25	0.00	0.00	2.304	7.30	17667	6.35	20306
0.0	0.00	0.00	0.00	1.745	4.94	19785	4.49	21726
15.0	0.00	0.00	0.00	1.745	5.43	17990	4.74	20618
30.0	0.00	0.00	0.00	1.745	5.99	16315	5.01	19505
60.0	0.00	0.00	0.00	1.745	7.29	13400*	5.65	17298
90.0	0.00	0.00	0.00	1.745	8.78	11122	6.44	15173
120.0	0.00	0.00	0.00	1.745	10.36	9431	7.39	13211
167.0	0.00	0.00	0.00	1.745	11.16	8754	9.19	10629
212.0	0.00	0.00	0.00	1.745	11.75	8318	11.12	8792

* Design Condition

Span = 2606.7 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	111.26	20014	109.06	20411
32.0	0.25	0.00	0.00	2.304	111.44	17686	108.24	18201
0.0	0.00	0.00	0.00	1.745	105.22	14177	101.23	14730
15.0	0.00	0.00	0.00	1.745	106.80	13971	102.55	14543
30.0	0.00	0.00	0.00	1.745	108.35	13773	103.86	14361

60.0	0.00	0.00	0.00	1.745	111.42	13400*	106.48	14012
90.0	0.00	0.00	0.00	1.745	114.42	13054	109.09	13682
120.0	0.00	0.00	0.00	1.745	117.36	12731	111.68	13369
167.0	0.00	0.00	0.00	1.745	121.86	12269	115.70	12911
212.0	0.00	0.00	0.00	1.745	124.17	12044	119.50	12507

* Design Condition

Span = 721.9 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.603	8.42	20145	7.75	21892
32.0	0.25	0.00	0.00	2.304	8.50	17668	7.43	20202
0.0	0.00	0.00	0.00	1.745	5.85	19433	5.31	21430
15.0	0.00	0.00	0.00	1.745	6.42	17720	5.59	20343
30.0	0.00	0.00	0.00	1.745	7.05	16134	5.90	19258
60.0	0.00	0.00	0.00	1.745	8.49	13400*	6.64	17119
90.0	0.00	0.00	0.00	1.745	10.09	11272	7.54	15082
120.0	0.00	0.00	0.00	1.745	11.76	9679	8.60	13221
167.0	0.00	0.00	0.00	1.745	12.73	8943	10.54	10790
212.0	0.00	0.00	0.00	1.745	13.35	8526	12.58	9049

* Design Condition

Certain information such as the data, opinions or recommendations set forth herein or given by Southwire representatives, is intended as a general guide only. Each installation of overhead electrical conductor, underground electrical conductor, and/or conductor accessories involves special conditions creating problems that require individual solutions and, therefore, the recipient of this information has the sole responsibility in connection with the use of the information. Southwire does not assume any liability in connection with such information.

Southwire SAG10™

6/22/2010

David Evans and Associates

Susquehanna - Roseland 500kV
B&M P&P

Conductor: 1590.0 Kcmil 54/19 Stranding ACSR "FALCON"

Area = 1.4070 Sq. in Diameter = 1.545 in Weight = 2.044 lb/ft RTS = 54500 lb
Data from Chart No. 1-1009
English Units
Limits and Outputs in Average Tensions.

Span = 152.4 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	0.44	18860	0.37	22902
32.0	0.25	0.00	0.00	2.602	0.47	16232	0.35	21520
0.0	0.00	0.00	0.00	2.044	0.28	21011	0.25	23991
15.0	0.00	0.00	0.00	2.044	0.32	18699	0.26	22840
30.0	0.00	0.00	0.00	2.044	0.36	16403	0.27	21639
60.0	0.00	0.00	0.00	2.044	0.50	11905	0.31	19074*
90.0	0.00	0.00	0.00	2.044	0.76	7768	0.36	16279
120.0	0.00	0.00	0.00	2.044	1.07	5561	0.45	13246
167.0	0.00	0.00	0.00	2.044	1.31	4529	0.73	8171
212.0	0.00	0.00	0.00	2.044	1.61	3697	1.39	4277

* Design Condition

Span = 839.0 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	12.75	19960	10.75	23677
32.0	0.25	0.00	0.00	2.602	12.99	17639	10.37	22087
0.0	0.00	0.00	0.00	2.044	9.70	18560	7.77	23162
15.0	0.00	0.00	0.00	2.044	10.51	17117	8.12	22153
30.0	0.00	0.00	0.00	2.044	11.38	15811	8.51	21131
60.0	0.00	0.00	0.00	2.044	13.23	13604	9.43	19075*
90.0	0.00	0.00	0.00	2.044	15.15	11885	10.55	17056
120.0	0.00	0.00	0.00	2.044	17.07	10556	11.88	15153
167.0	0.00	0.00	0.00	2.044	19.95	9034	14.32	12578
212.0	0.00	0.00	0.00	2.044	21.48	8394	16.88	10670

* Design Condition

Span = 418.0 Feet NESC Medium Load Zone
Creep IS a Factor Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	3.31	19056	2.73	23113
32.0	0.25	0.00	0.00	2.602	3.43	16571	2.62	21675
0.0	0.00	0.00	0.00	2.044	2.22	20076	1.88	23788
15.0	0.00	0.00	0.00	2.044	2.48	17996	1.97	22669

30.0	0.00	0.00	0.00	2.044	2.79	16007	2.08	21509
60.0	0.00	0.00	0.00	2.044	3.59	12439	2.34	19075*
90.0	0.00	0.00	0.00	2.044	4.63	9637	2.70	16511
120.0	0.00	0.00	0.00	2.044	5.82	7674	3.21	13893
167.0	0.00	0.00	0.00	2.044	6.91	6471	4.43	10091
212.0	0.00	0.00	0.00	2.044	7.60	5881	6.02	7426

* Design Condition

Span = 708.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	9.23	19625	7.71	23486
32.0	0.25	0.00	0.00	2.602	9.45	17272	7.43	21948
0.0	0.00	0.00	0.00	2.044	6.76	18943	5.48	23387
15.0	0.00	0.00	0.00	2.044	7.41	17297	5.74	22336
30.0	0.00	0.00	0.00	2.044	8.11	15792	6.02	21264
60.0	0.00	0.00	0.00	2.044	9.68	13238	6.72	19075*
90.0	0.00	0.00	0.00	2.044	11.37	11274	7.59	16882
120.0	0.00	0.00	0.00	2.044	13.09	9799	8.67	14776
167.0	0.00	0.00	0.00	2.044	15.66	8197	10.77	11901
212.0	0.00	0.00	0.00	2.044	16.67	7698	13.07	9812

* Design Condition

Span = 574.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	6.16	19324	5.11	23302
32.0	0.25	0.00	0.00	2.602	6.34	16920	4.91	21814
0.0	0.00	0.00	0.00	2.044	4.33	19431	3.57	23592
15.0	0.00	0.00	0.00	2.044	4.79	17573	3.74	22505
30.0	0.00	0.00	0.00	2.044	5.32	15844	3.94	21388
60.0	0.00	0.00	0.00	2.044	6.55	12860	4.41	19075*
90.0	0.00	0.00	0.00	2.044	7.97	10572	5.04	16704
120.0	0.00	0.00	0.00	2.044	9.46	8909	5.86	14370
167.0	0.00	0.00	0.00	2.044	11.32	7446	7.58	11120
212.0	0.00	0.00	0.00	2.044	12.20	6912	9.57	8807

* Design Condition

Span = 1058.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb
15.0	0.25	4.00	0.20	2.890	20.43	19820	17.60	22995
32.0	0.25	0.00	0.00	2.602	20.73	17588	17.12	21288
0.0	0.00	0.00	0.00	2.044	16.58	17271	13.27	21571
15.0	0.00	0.00	0.00	2.044	17.67	16207	13.85	20657
30.0	0.00	0.00	0.00	2.044	18.78	15250	14.49	19750
60.0	0.00	0.00	0.00	2.044	21.02	13625*	15.92	17986
90.0	0.00	0.00	0.00	2.044	23.26	12322	17.53	16332
120.0	0.00	0.00	0.00	2.044	25.44	11270	19.31	14831
167.0	0.00	0.00	0.00	2.044	28.71	9991	22.31	12839
212.0	0.00	0.00	0.00	2.044	31.20	9199	25.29	11334

* Design Condition

Span = 588.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp °F	Ice in	Wind psf	K lb/ft	Weight lb/ft	Sag Ft	Tension lb	Sag Ft	Tension lb

15.0	0.25	4.00	0.20	2.890	6.46	19353	5.36	23321
32.0	0.25	0.00	0.00	2.602	6.64	16955	5.15	21827
0.0	0.00	0.00	0.00	2.044	4.56	19376	3.75	23572
15.0	0.00	0.00	0.00	2.044	5.04	17540	3.93	22489
30.0	0.00	0.00	0.00	2.044	5.58	15835	4.13	21376
60.0	0.00	0.00	0.00	2.044	6.85	12899	4.63	19075*
90.0	0.00	0.00	0.00	2.044	8.30	10649	5.28	16723
120.0	0.00	0.00	0.00	2.044	9.82	9008	6.13	14413
167.0	0.00	0.00	0.00	2.044	11.75	7528	7.89	11206
212.0	0.00	0.00	0.00	2.044	12.65	6998	9.92	8919

* Design Condition

Span = 528.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	5.24	19234	4.33	23242
32.0	0.25	0.00	0.00	2.602	5.40	16808	4.17	21770
0.0	0.00	0.00	0.00	2.044	3.63	19615	3.01	23655
15.0	0.00	0.00	0.00	2.044	4.03	17688	3.16	22557
30.0	0.00	0.00	0.00	2.044	4.49	15880	3.32	21426
60.0	0.00	0.00	0.00	2.044	5.60	12732	3.74	19075*
90.0	0.00	0.00	0.00	2.044	6.91	10310	4.28	16644
120.0	0.00	0.00	0.00	2.044	8.32	8570	5.01	14227
167.0	0.00	0.00	0.00	2.044	9.95	7171	6.58	10830
212.0	0.00	0.00	0.00	2.044	10.77	6623	8.46	8426

* Design Condition

Span = 750.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	10.31	19730	8.63	23547
32.0	0.25	0.00	0.00	2.602	10.53	17388	8.32	21992
0.0	0.00	0.00	0.00	2.044	7.64	18810	6.17	23317
15.0	0.00	0.00	0.00	2.044	8.35	17230	6.45	22279
30.0	0.00	0.00	0.00	2.044	9.11	15791	6.77	21223
60.0	0.00	0.00	0.00	2.044	10.77	13357	7.54	19075*
90.0	0.00	0.00	0.00	2.044	12.54	11477	8.49	16938
120.0	0.00	0.00	0.00	2.044	14.32	10052	9.65	14900
167.0	0.00	0.00	0.00	2.044	17.01	8465	11.86	12127
212.0	0.00	0.00	0.00	2.044	18.17	7928	14.25	10100

* Design Condition

Span = 2024.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	76.44	19470	71.32	20851
32.0	0.25	0.00	0.00	2.602	76.87	17433	70.75	18926
0.0	0.00	0.00	0.00	2.044	71.32	14749	63.94	16436
15.0	0.00	0.00	0.00	2.044	72.83	14445	65.30	16095
30.0	0.00	0.00	0.00	2.044	74.33	14157	66.67	15767
60.0	0.00	0.00	0.00	2.044	77.27	13625*	69.40	15152
90.0	0.00	0.00	0.00	2.044	80.13	13144	72.13	14585
120.0	0.00	0.00	0.00	2.044	82.93	12706	74.84	14063
167.0	0.00	0.00	0.00	2.044	87.18	12095	79.03	13325
212.0	0.00	0.00	0.00	2.044	91.11	11582	82.97	12700

* Design Condition

Span = 1129.0 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	23.32	19776	20.25	22772
32.0	0.25	0.00	0.00	2.602	23.64	17567	19.74	21033
0.0	0.00	0.00	0.00	2.044	19.27	16921	15.49	21039
15.0	0.00	0.00	0.00	2.044	20.43	15962	16.16	20166
30.0	0.00	0.00	0.00	2.044	21.60	15099	16.88	19306
60.0	0.00	0.00	0.00	2.044	23.95	13625*	18.47	17650
90.0	0.00	0.00	0.00	2.044	26.26	12429	20.23	16116
120.0	0.00	0.00	0.00	2.044	28.51	11452	22.14	14733
167.0	0.00	0.00	0.00	2.044	31.89	10244	25.30	12901
212.0	0.00	0.00	0.00	2.044	34.69	9425	28.38	11503

* Design Condition

Span = 1308.0 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	31.47	19682	27.82	22254
32.0	0.25	0.00	0.00	2.602	31.83	17526	27.26	20445
0.0	0.00	0.00	0.00	2.044	27.03	16199	22.14	19764
15.0	0.00	0.00	0.00	2.044	28.33	15461	23.02	19011
30.0	0.00	0.00	0.00	2.044	29.61	14791	23.94	18280
60.0	0.00	0.00	0.00	2.044	32.16	13625*	25.90	16901
90.0	0.00	0.00	0.00	2.044	34.64	12653	27.99	15647
120.0	0.00	0.00	0.00	2.044	37.05	11835	30.16	14527
167.0	0.00	0.00	0.00	2.044	40.67	10788	33.63	13031
212.0	0.00	0.00	0.00	2.044	43.97	9987	36.97	11862

* Design Condition

Span = 1089.0 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	21.67	19801	18.73	22897
32.0	0.25	0.00	0.00	2.602	21.98	17579	18.24	21176
0.0	0.00	0.00	0.00	2.044	17.72	17113	14.21	21338
15.0	0.00	0.00	0.00	2.044	18.85	16097	14.83	20441
30.0	0.00	0.00	0.00	2.044	19.98	15182	15.51	19554
60.0	0.00	0.00	0.00	2.044	22.28	13625*	17.00	17837
90.0	0.00	0.00	0.00	2.044	24.54	12370	18.69	16235
120.0	0.00	0.00	0.00	2.044	26.76	11352	20.52	14787
167.0	0.00	0.00	0.00	2.044	30.08	10105	23.59	12867
212.0	0.00	0.00	0.00	2.044	32.70	9300	26.62	11410

* Design Condition

Span = 869.0 Feet

NESC Medium Load Zone

Creep IS a Factor

Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	13.68	19961	11.56	23614
32.0	0.25	0.00	0.00	2.602	13.93	17652	11.17	22008
0.0	0.00	0.00	0.00	2.044	10.50	18391	8.40	22985
15.0	0.00	0.00	0.00	2.044	11.36	17001	8.78	21986
30.0	0.00	0.00	0.00	2.044	12.26	15745	9.20	20978
60.0	0.00	0.00	0.00	2.044	14.18	13625*	10.18	18956
90.0	0.00	0.00	0.00	2.044	16.14	11968	11.37	16982
120.0	0.00	0.00	0.00	2.044	18.10	10679	12.76	15134
167.0	0.00	0.00	0.00	2.044	21.04	9190	15.28	12642

212.0	0.00	0.00	0.00	2.044	22.70	8521	17.91	10791

* Design Condition

Span = 1795.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points				Final			Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	59.90	19518	55.13	21193
32.0	0.25	0.00	0.00	2.602	60.31	17454	54.54	19286
0.0	0.00	0.00	0.00	2.044	54.91	15050	48.02	17193
15.0	0.00	0.00	0.00	2.044	56.38	14658	49.29	16752
30.0	0.00	0.00	0.00	2.044	57.84	14292	50.57	16329
60.0	0.00	0.00	0.00	2.044	60.70	13625*	53.16	15539
90.0	0.00	0.00	0.00	2.044	63.48	13034	55.76	14820
120.0	0.00	0.00	0.00	2.044	66.18	12507	58.36	14166
167.0	0.00	0.00	0.00	2.044	70.27	11786	62.39	13258
212.0	0.00	0.00	0.00	2.044	74.04	11195	66.19	12505

* Design Condition

Span = 1410.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points				Final			Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	36.67	19638	32.73	21989
32.0	0.25	0.00	0.00	2.602	37.04	17506	32.16	20150
0.0	0.00	0.00	0.00	2.044	32.06	15875	26.62	19106
15.0	0.00	0.00	0.00	2.044	33.41	15236	27.61	18425
30.0	0.00	0.00	0.00	2.044	34.75	14652	28.63	17769
60.0	0.00	0.00	0.00	2.044	37.39	13625*	30.77	16539
90.0	0.00	0.00	0.00	2.044	39.95	12756	33.00	15425
120.0	0.00	0.00	0.00	2.044	42.44	12014	35.29	14430
167.0	0.00	0.00	0.00	2.044	46.17	11048	38.92	13092
212.0	0.00	0.00	0.00	2.044	49.58	10295	42.37	12032

* Design Condition

Span = 669.0 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points				Final			Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	8.28	19532	6.90	23431
32.0	0.25	0.00	0.00	2.602	8.49	17166	6.65	21908
0.0	0.00	0.00	0.00	2.044	6.00	19075	4.88	23450
15.0	0.00	0.00	0.00	2.044	6.59	17367	5.11	22388
30.0	0.00	0.00	0.00	2.044	7.24	15799	5.37	21301
60.0	0.00	0.00	0.00	2.044	8.72	13128	6.00	19075*
90.0	0.00	0.00	0.00	2.044	10.33	11078	6.80	16830
120.0	0.00	0.00	0.00	2.044	11.99	9553	7.80	14659
167.0	0.00	0.00	0.00	2.044	14.35	7986	9.80	11683
212.0	0.00	0.00	0.00	2.044	15.32	7478	12.01	9534

* Design Condition

Span = 2606.7 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points				Final			Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	127.78	19394	122.11	20277
32.0	0.25	0.00	0.00	2.602	128.24	17400	121.57	18338
0.0	0.00	0.00	0.00	2.044	122.48	14300	114.47	15284
15.0	0.00	0.00	0.00	2.044	124.05	14122	115.94	15093
30.0	0.00	0.00	0.00	2.044	125.60	13951	117.41	14907

60.0	0.00	0.00	0.00	2.044	128.66	13625*	120.32	14552
90.0	0.00	0.00	0.00	2.044	131.67	13320	123.22	14216
120.0	0.00	0.00	0.00	2.044	134.62	13034	126.09	13898
167.0	0.00	0.00	0.00	2.044	139.14	12619	130.53	13434
212.0	0.00	0.00	0.00	2.044	143.36	12256	134.73	13024

* Design Condition

Span = 721.9 Feet
Creep IS a Factor

NESC Medium Load Zone
Rolled Rod

Design Points					Final		Initial	
Temp	Ice	Wind	K	Weight	Sag	Tension	Sag	Tension
°F	in	psf	lb/ft	lb/ft	Ft	lb	Ft	lb
15.0	0.25	4.00	0.20	2.890	9.58	19660	8.01	23507
32.0	0.25	0.00	0.00	2.602	9.80	17310	7.72	21963
0.0	0.00	0.00	0.00	2.044	7.05	18898	5.70	23364
15.0	0.00	0.00	0.00	2.044	7.71	17274	5.97	22318
30.0	0.00	0.00	0.00	2.044	8.44	15791	6.27	21250
60.0	0.00	0.00	0.00	2.044	10.04	13277	6.98	19075*
90.0	0.00	0.00	0.00	2.044	11.75	11342	7.88	16901
120.0	0.00	0.00	0.00	2.044	13.49	9884	8.99	14818
167.0	0.00	0.00	0.00	2.044	16.12	8275	11.13	11977
212.0	0.00	0.00	0.00	2.044	17.16	7775	13.46	9909

* Design Condition

Certain information such as the data, opinions or recommendations set forth herein or given by Southwire representatives, is intended as a general guide only. Each installation of overhead electrical conductor, underground electrical conductor, and/or conductor accessories involves special conditions creating problems that require individual solutions and, therefore, the recipient of this information has the sole responsibility in connection with the use of the information. Southwire does not assume any liability in connection with such information.

CONDUCTOR CUT SHEETS

The information in this section was used to determine the insulator swing angle Θ. See calculations tab for detailed information.

TransPowr™ ACCC/TW Bare Overhead Conductor

Trapezoidal Aluminum Conductor Composite Core Concentric-Lay-Stranded

ACSR vs ACSS vs ACSS/TW vs ACCC/TW CONDUCTORS - COMPARISON OF PHYSICAL PROPERTIES OF EQUIVALENT SIZES

CODE WORD (1)	SIZE kcmil	TYPE (2)	NO. OF ALUM. WIRES	CORE	CORE O.D. INCHES	CROSS-SECTIONAL AREA (in²) TOTAL	ALUM.	NOMINAL O.D. INCHES	NOMINAL WEIGHT lb/1000 ft TOTAL	ALUM.	CORE	RATED STRENGTH lb (3) CTC CORE	GA/MA STEEL	HS/MS STEEL	AMPS 75°C (4)	AMPS 200°C (5)	PERCENT BY WEIGHT ALUM.	CORE	STANDARDPACKAGE (6) REEL SIZE	WGHT. Pounds	LNGTH. Feet
LINNET ACSR	336.4	16	26	7x0.0934	0.2652	0.3071	0.2641	0.720	462	317	145	-	14100	14900	530	-	68.5	31.5	RMT 84.36	7550	16350
LINNET ACSS	336.4	16	26	7x0.0934	0.2652	0.3071	0.2641	0.720	462	317	145	-	11200	12900	535	945	68.5	31.5	RMT 84.36	7590	16390
LINNET ACSS/TW	336.4	16	18	7x0.0864	0.2652	0.3071	0.2641	0.663	462	316	145	-	11200	12200	525	920	68.5	31.5	RMT 84.36	7880	17080
LINNET ACSS/TW2	398.7	16	18	7x0.0952	0.2855	0.3641	0.3132	0.770	547	375	172	-	13000	14300	560	1090	68.5	31.5	RMT 84.36	7880	14410
LINNET ACCC/TW	**431**	**A**	**16**	**1x0.2350**	**0.2350**	**0.3819**	**0.3385**	**0.720**	**441**	**405**	**36**	**16300**	**-**	**-**	**600**	**1060***	**92.1**	**7.9**	**RM 78.48**	**5010**	**11400**
HAWK ACSR	477	16	26	7x0.1053	0.3159	0.4353	0.3744	0.858	656	449	206	-	19900	20700	660	-	68.5	31.5	RMT 84.36	7580	11560
HAWK ACSS	477	16	26	7x0.1053	0.3159	0.4353	0.3744	0.858	656	449	206	-	15600	17100	665	940	68.5	31.5	RMT 84.36	7580	11560
HAWK ACSS/TW	477	16	18	7x0.1053	0.3159	0.4353	0.3745	0.788	655	448	206	-	15600	17100	650	1160	68.5	31.5	RMT 84.36	7890	12050
CALUMENT ACSS TW	555.3	16	20	7x0.1146	0.3438	0.5161	0.4438	0.858	776	531	244	-	18400	20200	725	1295	68.5	31.5	RMT 84.36	8760	11360
HAWK ACCC/TW	**611**	**A**	**16**	**1x0.2800**	**0.2800**	**0.5415**	**0.4799**	**0.858**	**624**	**574**	**51**	**23200**	**-**	**-**	**745**	**1330***	**92.1**	**7.9**	**RM 78.48**	**3420**	**5500**
DOVE ACSR	556.5	16	26	7x0.1198	0.3414	0.5083	0.4371	0.927	765	524	241	-	22600	24000	725	-	68.5	31.5	RMT 84.36	7580	9910
DOVE ACSS	556.5	16	26	7x0.1198	0.3414	0.5083	0.4371	0.927	765	524	241	-	18200	20000	735	1315	68.5	31.5	RMT 84.36	7590	9910
DOVE ACSS/TW	556.5	16	20	7x0.1136	0.3414	0.5083	0.4371	0.850	764	523	241	-	18200	19500	720	1280	68.4	31.6	RMT 84.36	8780	11470
OSWEGO ACSS/TW	664.8	16	20	7x0.1244	0.3732	0.6073	0.5222	0.927	913	625	288	-	21700	23400	800	1440	68.4	31.6	RMT 84.36	8770	9610
DOVE ACCC/TW	**713**	**A**	**18**	**1x0.3050**	**0.3050**	**0.6328**	**0.5597**	**0.927**	**728**	**669**	**59**	**27500**	**-**	**-**	**820**	**1470***	**92.0**	**8.0**	**RM 78.48**	**3850**	**5350**
GROSBEAK ACSR	636	16	26	7x0.1216	0.3648	0.5807	0.4994	0.990	874	599	275	-	25200	26800	790	-	68.5	31.5	RMT 84.36	7590	8670
GROSBEAK ACSS	636	16	26	7x0.1216	0.3648	0.5807	0.4994	0.990	874	599	275	-	20800	22400	800	1435	68.5	31.5	RMT 84.36	7590	8670
GROSBEAK ACSS TW	636	16	20	7x0.1216	0.3648	0.5809	0.4996	0.908	873	598	275	-	20800	22400	760	1400	68.5	31.5	RMT 84.36	8760	10010
WABASH ACSS/TW	762.8	16	20	7x0.1331	0.3993	0.6963	0.5989	0.990	1046	717	330	-	24900	26800	875	1570	68.5	31.5	RMT 84.36	8760	8370
GROSBEAK ACCC/TW	**816**	**A**	**19**	**1x0.3200**	**0.3200**	**0.7215**	**0.6411**	**0.990**	**832**	**766**	**66**	**30400**	**-**	**-**	**890**	**1610***	**92.3**	**7.7**	**RM 78.48**	**4730**	**5700**
DRAKE ACSR	795	16	26	7x0.1360	0.4080	0.7263	0.6246	1.107	1093	749	344	-	31500	33500	905	-	68.5	31.5	RMT 84.36	7590	6940
DRAKE ACSS	795	16	26	7x0.1360	0.4080	0.7263	0.6246	1.107	1093	749	344	-	26000	28000	915	1660	68.5	31.5	RMT 84.36	7590	6940
DRAKE ACSS/TW	795	16	20	7x0.1360	0.4080	0.7259	0.6242	1.010	1091	747	344	-	25900	28000	895	1615	68.5	31.5	RMT 84.36	8760	8010
SAVANNAH ACSS/TW	959.6	16	22	7x0.1493	0.4479	0.8764	0.7539	1.108	1317	902	415	-	30700	33100	1005	1825	68.5	31.5	RMT 84.36	9540	7320
DRAKE ACCC/TW	**1020**	**A**	**22**	**1x0.3750**	**0.3750**	**0.9112**	**0.8014**	**1.108**	**1046**	**957**	**89**	**41100**	**-**	**-**	**1025**	**1865***	**91.6**	**8.4**	**RM 78.48**	**5960**	**5700**
CARDINAL ACSR	954	13	54	7x0.1329	0.3987	0.8462	0.7491	1.196	1227	899	329	-	33600	35700	995	-	73.2	26.8	RMT 90.45	11780	9680
CARDINAL ACSS	954	13	54	7x0.1329	0.3987	0.8462	0.7491	1.196	1227	899	329	-	26000	28000	1005	1824	73.2	26.8	RMT 90.45	11780	9680
CARDINAL ACSS TW	954	13	21	7x0.1329	0.3987	0.8463	0.7492	1.084	1224	895	329	-	26000	28000	995	1805	73.1	26.9	RMT 84.36	8620	7040
HUDSON ACSS/TW	1158.4	13	26	7x0.1467	0.4401	1.0279	0.9096	1.196	1488	1087	401	-	31100	33500	1120	2050	73.1	26.9	RMT 84.36	10670	7170
CARDINAL ACCC/TW	**1222**	**B**	**36**	**1x0.3450**	**0.3450**	**1.0536**	**0.9601**	**1.196**	**1228**	**1152**	**76**	**37100**	**-**	**-**	**1140**	**2080***	**94.0**	**6.0**	**RM 78.48**	**6990**	**5700**
BITTERN ACSR	1272	7	45	7x0.1721	0.3963	1.0679	0.9988	1.345	1432	1198	234	-	34100	35400	1185	-	83.7	16.3	RMT 90.45	10740	7590
BITTERN ACSS	1272	7	45	7x0.1721	0.3963	1.0679	0.9988	1.345	1432	1198	234	-	27300	29000	1195	2200	83.7	16.3	RMT 90.45	10740	7590
BITTERN ACSS/TW	1272	7	33	7x0.1721	0.3963	1.0688	0.9994	1.215	1432	1198	234	-	22300	24100	1165	2130	83.7	16.3	RMT 84.36	11830	8260
POTOMAC ACSS/TW	1557.4	7	36	7x0.1961	0.4723	1.3004	1.2237	1.345	1754	1467	287	-	27400	29000	1320	2430	83.7	16.3	RMT 84.45	12910	7350
BITTERN ACCC/TW	**1572**	**B**	**39**	**1x0.3450**	**0.3450**	**1.3283**	**1.2348**	**1.345**	**1554**	**1478**	**76**	**39300**	**-**	**-**	**1320**	**2440***	**95.3**	**4.7**	**RMT 90.45**	**8850**	**5700**
LAPWING ACSR	1590	7	45	7x0.1753	0.3759	1.3353	1.2490	1.504	1790	1498	292	-	42200	43800	1355	-	83.7	16.3	RMT 90.45	10740	6080
LAPWING ACSS	1590	7	36	7x0.1753	0.3759	1.3351	1.2488	1.361	1790	1498	292	-	27400	29100	1370	2565	83.7	16.3	RMT 90.45	10740	6000
LAPWING ACSS/TW	1590	7	36	7x0.1753	0.3759	1.3351	1.2488	1.361	1790	1498	292	-	27400	29000	1330	2460	83.7	16.3	RMT 84.45	12900	7210
ATHABASKA ACSS/TW	1949.6	7	56	7x0.1962	0.4146	1.6467	1.5317	1.502	2195	1840	355	-	34000	36100	1505	2815	83.8	16.2	RMT 96.60	20040	9130
LAPWING ACCC/TW	**1966**	**B**	**56**	**1x0.3850**	**0.3850**	**1.6609**	**1.5444**	**1.504**	**1960**	**1864**	**96**	**49000**	**-**	**-**	**1500**	**2805***	**95.3**	**4.7**	**RMT 90.45**	**11150**	**5700**
CHUKAR ACSR	1780	8	84	19x0.0674	0.4370	1.5113	1.3974	1.601	2071	1685	387	-	51600	53100	1450	-	81.3	18.7	RMT 96.60	19050	9200
CHUKAR ACSS	1780	8	84	19x0.0674	0.4370	1.5113	1.3974	1.601	2071	1685	387	-	35300	38200	1465	2750	81.3	18.7	RMT 96.60	19050	9200
CHUKAR ACSS/TW	1780	8	36	19x0.0674	0.4370	1.5122	1.3982	1.447	2061	1674	387	-	35400	38200	1420	2630	81.2	18.8	RMT 84.45	14090	6810
POWDER ACSS/TW	2153.8	8	61	19x0.0961	0.4805	1.8293	1.3915	1.602	2510	2042	467	-	42100	45300	1600	3010	81.4	18.6	RMT 96.60	23590	9400
CHUKAR ACCC/TW	**2242**	**B**	**56**	**1x0.3950**	**0.3950**	**1.883**	**1.761**	**1.602**	**2225**	**2126**	**98**	**52700**	**-**	**-**	**1610**	**3045***	**95.7**	**4.3**	**RMT 90.45**	**12670**	**5700**
BLUEBIRD ACSR	2156	8	84	19x0.0961	0.4805	1.8306	1.6930	1.762	2508	2041	467	-	60300	62000	1620	-	81.4	18.6	RMT 96.60	18910	7580
BLUEBIRD ACSS	2156	8	84	19x0.0961	0.4805	1.8306	1.6930	1.762	2508	2041	467	-	42100	45500	1640	3110	81.4	18.6	RMT 96.60	18910	7580
BLUEBIRD ACSS/TW	2156	8	64	19x0.0961	0.4805	1.8312	1.6934	1.612	2512	2045	467	-	42100	45500	1600	3010	81.4	18.6	RMT 96.60	23590	9320
SANTEE ACSS/TW	2627.3	8	64	19x0.1060	0.5300	2.2627	2.0645	1.762	3062	2492	571	-	51400	55600	1785	3405	81.4	18.6	RMT 96.60	23610	7710
BLUEBIRD ACCC/TW	**2727**	**B**	**64**	**1x0.4150**	**0.4159**	**2.277**	**2.1424**	**1.762**	**2696**	**2586**	**110**	**59600**	**-**	**-**	**1790**	**3430***	**96.1**	**3.9**	**RMT 96.60**	**15350**	**5700**

* The continuous temperature rating for the TransPowr ACCC/TW conductor is 160 C. The 200 C temperature is a short-duration emergency operation temperature.

Footnotes

(1) Code words are grouped into sets of five characters or less for communication purposes. For conductors named ACSR and ACSS conductor, followed by a space and a number, such as Bluebird 2156, the number is the actual diameter of the conductor in mils (thousandths of an inch). For conductors named ACSS/TW or ACCC/TW conductor, followed by a space and a number, such as Bluebird 2156, the number is the actual diameter of the conductor in mils (thousandths of an inch). For conductors named ACSS/TW2 conductor, followed by a space and a number, such as Linnet 398.7, the number is the actual diameter of the conductor in mils (thousandths of an inch).

(2) Type - a numerical value represents the number of the outermost layer of round wires in the conductor. A letter "A" signifies that the aluminum strands in the ACCC conductor, the letter "A" signifies that even with a greater aluminum metal content, on the equivalent diameter ACSR or ACSS conductor, the overall mass of the conductor design is lower. For the ACCC conductor, the letter "B" signifies an ACCC conductor design where the overall mass is greater than the equivalent diameter ACSR or ACSS conductor.

(3) Rated strengths shown are applicable to the conductor built with the CTC Composite Carbon Fiber Core (also core with GA (ASTM B549) or HA (ASTM B803) regular strength steel wire, or with HS (ASTM B606) or MS (ASTM B803) high strength steel wire.

(4) (5) Based on conductivity of 61.2% (average) for ACSR, ACSS/TW and ACCC/TW for aluminum in ACSR, ACSS/TW and ACCC/TW conductors, and 20.3 MACS, ACCC/TW for steel core, for a 75°C temperature rating a conductor temperature rise of 50 C over 25 C ambient, 2 feet/second wind perpendicular to conductor axis, with sun (EMF Vol. 1). For the 200 C temperature rating, a conductor rise of 175°C over 25°C ambient.

(6) Indicated reel dimensions and weights may change. Weights shown are nominal values. All weights and lengths are nominal. Nominal length and shipping tolerances apply.

BULLETIN 1724E-200
SECTION 5

This section was used to determine and calculate the ROW width required based on the conductor swing angle (blowout) calculations using the formulas tabbed herein.

5. HORIZONTAL CLEARANCES FROM LINE CONDUCTORS TO OBJECTS AND RIGHT-OF-WAY WIDTH

5.1 General: The preliminary comments and assumptions in Chapter 4 of this bulletin also apply to this chapter.

5.2 Minimum Horizontal Clearance of Conductor to Objects: Recommended design horizontal clearances of conductors to various objects are provided in Table 5-1 and minimum radial operating clearances of conductors to vegetation in Table 5-2. The clearances apply only for lines that are capable of automatically clearing line-to-ground faults.

Clearance values provided in Table 5-1are recommended design values. In order to provide an additional margin of safety, the recommended design values exceed the minimum clearances in the 2007 NESC. Clearance values provided in Table 5-2 are minimum operating clearances to be used by the designer to determine appropriate design clearances for vegetation maintenance management.

5.2.1 Conditions Under Which Horizontal Clearances to Other Supporting Structures, Buildings and Other Installations Apply:

Conductors at Rest (No Wind Displacement): When conductors are at rest the clearances apply for the following conditions: (a) 167°F but not less than 120°F, final sag, (b) the maximum operating temperature the line is designed to operate, final sag, (c) 32°F, final sag with radial thickness of ice for the loading district (0 in., ¼ in., or ½ in.).

Conductors Displaced by 6 psf Wind: The clearances apply when the conductor is displaced by 6 lbs. per sq. ft. at final sag at 60°F. See Figure 5-1.

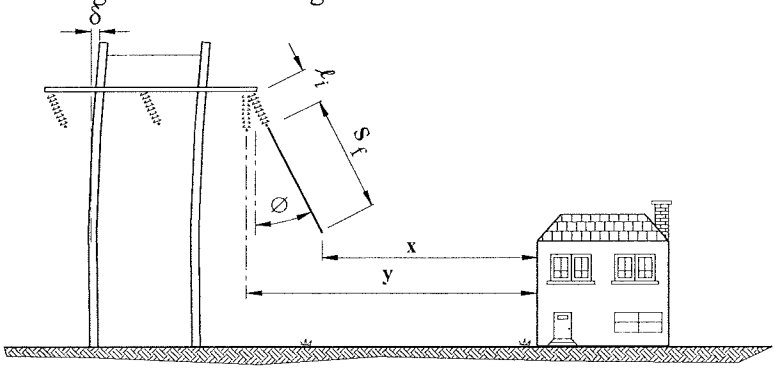

FIGURE 5-1: HORIZONTAL CLEARANCE REQUIREMENT TO BUILDINGS

where:

ϕ	=	conductor swing out angle in degrees under 6 psf. of wind
S_f	=	conductor final sag at 60°F with 6 psf. of wind
x	=	horizontal clearance required per Tables 5-1 for conductors displaced by 6 psf wind (include altitude correction if necessary)
ℓ_i	=	insulator string length ($\ell_i = 0$ for post insulators or restrained suspension insulators).
y	=	total horizontal distance from insulator suspension point (conductor attachment point for post insulators) to structure with conductors at rest
δ	=	structure deflection with a 6 psf. Wind

TABLE 5-1
RECOMMENDED DESIGN HORIZONTAL CLEARANCES (in feet) FROM CONDUCTORS AT REST AND DISPLACED BY 6 PSF WIND TO OTHER SUPPORTING STRUCTURES, BUILDINGS AND OTHER INSTALLATIONS
(NESC Rules 234B, 234C, 234D, 234E, 234F, 234I, Tables 234-1, 234-2, 234-3)

Conditions under which clearances apply:

No wind: When the conductor is at rest the clearances apply at the following conditions: (a) 120°F, final sag, (b) the maximum operating temperature the line is designed to operate, final sag, (c) 32°F, final sag with radial thickness of ice for the loading district (1/4 in. for Medium or 1/2 in. Heavy).

Displaced by Wind: Horizontal clearances are to be applied with the conductor displaced from rest by a 6 psf wind at final sag at 60°F. The displacement of the conductor is to include deflection of suspension insulators and deflection of flexible structures.

The clearances shown are for the displaced conductors and do not provide for the horizontal distance required to account for blowout of the conductor and the insulator string. This distance is to be added to the required clearance. See Equation 5-1.

Clearances are based on the Maximum Operating Voltage

Nominal voltage, Phase to Phase, kV_{L-L}		**34.5 & 46**	**69**	**115**	**138**	**161**	**230**
Max. Operating Voltage, Phase to Phase, kV_{L-L}		----	72.5	120.8	144.9	169.1	241.5
Max. Operating Voltage, Phase to Ground, kV_{L-G}		----	41.8	69.7	83.7	97.6	139.4
Horizontal Clearances - (Notes 1,2,3)	NESC Basic Clear	Clearances in feet					
1.0 From a lighting support, traffic signal support or supporting structure of another line							
At rest	**(NESC Rule 234B1a)**	5.0	6.5	6.5	7.2	7.6	8.1	9.5
Displaced by wind	**(NESC Rule 234B1b)**	4.5	6.2	6.7	7.6	8.1	8.5	9.9
2.0 From buildings, walls, projections, guarded windows, windows not designed to open, balconies, and areas accessible to pedestrians							
At rest	**(NESC Rule 234C1a)**	7.5	9.2	9.7	10.6	11.1	11.5	12.9
Displaced by wind	**(NESC Rule 234C1b)**	4.5	6.2	6.7	7.6	8.1	8.5	9.9
3.0 From signs, chimneys, billboards, radio, & TV antennas, tanks & other installations not classified as buildings							
At rest	**(NESC Rule 234C1a)**	7.5	9.2	9.7	10.6	11.1	11.5	12.9
Displaced by wind	**(NESC Rule 234C1b)**	4.5	6.2	6.7	7.6	8.1	8.5	9.9
4.0 From portions of bridges which are readily accessible and supporting structures are not attached							
At rest	**(NESC Rule 234D1a)**	7.5	9.2	9.7	10.6	11.1	11.5	12.9
Displaced by wind	**(NESC Rule 234D1b)**	4.5	6.2	6.7	7.6	8.1	8.5	9.9
5.0 From portions of bridges which are ordinarily inaccessible and supporting structures are not attached							
At rest	**(NESC Rule 234D1a)**	6.5	8.2	8.7	9.6	10.1	10.5	11.9
Displaced by wind	**(NESC Rule 234D1b)**	4.5	6.2	6.7	7.6	8.1	8.5	9.9

TABLE 5-1 (continued)
RECOMMENDED DESIGN HORIZONTAL CLEARANCES (in feet) FROM CONDUCTORS AT REST AND DISPLACED BY 6 PSF WIND TO OTHER SUPPORTING STRUCTURES, BUILDINGS AND OTHER INSTALLATIONS
(NESC Rules 234B, 234C, 234D, 234E, 234F, 234I, Tables 234-1, 234-2, 234-3)

Conditions under which clearances apply:

No wind: When the conductor is at rest the clearances apply at the following conditions: (a) 120°F, final sag, (b) the maximum operating temperature the line is designed to operate, final sag, (c) 32°F, final sag with radial thickness of ice for the loading district (1/4 in. for Medium or 1/2 in. Heavy).

Displaced by Wind: Horizontal clearances are to be applied with the conductor displaced from rest by a 6 psf wind at final sag at 60°Funder extreme wind conditions (such as the 50 or 100-year mean wind) at final sag at 60°F. The displacement of the conductor is to include deflection of suspension insulators and deflection of flexible structures.

The clearances shown are for the displaced conductors and do not provide for the horizontal distance required to account for blowout of the conductor and the insulator string. This distance is to be added to the required clearance. See Equation 5-1.

Clearances are based on the Maximum Operating Voltage

Nominal voltage, Phase to Phase, kV_{L-L}		**34.5 & 46**	**69**	**115**	**138**	**161**	**230**
Max. Operating Voltage, Phase to Phase, kV_{L-L}		----	72.5	120.8	144.9	169.1	241.5
Max. Operating Voltage, Phase to Ground, kV_{L-G}		----	41.8	69.7	83.7	97.6	139.4
Horizontal Clearances - (Notes 1,2,3)	NESC Basic Clear	Clearances in feet					
6.0 Swimming pools – see section 4.4.3 of Chapter 4 and item 9 of Table 4–2. (NESC Rule 234E)							
Clearance in any direction from swimming pool edge (Clearance A, Figure 4-2 of this bulletin)	25.0	27.2	27.7	28.6	29.1	29.5	30.9
Clearance in any direction from diving structures (Clearance B, Figure 4-2 of this bulletin)	17.0	19.2	19.7	20.6	21.1	21.5	22.9
7.0 From grain bins loaded with permanently attached conveyor							
At rest (NESC Rule 234F1b)	15.0	17.2	17.7	18.6	19.1	19.5	20.9
Displaced by wind (NESC Rule 234C1b)	4.5	6.7	7.2	8.1	8.6	9.0	10.4
8.0 From grain bins loaded with a portable conveyor. Height 'V' of highest filling or probing port on bin must be added to clearance shown. Clearances for 'at rest' and not displaced by the wind. See NESC Figure 234-4 for other requirements.							
Horizontal clearance envelope (includes area of sloped clearance per NESC Figure 234-4b)		(24+V) + 1.5V (Note 3)					
9.0 From rail cars (Applies only to lines parallel to tracks) See Figure 234-5 and section 234I (Eye) of the NESC							
Clearance measured to the nearest rail		14.1	14.1	15.1	15.6	16.0	17.5
ALTITUDE CORRECTION TO BE ADDED TO VALUES ABOVE							
Additional feet of clearance per 1000 feet of altitude above 3300 feet		.02	.02	.05	.07	.08	.12

Notes:

1. Clearances for categories 1-5 in the table are approximately 1.5 feet greater than NESC clearances.
2. Clearances for categories 6 to 9 in the table are approximately 2.0 feet greater than NESC clearances.
3. "V" is the height of the highest filling or probing port on a grain bin. Clearance is for the highest voltage of 230 kV.

5.2.2 Considerations in Establishing Radial and Horizontal Clearances to Vegetation:

The designer should identify and document clearances between vegetation and any overhead, ungrounded supply conductors, taking into consideration transmission line voltage, the effects of ambient temperature on conductor sag under maximum design loading, and the effects of wind velocities on conductor sway. Specifically, the designer should establish clearances to be achieved at the time of vegetation management work and should also establish and maintain a set of clearances to prevent flashover between vegetation and overhead ungrounded supply conductors. As a mimimum, these clearances should apply to all transmission lines operated at 200 kV phase-to-phase and above and to any lower voltage lines designated as critical (refer to NERC FAC 003).

The designer should determine and document appropriate clearance distances to be achieved at the time of transmission vegetation management work based upon local conditions and the expected time frame in which the Transmission Owner plans to return for future vegetation management work. Local conditions may include, but are not limited to: operating voltage, appropriate vegetation management techniques, fire risk, reasonably anticipated tree and conductor movement, species types and growth rates, species failure characteristics, local climate and rainfall patterns, line terrain and elevation, location of the vegetation within the span, and worker approach distance requirements.

The designer should determine and document specific radial clearances to be maintained between vegetation and conductors under all rated electrical operating conditions. These minimum clearance distances are necessary to prevent flashover between vegetation and conductors and will vary due to such factors as altitude and operating voltage. These specific minimum clearance distances should be no less than those set forth in the Institute of Electrical and Electronics Engineers (IEEE) Standard 516-2003 (Guide for Maintenance Methods on Energized Power Lines) and as specified in its Section 4.2.2.3, Minimum Air Insulation Distances without Tools in the Air Gap. Where transmission system transient overvoltage factors are not known, clearances shall be derived from Table 5, IEEE 516-2003, phase-to-ground distances, with appropriate altitude correction factors applied.Where transmission system transient overvoltage factors are known, clearances shall be derived from Table 7, IEEE 516-2003, phase-to-phase voltages, with appropriate altitude correction factors applied. Table 5-2 contains radial clearances determined from Table 5, IEEE 516-2003, where transmission system transient overvoltage factors are not known.

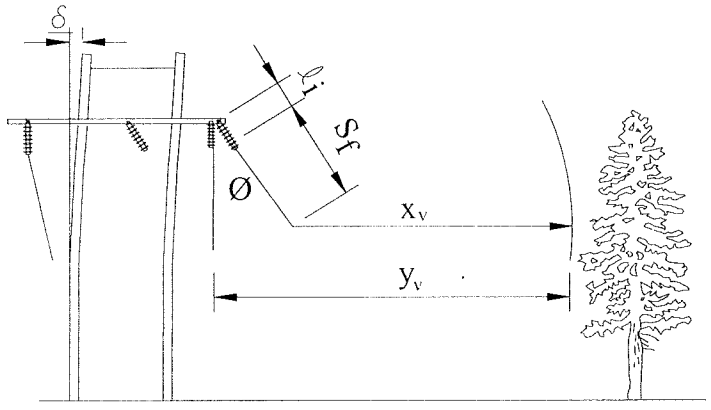

FIGURE 5-2: RADIAL CLEARANCE REQUIREMENT TO VEGETATION

where:

ϕ = conductor swing out angle in degrees under all rated operating conditions
S_f = conductor final sag at all rated operating conditions
x_v = radial clearance (include altitude correction if necessary)
ℓ_i = insulator string length ($\ell_i = 0$ for post insulators or restrained suspension insulators).
y_v = horizontal clearance at the time of vegetation management work
δ = structure deflection at all rated operating conditions

TABLE 5-2
RADIAL OPERATING CLEARANCES (in feet) FROM IEEE 516 FOR USE IN DETERMINING CLEARANCES TO VEGETATION FROM CONDUCTORS (NERC Standard FAC-003.1 Transmission Vegetation Management Program, IEEE 516, Guideline For Maintenance Methods Of Energized Power Lines)

Conditions under which clearances apply:

Displaced by Wind: Radial operating clearances are to be applied at all rated operating conditions.The designer should determine applicable conductor temperature and wind conditions for all rated operating conditions. The displacement of the conductor is to include deflection of suspension insulators and deflection of flexible structures.

The operating clearances shown are for the displaced conductors and do not provide for the horizontal distance required to account for blowout of the conductor and the insulator string. This distance is to be added to the required clearance. See Equation 5-1.

Clearances are based on the Maximum Operating Voltage.

Nominal voltage, Phase to Phase, kV_{L-L}	**34.5 & 46[1]**	**69[1]**	**115[1]**	**138[1]**	**161[1]**	**230[1,2]**
Max. Operating Voltage, Phase to Phase, kV_{L-L}	----	72.5	120.8	144.9	169.1	241.5
Max. Operating Voltage, Phase to Ground, kV_{L-G}	----	41.8	69.7	83.7	97.6	139.4
Radial Table 5 IEEE Standard 516 Operating Clearances	Clearances in feet					
Operating clearance at all rated operating conditions	1.8	1.8	1.9	2.3	2.5	2.7
Design adder for survey and installation tolerance	1.5 feet for all voltages					
Design adder for vegetation	Determined by designer (see Note 3 below)					
ALTITUDE CORRECTION TO BE ADDED TO VALUES ABOVE						
Additional feet of clearance per 1000 feet of altitude above 3300 feet	.02	.02	.05	.07	.08	.12

Notes:

1. These clearances apply to all transmission lines operated at 200 kV phase-to-phase and above and to any lower voltage lines designated as critical (refer to NERC FAC 003).
2. The 230 kV clearance is based on 3.0 Per Unit switching surge.
3. The design adder for vegetation, applied to conductors displaced by wind, should account for reasonably anticipated tree movement, species types and growth rates, species failure characteristics, and local climate and rainfall patterns. The design adder for vegetation, applied to conductors at rest, should account for worker approach distances in addition to the aforementioned factors.

5.2.3 Clearances to Grain Bins: The NESC has defined clearances from grain bins based on grain bins that are loaded by permanent or by portable augers, conveyers, or elevator systems.

In NESC Figure 234-4(a), the horizontal clearance envelope for permanent loading equipment is graphically displayed and shown Figure 5-2.

P = probe clearance, item 7, Table 4-2
H = horizontal clearance, item 7, Table 5-1
T = transition clearance
V_1 = vertical clearance, item 2&3, Table 4-2
V_2 = vertical clearance, Table 4-1

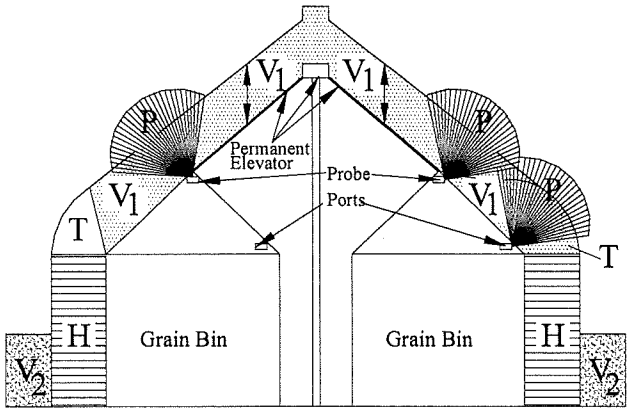

FIGURE 5-3: CLEARANCE TO GRAIN BINS
NESC FIGURE 234-4a

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Because the vertical distance from the probe in Table 4-2, item 7.0, is greater than the horizontal distance, (see Table 5-1, item 7.0), the user may want to simplify design and use this distance as the horizontal clearance distance as shown below:

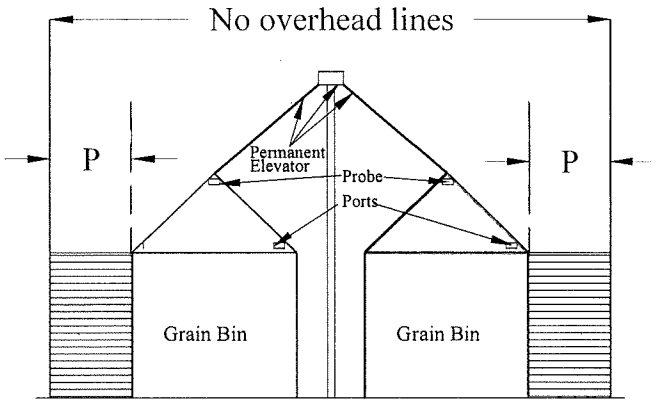


FIGURE 5-4: HORIZONTAL CLEARANCE TO GRAIN BINS, CONDUCTORS AT REST
P = clearance from item 7, Table 4-2

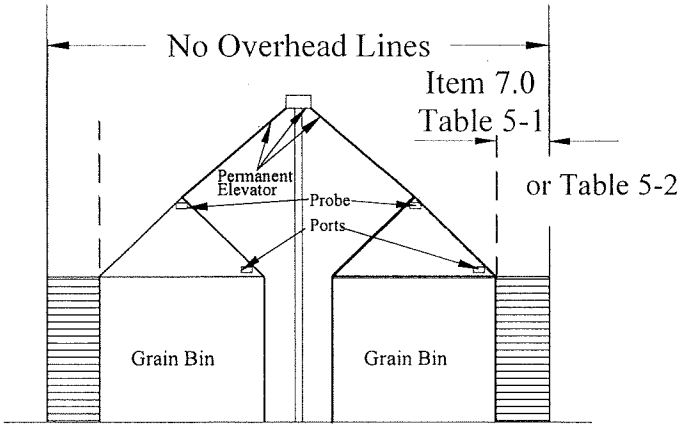
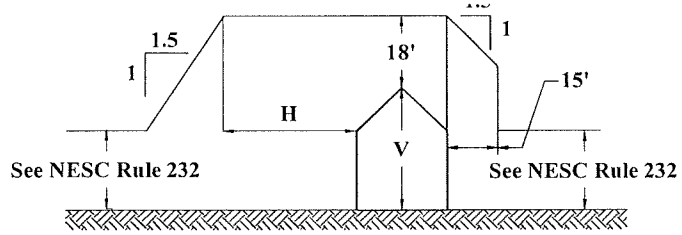


FIGURE 5-5: HORIZONTAL CLEARANCE TO GRAIN BINS, CONDUCTORS DISPLACED BY 6 PSF WIND

The clearance envelope for portable loading equipment from NESC Figure 234(b), is shown in Figure 5-6.



V=Height of highest filling or probing port on grain bin
H=V- 18'

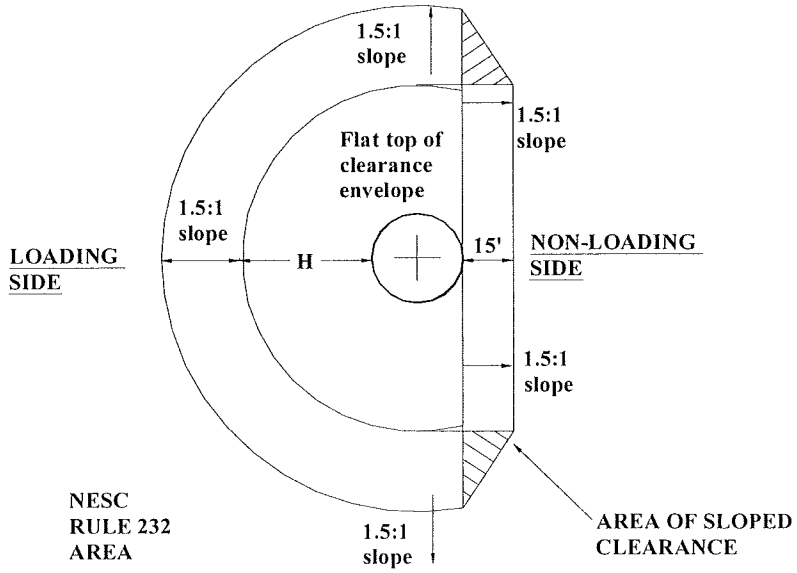


FIGURE 5-6: NESC CLEARANCE TO GRAIN BINS WITH PORTABLE LOADING EQUIPMENT

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In order to simplify the clearance envelope, the horizontal clearances in category 8 of Table 5-1 is shown as 'H' in the drawing below:

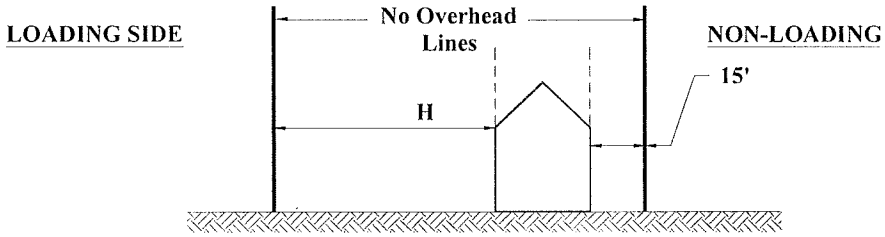


FIGURE 5-7: SIMPLIFIED RECOMMENDATIONS FOR CLEARANCES TO GRAIN BINS WITH PORTABLE LOADING EQUIPMENT

5.2.4 Altitude Greater Than 3300 Feet: If the altitude of the transmission line or portion thereof is greater than 3300 feet, an additional clearance as indicated in Table 5-1 and 5-2 has to be added to the base clearance given.

5.2.5 Total Horizontal Clearance to Point of Insulator Suspension to Object: As can be seen from Figure 5-1, the total horizontal clearance (y) is:

$$y = (\ell_i + S_f)\sin\phi + x + \delta \qquad \text{Eq. 5-1}$$

Symbols are defined in Section 5.2.1 and figure 5-1. The factor "δ" indicates that structure deflection should be taken into account.

For the sake of simplicity when determining **horizontal** clearances, the insulator string should be assumed to have the same swing angle as the conductor. This assumption should be made only in this chapter as its use in calculations elsewhere may not be appropriate.

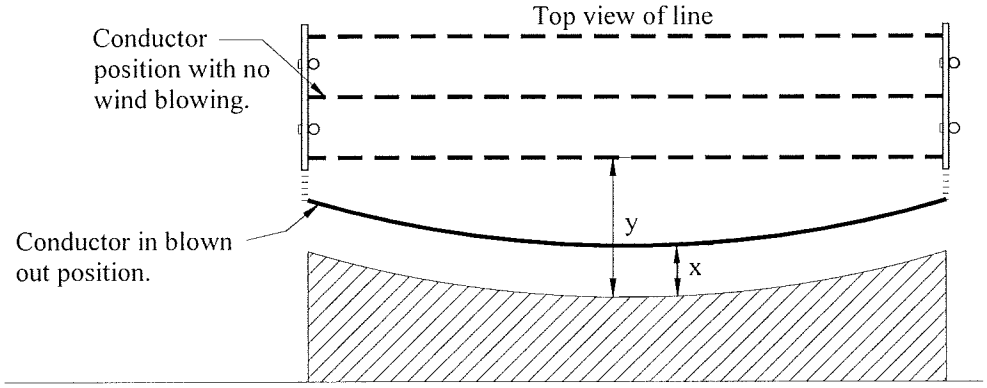
The conductor swing angle (ϕ) under wind can be determined from the formula.

$$\phi = \tan^{-1}\left(\frac{(d_c)(F)}{12\ w_c}\right) \qquad \text{Eq. 5-2}$$

where:

d_C = conductor diameter in inches
w_C = weight of conductor in lbs./ft.
F = wind force;

The total horizontal distance (y) at a particular point in the span depends upon the conductor sag at that point. The value of (y) for a structure adjacent to the maximum sag point will be greater than the value of (y) for a structure placed elsewhere along the span. See Figure 5-7.



x = clearance from wind-displaced conductor, y= total horizontal clearance from conductor at rest

FIGURE 5-8: A TOP VIEW OF A LINE SHOWING TOTAL HORIZONTAL CLEARANCE REQUIREMENTS

5.2.6 Examples of Horizontal Clearance Calculations: The following examples demonstrate the derivation of the horizontal clearance in Table 5-1 of this bulletin.

To determine the horizontal clearance of a 115 kV line to a building (category 2.0 of Table 5-1), the clearance is based on NESC Table 234-1 and NESC Rule 234.

At rest:

NESC Horizontal Clear. = NESC Basic Clearance(Table 234-1) + .4(kV_{L-G} – 22)/12
= 7.5 feet + .4(69.7-22)/12 feet
= 7.5 feet + 1.59 feet
NESC Horizontal Clear. = 9.09 feet

Recommended Clearance = NESC Horizontal Clearance + Adder
= 9.09 feet + 1.5 feet
y = 10.59 feet (10.60 feet in Table 5-1)

Conductors displaced by 6 psf wind:

NESC Horizontal Clear. = NESC Basic Clearance (Table 234-1) + .4(kV_{L-G} – 22)/12
= 4.5 feet + .4(69.7-22)/12 feet
= 4.5 feet + 1.59 feet
NESC Horizontal Clear. = 6.09 feet

Recommended Clearance = NESC Horizontal Clearance + Adder
= 6.09 feet + 1.5 feet
x = 7.59 feet (7.6 feet in Table 5-1)

5.3 Right-of-Way (ROW) Width: For transmission lines, a right-of-way provides an environment allows the line to be operated and maintained safely and reliably. Determination of the right-of-way width is a task that requires the consideration of a variety of judgmental, technical, and economic factors.

Typical right-of-way widths (predominantly H-frames) that have been used by agency borrowers in the past are shown in Table 5-2. In many cases a range of widths is provided. The actual width used will depend upon the particulars of the line design.

TABLE 5-3
TYPICAL RIGHT-OF-WAY WIDTHS

	Nominal Line-to-Line Voltage in kV				
	69	115	138	161	230
ROW Width, ft.	75-100	100	100-150	100-150	125-200

5.4 Calculation of Right-of-Way Width for a Single Line of Structures on a Right-of-Way: Right-of-way widths can be calculated using the method described below. The calculated values for right-of-way widths are directly related to the particular parameters of the line design. This method provides sufficient width to meet clearance requirements to buildings of undetermined height or vegetation located directly on the edge of the right-of-way. See Figures 5-8 and 5-9.

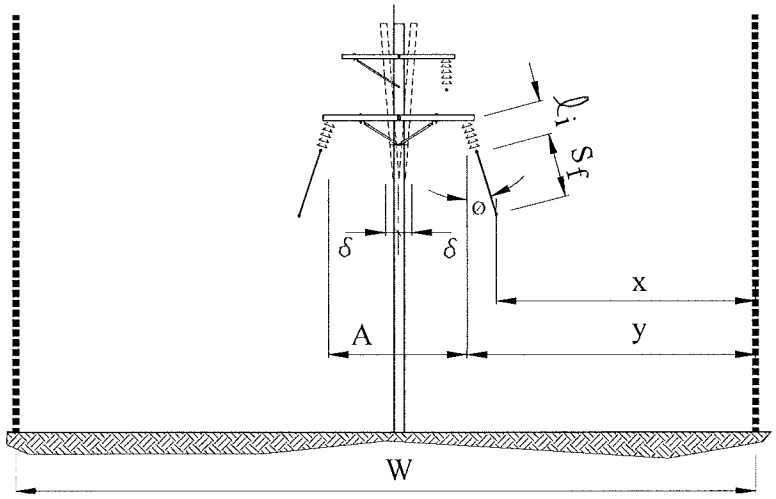


FIGURE 5-9: ROW WIDTH FOR SINGLE LINE OF STRUCTURES

$$W = A + 2(\ell_i + S_f)\sin\phi + 2\delta + 2x \qquad \text{Eq. 5-3}$$

where:

W = total right-of-way width required
A = separation between points of suspension of insulator strings for outer two phases
x = clearance required per Table 5-1 and appropriate clearance derived from Table 5-2 of this bulletin (include altitude correction if necessary)
y = clearance required per Section 5.2.1 and Table 5-1 and appropriate clearance derived from Section 5.2.2. and Table 5-2 of this bulletin (include altitude correction if necessary)

Other symbols are as previously defined. In some instances, clearance "x" may control. In other instances, clearance "y" may control.

There are two ways of choosing the length (and thus the sag) on which the right-of-way width is based. One is to use a width based on the maximum span length in the line. The other way is to base the width on a relatively long span, (the ruling span, for instance), but not the longest span. For those spans that exceed this base span, additional width is added as appropriate.

5.5 Right-of-Way Width for a Line Directly Next to a Road: The right-of-way width for a line next to a road can be calculated based on the two previous sections with one exception. No ROW is needed on the road side of the line as long as the appropriate clearances to existing or possible future structures on the road side of the line are met.

If a line is to be placed next to a roadway, consideration should be given to the possibility that the road may be widened. If the line is on the road right-of-way, the borrower would generally be expected to pay for moving the line. If the right-of-way is on private land, the highway

department should pay. Considerations involved in placing a line on a road right-of-way should also include evaluation of local ordinances and requirements.

5.6 Right-of-Way Width for Two or More Lines of Structures on a Single Right-of-Way: To determine the right-of-way width when the right ROW contains two parallel lines, start by calculating the distance from the outside phases of the lines to the ROW edge (see Section 5.4). The distance between the two lines is governed by the two criteria provided in section 5.6.1. If one of the lines involved is an extra high voltage (EHV) line (345 kV and above), the NESC should be referred to for additional applicable clearance rules not covered in this bulletin.

5.6.1 Separation Between Lines as Dictated by Minimum Clearance Between Conductors Carried on Different Supports: The horizontal clearance between a phase conductor of one line to a phase conductor of another line shall meet the larger of C_1, or C_2 below, under the following conditions: (a) both phase conductors displaced by a 6 psf wind at 60°F, final sag; (b) if insulators are free to swing, one should be assumed to be displaced by a 6 lbs/sq. ft. wind while the other should be assumed to be unaffected by the wind (see Figure 5-10). The assumed wind direction should be that which results in the greatest separation requirement. It should be noted that in the Equations 5-5, and 5-6, the 'δ_1-δ_2' term, (the differential structure deflection between the two lines of structures involved), is to be taken into account. An additional 1.5 feet have been added to the NESC clearance to obtain design clearances 'C_1'and 'C_2'. Note Equation 5-6 has been revised from previous versions due to the voltage adder change in the 2007 NESC edition.

$$C_1 = 6.5 + (\delta_1 - \delta_2) \text{ (NESC Rule 233B1)} \qquad \text{Eq. 5-5}$$

$$C_2 = 6.5 + \frac{.4}{12}\left[(kV_{LG1} + kV_{LG2}) - 22\right] + (\delta_1 - \delta_2) \text{ (NESC Rule 233B1)} \qquad \text{Eq. 5-6}$$

where:

C_1, C_2 = clearance requirements between conductors on different lines in feet (largest value governs)
kV_{LG1} = maximum line-to-ground voltage in kV of line 1
kV_{LG2} = maximum line-to-ground voltage in kV of line 2
δ_1 = deflection of the upwind structure in feet
δ_2 = deflection of the downwind structure in feet

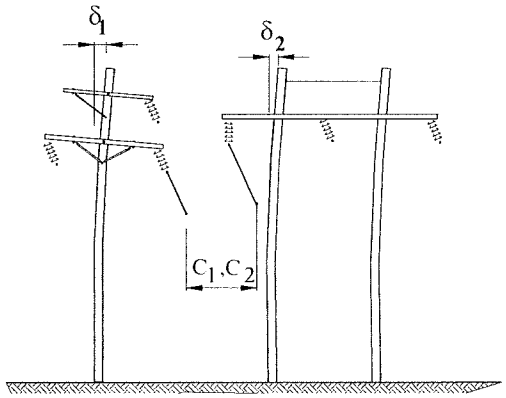


FIGURE 5-10: CLEARANCE BETWEEN CONDUCTORS OF ONE LINE TO CONDUCTOR OF ANOTHER LINE

5.6.2 Separation Between Lines as Dictated by Minimum Clearance of Conductors From One Line to the Supporting Structure of Another: The horizontal clearance of a phase conductor of one line to the supporting structure of another when the conductor and insulator are displaced by a 6 psf wind at 60°F final sag should meet Equation 5-7.

$$C_3 = 6' + \frac{.4}{12}(kV_{LG} - 22) + (\delta_1 - \delta_2) \qquad \text{Eq. 5-7}$$

where:

kV_{LG} = the maximum line-to-ground voltage in kV
C_3 = the clearance of conductors of one line to structure of another in feet

Other symbols are defined in Figure 5-1.

Additional 1.5 feet have been added to the NESC clearance and included in equation 5-7 to obtain the design clearance 'C_3'.

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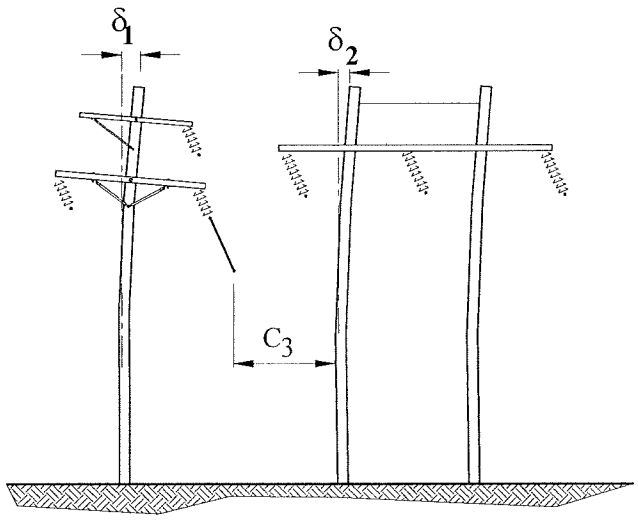


FIGURE 5-11: CLEARANCE BETWEEN CONDUCTORS OF ONE LINE AND STRUCTURE OF ANOTHER

The separation between lines will depend upon the spans and sags of the lines as well as how structures of one line match up with structures of another. In order to avoid the unreasonable task of determining separation of structures span-by-span, a standard separation value should be used, based on a worst case analysis. Thus if structures of one line do not always line up with those of the other, the separation determined in section 5.6.2 should be based on the assumption that the structure of one line is located next to the mid-span point of the line that has the most sag.

5.6.3 Other Factors: Galloping should be taken into account in determining line separation. In fact, it may be the determining factor in line separation. See Chapter 6 for a discussion of galloping.

Standard phase spacing should also be taken into account. For example, if two lines of the same voltage using the same type structures and phase conductors are on a single ROW, a logical separation of the two closest phases of the two lines should be at least the standard phase separation of the structure.

5.6.4 Altitude Greater than 3300 Feet: If the altitude at which the lines included in the design are installed greater than 3300 feet, NESC Section 23 rules provide additional separation requirements.

NESC MINIMUM CLEARANCE PRACTICES BY OTHERS

The information in this section provides a summary of the standard practices used in the industry. If required other utility standards can be provided.

Clearances—from Buildings, Bridges, and Other Installations (NESC 234)

A. Scope

This Standard provides the ***minimum*** clearances of wires, conductors, cables and equipment from buildings, bridges, swimming pools, and other installations as required by the National Electric Safety Code (NESC) Rule 234. These clearances apply to all PacifiCorp transmission facilities, with the exception of facilities in the states of California and Washington.

B. General

The vertical and horizontal clearances specified in this standard apply under whichever conditions of conductor temperature and loading that produce the minimum clearance (refer also to TC 011, C2).

1. Horizontal Clearances (with Wind Displacement)

   For horizontal clearances, conductors or cables shall be considered to be displaced from rest toward the installation by a 6 pound per square foot (psf) wind at a 60 degree F (15 degrees C) final sag. The displacement of a conductor or cable shall include the deflection of suspension insulators and structures.

2. Transition between Horizontal and Vertical Clearances.

   The horizontal clearance governs above the level of the roof or top of an installation to the point where the diagonal equals the vertical clearance requirement. Similarly, the horizontal clearance governs above or below projections from installations to the point where the diagonal equals the vertical clearance requirement. From this point, the transitional clearance shall equal the vertical clearance, as shown in Figure 1.

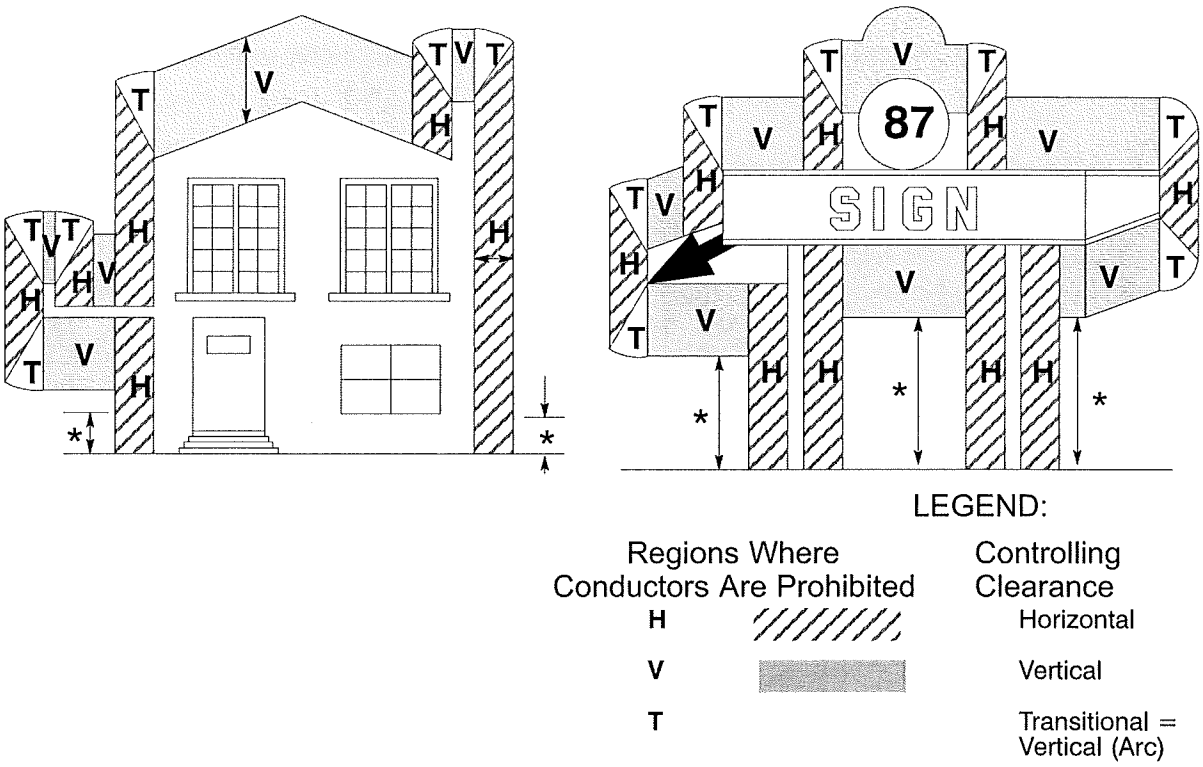


Figure 1 – Clearance Diagram for Buildings and Other Structures

C. Minimum Clearances of Conductors from Other Supporting Structures

Wires, conductors or cables passing near supporting structures of another line, lighting, or traffic signal circuits without being attached, shall have the minimum horizontal and vertical clearances summarized in Table 1.

The horizontal clearances shall be applied with the conductor having a wind displacement indicated in paragraph B.2.

Table 1 – Minimum Clearances of Conductors from Other Supporting Structures

Conductor or Cable	Clearances (Feet)	
	Horizontal	Vertical
Guys, Messengers, Neutrals	3.0	2.0
Cables – 0 to 300 V	3.0	2.0
Cables – 301 to 750 V	3.5	4.5
Cables – Above 750 V	3.5	4.5
Open Supply Lines – 0 to 750 V	3.5	4.5
Open Supply Lines – 751 V to 22 kV	4.5	4.5

The wind displacement does not need to be considered for communication conductors.

D. Minimum Clearances of Conductors and Rigid Live Parts Adjacent But Not Attached to Buildings

The minimum vertical and horizontal clearances of conductors not attached to buildings are summarized in Clearance Tables 3a–3d. Clearances with six pounds per square foot wind are summarized in Clearance Tables 4a–4d.

E. Minimum Clearances of Conductors and Rigid Live Parts From Bridges

The minimum vertical and horizontal clearances of conductors or rigid live parts located adjacent to or within a bridge structure, are summarized in Clearance Tables 5a–5d and 6a–6d. No wire, conductor, cable or live part shall be closer to a bridge structure.

F. Minimum Clearances from Swimming Areas

Where wires, conductors, or cables cross over a swimming pool or the surrounding area, the clearances in any direction shall not be less than Clearance Tables 7a–7d. These horizontal clearances shall also be met under wind conditions. The clearances are illustrated in Figure 3.

In general, avoid placing lines near swimming areas whenever possible.

Swimming areas where rescue poles are not used or waterways subject to water skiing, shall conform to TC 111 (NESC 232).

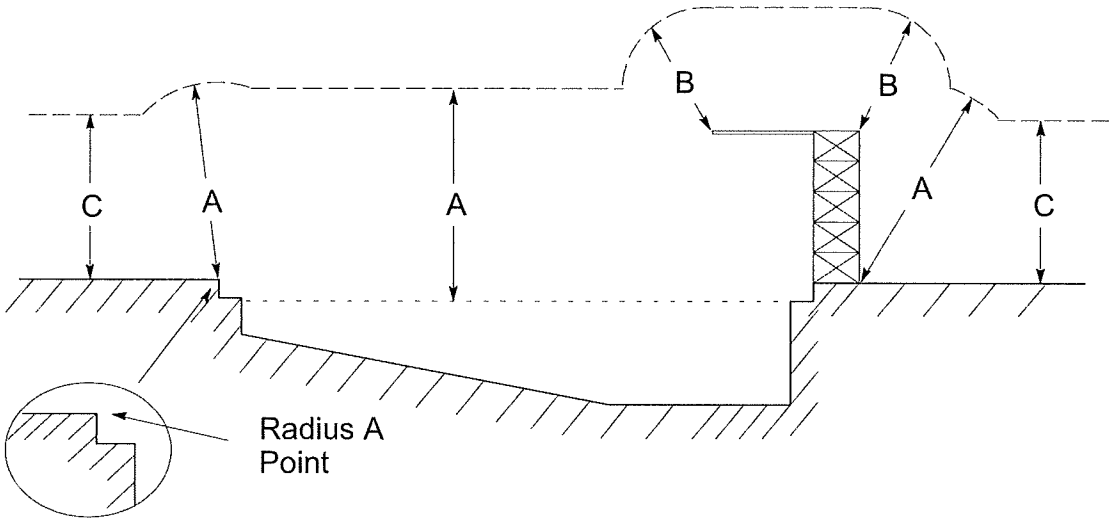


Figure 2 – Swimming Pool Clearances

G. Clearances of Conductors and Rigid Live Parts from Grain Bins

Refer to NESC 234F for the special requirement which apply to grain bins.

H. Additional Clearances for Voltages Exceeding 22 kV for Conductors and Unguarded Rigid Live Parts

For voltages between 22 and 470 kV, the clearances specified in paragraphs C, D, F, G, H, and J shall be increased at the rate of 0.4 inch per kV in excess of 22 kV.

For voltages exceeding 50 kV, the additional clearance specified above shall be increased 3 percent for each 1000 feet in excess of 3300 feet above mean sea level.

I. Clearances of Conductors to Rail Cars

Where overhead wires, conductors, or cables run along railroad tracks, the clearance in any direction shall be not less than that shown in Figure 4. The Values of V and H are as defined below:

V = Vertical clearance from the wire, conductor, or cable above the top of the rail as specified in TC 111 (Rule 232) minus 20 feet, the assumed height of the rail car

H = Horizontal clearance from the wire, conductor, or cable to the nearest rail, which is equal to the required vertical clearance above the rail minus 15 feet.

Refer to NESC 234 I for rail cars smaller than standard freight cars.

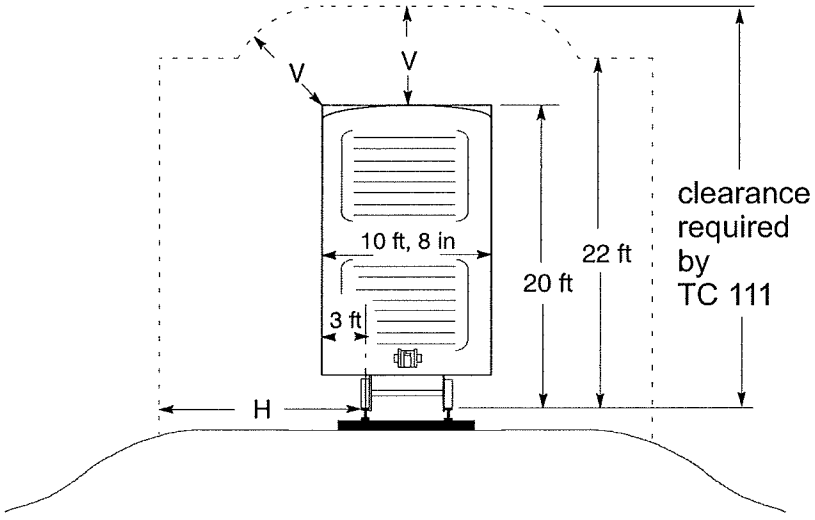


Figure 3 – Rail Car Clearances

Table 1 – PacifiCorp Standard Practice (NESC Table 234–1)
Clearances of Wires, Conductors, and Cables, and Unguarded Rigid Live Parts Adjacent but Not Attached to Buildings and Other Installations Except Bridges

Clearances are with NO WIND. See NESC Rules 233C1 and 233C2a.

Elevation range for table: Sea Level to 3300
Construction tolerance: 4 feet

Clearances of	Insulated communication conductors and cables messengers; surge protection wires; grounded guys; natural conductors meeting Rule 230E1; supply cables meeting Rule 230C1 (feet)	Supply cables cables of 0 to750 V meeting Rules 230C2 or 230C3 (feet)	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors: over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 27 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Buildings													
a. Horizontal													
(1). To walls, projection, and guarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.1)	14.0 (9.6)	15.0 (10.0)	16.0 (11.4)	18.0 (13.8)	22.0 (17.4)
(2) To unguarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.1)	14.0 (9.6)	15.0 (10.0)	16.0 (11.4)	18.0 (13.8)	22.0 (17.4)
(3) To balconies and areas readily accessible to pedestrians.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.1)	14.0 (9.6)	15.0 (10.0)	16.0 (11.4)	18.0 (13.8)	22.0 (17.4)
b. Vertical													
(1) Over or under roofs or projections not readily accessible to pedestrians.	7.0 (3.0)	8.0 (3.5)	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.1)	19.0 (14.6)	20.0 (15.0)	21.0 (16.4)	23.0 (18.8)	27.0 (22.4)
(2) Over or under balconies and roofs readily accessible to pedestrians.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.1)	20.0 (15.6)	21.0 (16.0)	22.0 (17.4)	24.0 (19.8)	28.0 (23.4)
(3) Over roofs accessible to vehicles but not subject to truck traffic.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.1)	20.0 (15.6)	21.0 (16.0)	22.0 (17.4)	24.0 (19.8)	28.0 (23.4)
(4) Over roofs accessible to truck traffic.	20.0 (15.5)	20.0 (16.0)	20.0 (16.0)	21.0 (16.5)	23.0 (18.5)	23.0 (18.7)	24.0 (19.2)	25.0 (20.1)	25.0 (20.6)	26.0 (21.0)	27.0 (22.4)	29.0 (24.8)	33.0 (28.4)
2. Signs, chimneys, billboards, radio and television antennas, tanks, and other installations not classified as buildings or bridges.													
a. Horizontal	7.0 (3.0)	8.0 (3.5)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.1)	14.0 (9.6)	15.0 (10.0)	16.0 (11.4)	18.0 (13.8)	22.0 (17.4)
b. Vertical over or under	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (6.0)	12.0 (8.0)	13.0 (8.2)	13.0 (8.7)	14.0 (9.6)	15.0 (10.1)	15.0 (10.5)	16.0 (11.9)	19.0 (14.3)	22.0 (17.9)
3. Other supporting structures, wires, conductors, or cables of one line passing near a lighting support, traffic signal support, or a supporting structure of a second line, without being attached thereto.													
a. Horizontal	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	10.0 (5.7)	11.0 (6.1)	11.0 (6.6)	12.0 (8.0)	15.0 (10.3)	18.0 (13.9)
b. Vertical	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.5)	10.0 (5.5)	10.0 (5.5)	11.0 (6.2)	11.0 (6.6)	12.0 (7.1)	13.0 (8.5)	15.0 (10.8)	19.0 (14.4)

+3 PJM Buffer (min.)

Table 2 – PacifiCorp Standard Practice (NESC Table 234–1)
Clearances of Wires, Conductors, and Cables, and Unguarded Rigid Live Parts Adjacent but Not Attached to Buildings and Other Installations Except Bridges

Clearances are with NO WIND. See NESC Rules 233C1 and 233C2a.

Elevation range for table: 3300 6300
Construction tolerance: 4 feet

Clearances of	Insulated communication conductors and cables messengers; surge protection wires; grounded guys; natural conductors meeting Rule 230E1; supply cables meeting Rule 230C1 (feet)	Supply cables cables of 0 to750 V meeting Rules 230C2 or 230C3 (feet)	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors: over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 27 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Buildings													
a. Horizontal													
(1). To walls, projection, and guarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.2)	14.0 (9.8)	15.0 (10.3)	16.0 (11.8)	19.0 (14.3)	23.0 (18.3)
(2) To unguarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.2)	14.0 (9.8)	15.0 (10.3)	16.0 (11.8)	19.0 (14.3)	23.00 (18.3)
(3) To balconies and areas readily accessible to pedestrians.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.2)	14.0 (9.8)	15.0 (10.3)	16.0 (11.8)	19.0 (14.3)	23.0 (18.3)
b. Vertical													
(1) Over or under roofs or projections not readily accessible to pedestrians.	7.0 (3.0)	8.0 (3.5)	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.2)	19.0 (14.8)	20.0 (15.3)	21.0 (16.8)	24.0 (19.3)	28.0 (23.3)
(2) Over or under balconies and roofs readily accessible to pedestrians.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.2)	20.0 (15.8)	21.0 (16.3)	22.0 (17.8)	25.0 (20.3)	29.0 (24.3)
(3) Over roofs accessible to vehicles but not subject to truck traffic.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.2)	20.0 (15.8)	21.0 (16.3)	22.0 (17.8)	25.0 (20.3)	29.0 (24.3)
(4) Over roofs accessible to truck traffic.	20.0 (15.5)	20.0 (16.0)	20.0 (16.0)	21.0 (16.5)	23.0 (18.5)	23.0 (18.7)	24.0 (19.2)	25.0 (20.2)	25.0 (20.8)	26.0 (21.3)	27.0 (22.8)	30.0 (25.3)	34.0 (29.3)
2. Signs, chimneys, billboards, radio and television antennas, tanks, and other installations not classified as buildings or bridges.													
a. Horizontal	7.0 (3.0)	8.0 (3.5)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.2)	14.0 (9.8)	15.0 (10.3)	16.0 (11.8)	19.0 (14.3)	23.0 (18.3)
b. Vertical over or under	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (6.0)	12.0 (8.0)	13.0 (8.2)	13.0 (8.7)	14.0 (9.7)	15.0 (10.3)	15.0 (10.8)	17.0 (12.3)	19.0 (14.8)	23.0 (18.8)
3. Other supporting structures, wires, conductors, or cables of one line passing near a lighting support, traffic signal support, or a supporting structure of a second line, without being attached thereto.													
a. Horizontal	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	10.0 (5.7)	11.0 (6.2)	11.0 (6.7)	13.0 (8.3)	15.0 (10.8)	19.0 (14.7)
b. Vertical	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.5)	10.0 (5.5)	10.0 (5.5)	11.0 (6.2)	11.0 (6.7)	12.0 (7.2)	13.0 (8.8)	16.0 (11.3)	20.0 (15.2)

Table 3 – PacifiCorp Standard Practice (NESC Table 234–1)
Clearances of Wires, Conductors, and Cables, and Unguarded Rigid Live Parts Adjacent but Not Attached to Buildings and Other Installations Except Bridges

Clearances are with NO WIND. See NESC Rules 233C1 and 233C2a.

Elevation range for table: 6300 9300
Construction tolerance: 4 feet

Clearances of	Insulated communication conductors and cables messengers; surge protection wires; grounded guys; natural conductors meeting Rule 230E1; supply cables meeting Rule 230C1 (feet)	Supply cables cables of 0 to750 V meeting Rules 230C2 or 230C3 (feet)	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors							
					over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 27 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Buildings													
a. Horizontal													
(1). To walls, projection, and guarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.4)	14.0 (9.9)	15.0 (10.5)	17.0 (12.1)	19.0 (14.9)	24.0 (19.1)
(2) To unguarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.4)	14.0 (9.9)	15.0 (10.5)	17.0 (12.1)	19.0 (14.9)	24.0 (19.1)
(3) To balconies and areas readily accessible to pedestrians.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.4)	14.0 (9.9)	15.0 (10.5)	17.0 (12.1)	19.0 (14.9)	24.0 (19.1)
b. Vertical													
(1) Over or under roofs or projections not readily accessible to pedestrians.	7.0 (3.0)	8.0 (3.5)	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.4)	19.0 (14.9)	20.0 (15.5)	22.0 (17.1)	24.0 (19.9)	29.0 (24.1)
(2) Over or under balconies and roofs readily accessible to pedestrians.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.4)	20.0 (15.9)	21.0 (16.5)	23.0 (18.1)	25.0 (20.9)	30.0 (25.1)
(3) Over roofs accessible to vehicles but not subject to truck traffic.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.4)	20.0 (15.9)	21.0 (16.5)	23.0 (18.1)	25.0 (20.9)	30.0 (25.1)
(4) Over roofs accessible to truck traffic.	20.0 (15.5)	20.0 (16.0)	20.0 (16.0)	21.0 (16.5)	23.0 (18.5)	23.0 (18.7)	24.0 (19.2)	25.0 (20.4)	25.0 (20.9)	26.0 (21.5)	28.0 (23.1)	30.0 (25.9)	35.0 (30.1)
2. Signs, chimneys, billboards, radio and television antennas, tanks, and other installations not classified as buildings or bridges.													
a. Horizontal	7.0 (3.0)	8.0 (3.5)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.4)	14.0 (9.9)	15.0 (10.5)	17.0 (12.1)	19.0 (14.9)	24.0 (19.1)
b. Vertical over or under	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (6.0)	12.0 (8.0)	13.0 (8.2)	13.0 (8.7)	14.0 (9.9)	15.0 (10.4)	15.0 (11.0)	17.0 (12.6)	20.0 (15.4)	24.0 (19.6)
3. Other supporting structures, wires, conductors, or cables of one line passing near a lighting support, traffic signal support, or a supporting structure of a second line, without being attached thereto.													
a. Horizontal	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	10.0 (5.8)	11.0 (6.3)	11.0 (6.9)	13.0 (8.6)	16.0 (11.3)	20.0 (15.5)
b. Vertical	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.5)	10.0 (5.5)	10.0 (5.5)	11.0 (6.3)	11.0 (6.8)	12.0 (7.4)	14.0 (9.0)	16.0 (11.8)	21.0 (16.0)

Table 4 – PacifiCorp Standard Practice (NESC Table 234–1)
Clearances of Wires, Conductors, and Cables, and Unguarded Rigid Live Parts Adjacent but Not Attached to Buildings and Other Installations Except Bridges

Clearances are with NO WIND. See NESC Rules 233C1 and 233C2a.

Elevation range for table: 9300 12300
Construction tolerance: 4 feet

Clearances of	Insulated communication conductors and cables messengers; surge protection wires; grounded guys; natural conductors meeting Rule 230E1; supply cables meeting Rule 230C1 (feet)	Supply cables cables of 0 to750 V meeting Rules 230C2 or 230C3 (feet)	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors: over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 27 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Buildings													
a. Horizontal													
(1). To walls, projection, and guarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.5)	15.0 (10.1)	15.0 (10.7)	17.0 (12.5)	20.0 (15.5)	25.0 (20.0)
(2) To unguarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.5)	15.0 (10.1)	15.0 (10.7)	17.0 (12.5)	20.0 (15.5)	25.0 (20.0)
(3) To balconies and areas readily accessible to pedestrians.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.5)	15.0 (10.1)	15.0 (10.7)	17.0 (12.5)	20.0 (15.5)	25.0 (20.0)
b. Vertical													
(1) Over or under roofs or projections not readily accessible to pedestrians.	7.0 (3.0)	8.0 (3.5)	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.5)	20.0 (15.1)	20.0 (15.7)	22.0 (17.5)	25.0 (20.5)	30.0 (25.0)
(2) Over or under balconies and roofs readily accessible to pedestrians.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.5)	21.0 (16.1)	21.0 (16.7)	23.0 (18.5)	26.0 (21.5)	31.0 (26.0)
(3) Over roofs accessible to vehicles but not subject to truck traffic.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.5)	21.0 (16.1)	21.0 (16.7)	23.0 (18.5)	26.0 (21.5)	31.0 (26.0)
(4) Over roofs accessible to truck traffic.	20.0 (15.5)	20.0 (16.0)	20.0 (16.0)	21.0 (16.5)	23.0 (18.5)	23.0 (18.7)	24.0 (19.2)	25.0 (20.5)	26.0 (21.1)	26.0 (21.7)	28.0 (23.5)	31.0 (26.5)	36.0 (31.0)
2. Signs, chimneys, billboards, radio and television antennas, tanks, and other installations not classified as buildings or bridges.													
a. Horizontal	7.0 (3.0)	8.0 (3.5)	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.5)	15.0 (10.1)	15.0 (10.7)	17.0 (12.5)	20.0 (15.5)	25.0 (20.0)
b. Vertical over or under	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (6.0)	12.0 (8.0)	13.0 (8.2)	13.0 (8.7)	15.0 (10.0)	15.0 (10.6)	16.0 (11.2)	17.0 (13.0)	20.0 (16.0)	25.0 (20.5)
3. Other supporting structures, wires, conductors, or cables of one line passing near a lighting support, traffic signal support, or a supporting structure of a second line, without being attached thereto.													
a. Horizontal	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	9.0 (5.0)	10.0 (6.8)	11.0 (6.4)	12.0 (7.0)	13.0 (8.8)	16.0 (11.8)	21.0 (16.3)
b. Vertical	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.5)	10.0 (5.5)	10.0 (5.5)	11.0 (6.3)	11.0 (6.9)	12.0 (7.5)	14.0 (9.3)	17.0 (12.3)	21.0 (16.8)

Table 5 – PacifiCorp Standard Practice (NESC Table 234–1)

Clearances of Wires, Conductors, and Cables, and Unguarded Rigid Live Parts Adjacent but Not Attached to Buildings and Other Installations Except Bridges

Clearances are with 6 lb/sf WIND. See NESC Rules 233C1 and 233C2a.

Elevation range for table: Sea Level to 3300
Construction tolerance: 4 feet

Clearances of	Insulated communication conductors and cables messengers; surge protection wires; grounded guys; natural conductors meeting Rule 230E1; supply cables meeting Rule 230C1 (feet)	Supply cables cables of 0 to750 V meeting Rules 230C2 or 230C3 (feet)	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors: over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 27 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Buildings													
a. Horizontal													
(1). To walls, projection, and guarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.1)	11.0 (6.3)	12.0 (7.0)	13.0 (8.4)	15.0 (10.8)	19.0 (14.4)
(2) To unguarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.1)	11.0 (6.6)	12.0 (7.0)	13.0 (8.4)	15.0 (10.8)	19.0 (14.4)
(3) To balconies and areas readily accessible to pedestrians.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.1)	11.0 (6.6)	12.0 (7.0)	13.0 (8.4)	15.0 (10.8)	19.0 (14.4)
b. Vertical													
(1) Over or under roofs or projections not readily accessible to pedestrians.	7.0 (3.0)	8.0 (3.5)	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.1)	19.0 (14.6)	20.0 (15.0)	21.0 (16.4)	23.0 (18.8)	27.0 (22.4)
(2) Over or under balconies and roofs readily accessible to pedestrians.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.1)	20.0 (15.6)	21.0 (16.0)	22.0 (17.4)	24.0 (19.8)	28.0 (23.4)
(3) Over roofs accessible to vehicles but not subject to truck traffic.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.1)	20.0 (15.6)	21.0 (16.0)	22.0 (17.4)	24.0 (19.8)	28.0 (23.4)
(4) Over roofs accessible to truck traffic.	20.0 (15.5)	20.0 (16.0)	20.0 (16.0)	21.0 (16.5)	23.0 (18.5)	23.0 (18.5)	24.0 (19.2)	25.0 (20.1)	25.0 (20.6)	26.0 (21.0)	27.0 (22.4)	29.0 (24.8)	33.0 (28.4)
2. Signs, chimneys, billboards, radio and television antennas, tanks, and other installations not classified as buildings or bridges.													
a. Horizontal	7.0 (3.0)	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.1)	11.0 (6.6)	12.0 (7.0)	13.0 (8.4)	15.0 (10.8)	19.0 (14.4)
b. Vertical over or under	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (6.0)	12.0 (8.0)	13.0 (8.2)	13.0 (8.7)	14.0 (9.6)	15.0 (10.1)	15.0 (10.5)	16.0 (11.9)	19.0 (14.3)	22.0 (17.9)
3. Other supporting structures, wires, conductors, or cables of one line passing near a lighting support, traffic signal support, or a supporting structure of a second line, without being attached thereto.													
a. Horizontal	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.2)	10.0 (5.6)	11.0 (6.1)	12.0 (7.5)	14.0 (9.8)	18.0 (13.4)
b. Vertical	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.5)	10.0 (5.5)	10.0 (5.5)	11.0 (6.2)	11.0 (6.6)	12.0 (7.1)	13.0 (8.6)	15.0 (10.8)	19.0 (14.4)

+3' PSB Buffer min.

Table 6 – PacifiCorp Standard Practice (NESC Table 234–1)

Clearances of Wires, Conductors, and Cables, and Unguarded Rigid Live Parts Adjacent but Not Attached to Buildings and Other Installations Except Bridges

Clearances are with 6 lb/sf WIND. See NESC Rules 233C1 and 233C2a.

Elevation range for table: 3300 6300
Construction tolerance: 4 feet

Clearances of	Insulated communication conductors and cables messengers; surge protection wires; grounded guys; natural conductors meeting Rule 230E1; supply cables meeting Rule 230C1 (feet)	Supply cables cables of 0 to750 V meeting Rules 230C2 or 230C3 (feet)	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors: over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 27 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Buildings													
a. Horizontal													
(1). To walls, projection, and guarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.2)	11.0 (6.3)	12.0 (7.3)	13.0 (8.8)	16.0 (11.3)	20.0 (15.3)
(2) To unguarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.2)	11.0 (7.2)	12.0 (7.7)	13.0 (9.2)	16.0 (11.7)	20.0 (15.3)
(3) To balconies and areas readily accessible to pedestrians.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.2)	11.0 (6.8)	12.0 (7.3)	13.0 (8.8)	16.0 (11.3)	20.0 (15.3)
b. Vertical													
(1) Over or under roofs or projections not readily accessible to pedestrians.	7.0 (3.0)	8.0 (3.5)	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.2)	19.0 (14.8)	20.0 (15.3)	21.0 (16.8)	24.0 (19.3)	28.0 (23.3)
(2) Over or under balconies and roofs readily accessible to pedestrians.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.2)	20.0 (15.8)	21.0 (16.3)	22.0 (17.8)	25.0 (20.3)	29.0 (24.3)
(3) Over roofs accessible to vehicles but not subject to truck traffic.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.2)	20.0 (15.8)	21.0 (16.3)	22.0 (17.8)	25.0 (20.3)	29.0 (24.3)
(4) Over roofs accessible to truck traffic.	20.0 (15.5)	20.0 (16.0)	20.0 (16.0)	21.0 (16.5)	23.0 (18.5)	23.0 (18.5)	24.0 (19.2)	25.0 (20.2)	25.0 (20.8)	26.0 (21.3)	27.0 (22.8)	30.0 (25.3)	34.0 (29.3)
2. Signs, chimneys, billboards, radio and television antennas, tanks, and other installations not classified as buildings or bridges.													
a. Horizontal	7.0 (3.0)	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.2)	11.0 (6.8)	12.0 (7.3)	13.0 (8.8)	16.0 (11.3)	20.0 (15.3)
b. Vertical over or under	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (6.0)	12.0 (8.0)	13.0 (8.2)	13.0 (8.7)	14.0 (9.7)	15.0 (10.3)	15.0 (10.8)	17.0 (12.3)	19.0 (14.8)	23.0 (18.8)
3. Other supporting structures, wires, conductors, or cables of one line passing near a lighting support, traffic signal support, or a supporting structure of a second line, without being attached thereto.													
a. Horizontal	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.2)	10.0 (6.7)	11.0 (6.2)	12.0 (7.8)	15.0 (10.3)	19.0 (14.2)
b. Vertical	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.5)	10.0 (5.5)	10.0 (5.5)	11.0 (6.2)	11.0 (6.7)	12.0 (7.2)	13.0 (8.8)	16.0 (11.3)	20.0 (15.2)

Table 7 – PacifiCorp Standard Practice (NESC Table 234–1)

Clearances of Wires, Conductors, and Cables, and Unguarded Rigid Live Parts Adjacent but Not Attached to Buildings and Other Installations Except Bridges

Clearances are with 6 lb/sf WIND. See NESC Rules 233C1 and 233C2a.

Elevation range for table: 6300 9300
Construction tolerance: 4 feet

Clearances of	Insulated communication conductors and cables messengers; surge protection wires; grounded guys; natural conductors meeting Rule 230E1; supply cables meeting Rule 230C1 (feet)	Supply cables cables of 0 to750 V meeting Rules 230C2 or 230C3 (feet)	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors: over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 27 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Buildings													
a. Horizontal													
(1). To walls, projection, and guarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	10.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.4)	11.0 (6.3)	12.0 (7.5)	14.0 (9.1)	16.0 (11.9)	21.0 (16.1)
(2) To unguarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.4)	11.0 (7.7)	12.0 (8.3)	14.0 (10.0)	16.0 (12.7)	21.0 (16.1)
(3) To balconies and areas readily accessible to pedestrians.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.4)	11.0 (6.9)	12.0 (7.5)	14.0 (9.1)	16.0 (11.9)	21.0 (16.1)
b. Vertical													
(1) Over or under roofs or projections not readily accessible to pedestrians.	7.0 (3.0)	8.0 (3.5)	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.4)	19.0 (14.9)	20.0 (15.5)	22.0 (17.1)	24.0 (19.9)	29.0 (24.1)
(2) Over or under balconies and roofs readily accessible to pedestrians.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.4)	20.0 (15.9)	21.0 (16.5)	23.0 (18.1)	25.0 (20.9)	30.0 (25.1)
(3) Over roofs accessible to vehicles but not subject to truck traffic.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.4)	20.0 (15.9)	21.0 (16.5)	23.0 (18.1)	25.0 (20.9)	30.0 (25.1)
(4) Over roofs accessible to truck traffic.	20.0 (15.5)	20.0 (16.0)	20.0 (16.0)	21.0 (16.5)	23.0 (18.5)	23.0 (18.5)	24.0 (19.2)	25.0 (20.4)	25.0 (20.9)	26.0 (21.5)	28.0 (23.1)	30.0 (25.9)	35.0 (30.1)
2. Signs, chimneys, billboards, radio and television antennas, tanks, and other installations not classified as buildings or bridges.													
a. Horizontal	7.0 (3.0)	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.4)	11.0 (6.9)	12.0 (7.5)	14.0 (9.1)	16.0 (11.9)	21.0 (16.1)
b. Vertical over or under	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (6.0)	12.0 (8.0)	13.0 (8.2)	13.0 (8.7)	14.0 (9.9)	15.0 (10.4)	15.0 (11.0)	17.0 (12.6)	20.0 (15.4)	24.0 (19.6)
3. Other supporting structures, wires, conductors, or cables of one line passing near a lighting support, traffic signal support, or a supporting structure of a second line, without being attached thereto.													
a. Horizontal	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.3)	10.0 (5.8)	11.0 (6.4)	13.0 (8.0)	15.0 (10.8)	20.0 (15.0)
b. Vertical	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.5)	10.0 (5.5)	10.0 (5.5)	11.0 (6.3)	11.0 (6.8)	12.0 (7.4)	14.0 (9.0)	16.0 (11.8)	21.0 (16.0)

Table 8 – PacifiCorp Standard Practice (NESC Table 234–1)
Clearances of Wires, Conductors, and Cables, and Unguarded Rigid Live Parts Adjacent but Not Attached to Buildings and Other Installations Except Bridges

Clearances are with 6 lb/sf WIND. See NESC Rules 233C1 and 233C2a.

Elevation range for table: 9300 12300
Construction tolerance: 4 feet

Clearances of	Insulated communication conductors and cables messengers; surge protection wires; grounded guys; natural conductors meeting Rule 230E1; supply cables meeting Rule 230C1 (feet)	Supply cables cables of 0 to750 V meeting Rules 230C2 or 230C3 (feet)	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors: over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 27 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Buildings													
a. Horizontal													
(1). To walls, projection, and guarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	10.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.5)	12.0 (6.3)	12.0 (7.7)	14.0 (9.5)	17.0 (12.5)	22.0 (17.0)
(2) To unguarded windows.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.5)	12.0 (8.3)	12.0 (8.9)	14.0 (10.7)	17.0 (13.7)	22.0 (17.0)
(3) To balconies and areas readily accessible to pedestrians.	9.0 (4.5)	9.0 (5.0)	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.5)	12.0 (7.1)	12.0 (7.7)	14.0 (9.5)	17.0 (12.5)	22.0 (17.0)
b. Vertical													
(1) Over or under roofs or projections not readily accessible to pedestrians.	7.0 (3.0)	8.0 (3.5)	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.5)	20.0 (15.1)	20.0 (15.7)	22.0 (17.5)	25.0 (20.5)	30.0 (25.0)
(2) Over or under balconies and roofs readily accessible to pedestrians.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.5)	21.0 (16.1)	21.0 (16.7)	23.0 (18.5)	26.0 (21.5)	31.0 (26.0)
(3) Over roofs accessible to vehicles but not subject to truck traffic.	15.0 (10.5)	15.0 (11.0)	15.0 (11.0)	16.0 (11.5)	18.0 (13.5)	18.0 (13.7)	19.0 (14.2)	20.0 (15.5)	21.0 (16.1)	21.0 (16.7)	23.0 (18.5)	26.0 (21.5)	31.0 (26.0)
(4) Over roofs accessible to truck traffic.	20.0 (15.5)	20.0 (16.0)	20.0 (16.0)	21.0 (16.5)	23.0 (18.5)	23.0 (18.5)	24.0 (19.2)	25.0 (20.5)	26.0 (21.1)	26.0 (21.7)	28.0 (23.5)	31.0 (26.5)	36.0 (31.0)
2. Signs, chimneys, billboards, radio and television antennas, tanks, and other installations not classified as buildings or bridges.													
a. Horizontal	7.0 (3.0)	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.5)	12.0 (7.1)	12.0 (7.7)	14.0 (9.5)	17.0 (12.5)	22.0 (17.0)
b. Vertical over or under	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (6.0)	12.0 (8.0)	13.0 (8.2)	13.0 (8.7)	15.0 (10.0)	15.0 (10.6)	16.0 (11.2)	17.0 (13.0)	20.0 (16.0)	25.0 (20.5)
3. Other supporting structures, wires, conductors, or cables of one line passing near a lighting support, traffic signal support, or a supporting structure of a second line, without being attached thereto.													
a. Horizontal	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.3)	10.0 (5.9)	11.0 (6.5)	13.0 (8.3)	16.0 (11.3)	20.0 (15.8)
b. Vertical	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	9.0 (4.5)	10.0 (5.5)	10.0 (5.5)	10.0 (5.5)	11.0 (6.3)	11.0 (6.9)	12.0 (7.5)	14.0 (9.3)	17.0 (12.3)	21.0 (16.8)

Table 9 – PacifiCorp Standard Practice (NESC Table 234–2)
Clearances of Wires, Conductors, and Cables From Bridges

Clearances with NO WIND. See NESC Rules 234D1a and 234H4.

Elevation range for table: Sea Level to 3300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Clearance over bridges.											
a Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.1)	12.0 (7.6)	13.0 (8.0)	14.0 (9.4)	16.0 (11.8)	20.0 (15.4)
b. Not attached	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.1)	19.0 (14.6)	20.0 (15.0)	21.0 (16.4)	23.0 (18.8)	27.0 (22.4)
2. Clearance beside, under or within bridge structure.											
a. Readily accessible portions of any bridge, including wing, walls, and bridge attachments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.1)	12.0 (7.6)	13.0 (8.0)	14.0 (9.4)	16.0 (11.8)	20.0 (15.4)
(2) Not Attached	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.1)	14.0 (9.6)	15.0 (10.0)	16.0 (11.4)	18.0 (13.8)	22.0 (17.4)
b. Ordinarily inaccessible portions of bridges (other than brick, concrete, or masonry) and from abutments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.1)	12.0 (7.6)	13.0 (8.0)	14.0 (9.4)	16.0 (11.8)	20.0 (15.4)
(2) Not Attached	8.0 (4.0)	9.0 (4.5)	11.0 (6.5)	11.0 (6.7)	12.0 (7.2)	13.0 (8.1)	13.0 (8.6)	14.0 (9.0)	15.0 (10.4)	17.0 (12.8)	21.0 (16.4)

Table 10 – PacifiCorp Standard Practice (NESC Table 234–2)
Clearances of Wires, Conductors, and Cables From Bridges

Clearances with NO WIND. See NESC Rules 234D1a and 234H4.

Elevation range for table: 3300 6300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Clearance over bridges.											
a Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.2)	12.0 (7.8)	13.0 (8.3)	14.0 (9.8)	17.0 (12.3)	21.0 (16.3)
b. Not attached	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.2)	19.0 (14.8)	20.0 (15.3)	21.0 (16.8)	24.0 (19.3)	28.0 (23.3)
2. Clearance beside, under or within bridge structure.											
a. Readily accessible portions of any bridge, including wing, walls, and bridge attachments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.2)	12.0 (7.8)	13.0 (8.3)	14.0 (9.8)	17.0 (12.3)	21.0 (16.3)
(2) Not Attached	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.2)	14.0 (9.8)	15.0 (10.3)	16.0 (11.8)	19.0 (14.3)	23.0 (18.3)
b. Ordinarily inaccessible portions of bridges (other than brick, concrete, or masonry) and from abutments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.2)	12.0 (7.8)	13.0 (8.3)	14.0 (9.8)	17.0 (12.3)	21.0 (16.3)
(2) Not Attached	8.0 (4.0)	9.0 (4.5)	11.0 (6.5)	11.0 (6.7)	12.0 (7.2)	13.0 (8.2)	13.0 (8.8)	14.0 (9.3)	15.0 (10.8)	18.0 (13.3)	22.0 (17.3)

Table 11 – PacifiCorp Standard Practice (NESC Table 234–2)
Clearances of Wires, Conductors, and Cables From Bridges

Clearances with NO WIND. See NESC Rules 234D1a and 234H4.

Elevation range for table: 6300 9300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Clearance over bridges.											
a Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.4)	12.0 (7.9)	13.0 (8.5)	15.0 (10.1)	17.0 (12.9)	22.0 (17.1)
b. Not attached	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.4)	19.0 (14.9)	20.0 (15.5)	22.0 (17.1)	24.0 (19.9)	29.0 (24.1)
2. Clearance beside, under or within bridge structure.											
a. Readily accessible portions of any bridge, including wing, walls, and bridge attachments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.4)	12.0 (7.9)	13.0 (8.5)	15.0 (10.1)	17.0 (12.9)	22.0 (17.1)
(2) Not Attached	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.4)	14.0 (9.9)	15.0 (10.5)	17.0 (12.1)	19.0 (14.9)	24.0 (19.1)
b. Ordinarily inaccessible portions of bridges (other than brick, concrete, or masonry) and from abutments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.4)	12.0 (7.9)	13.0 (8.5)	15.0 (10.1)	17.0 (12.9)	22.0 (17.1)
(2) Not Attached	8.0 (4.0)	9.0 (4.5)	11.0 (6.5)	11.0 (6.7)	12.0 (7.2)	13.0 (8.4)	13.0 (8.9)	14.0 (9.5)	16.0 (11.1)	18.0 (13.9)	23.0 (18.1)

Table 12 – PacifiCorp Standard Practice (NESC Table 234–2)
Clearances of Wires, Conductors, and Cables From Bridges

Clearances with NO WIND. See NESC Rules 234D1a and 234H4.

Elevation range for table: 9300 12300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors: over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Clearance over bridges.											
a Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.5)	13.0 (8.1)	13.0 (8.7)	15.0 (10.5)	18.0 (13.5)	23.0 (18.0)
b. Not attached	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.5)	20.0 (15.1)	20.0 (15.7)	22.0 (17.5)	25.0 (20.5)	30.0 (25.0)
2. Clearance beside, under or within bridge structure.											
a. Readily accessible portions of any bridge, including wing, walls, and bridge attachments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.5)	13.0 (8.1)	13.0 (8.7)	15.0 (10.5)	18.0 (13.5)	23.0 (18.0)
(2) Not Attached	9.0 (5.0)	10.0 (5.5)	12.0 (7.5)	12.0 (7.7)	13.0 (8.2)	14.0 (9.5)	15.0 (10.1)	15.0 (10.7)	17.0 (12.5)	20.0 (15.5)	25.0 (20.0)
b. Ordinarily inaccessible portions of bridges (other than brick, concrete, or masonry) and from abutments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.5)	13.0 (8.1)	13.0 (8.7)	15.0 (10.5)	18.0 (13.5)	23.0 (18.0)
(2) Not Attached	8.0 (4.0)	9.0 (4.5)	11.0 (6.5)	11.0 (6.7)	12.0 (7.2)	13.0 (8.5)	14.0 (9.1)	14.0 (9.7)	16.0 (11.5)	19.0 (14.5)	24.0 (19.0)

Table 13 – PacifiCorp Standard Practice (NESC Table 234–2)
Clearances of Wires, Conductors, and Cables From Bridges

Clearances with 6 lbs/sf WIND. See NESC Rules 234D1a and 234H4.

Elevation range for table: Sea Level to 3300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Clearance over bridges.											
a Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.1)	12.0 (7.6)	13.0 (8.0)	14.0 (9.4)	16.0 (11.8)	20.0 (15.4)
b. Not attached	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.1)	19.0 (14.6)	20.0 (15.0)	21.0 (16.4)	23.0 (18.8)	27.0 (22.4)
2. Clearance beside, under or within bridge structure.											
a. Readily accessible portions of any bridge, including wing, walls, and bridge attachments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.1)	11.0 (6.6)	12.0 (7.0)	13.0 (8.4)	15.0 (10.8)	19.0 (14.4)
(2) Not Attached	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.1)	11.0 (6.6)	12.0 (7.0)	13.0 (8.4)	15.0 (10.8)	19.0 (14.4)
b. Ordinarily inaccessible portions of bridges (other than brick, concrete, or masonry) and from abutments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.1)	11.0 (6.6)	12.0 (7.0)	13.0 (8.4)	15.0 (10.8)	19.0 (14.4)
(2) Not Attached	8.0 (4.0)	9.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.1)	11.0 (6.6)	12.0 (7.0)	13.0 (8.4)	15.0 (10.8)	19.0 (14.4)

Table 14 – PacifiCorp Standard Practice (NESC Table 234–2)
Clearances of Wires, Conductors, and Cables From Bridges

Clearances with 6 lbs/sf WIND. See NESC Rules 234D1a and 234H4.

Elevation range for table: 3300 6300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Clearance over bridges.											
a Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.2)	12.0 (7.8)	13.0 (8.3)	14.0 (9.8)	17.0 (12.3)	21.0 (16.3)
b. Not attached	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.2)	19.0 (14.8)	20.0 (15.3)	21.0 (16.8)	24.0 (19.3)	28.0 (23.3)
2. Clearance beside, under or within bridge structure.											
a. Readily accessible portions of any bridge, including wing, walls, and bridge attachments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.2)	11.0 (6.8)	12.0 (7.3)	13.0 (8.8)	16.0 (11.3)	20.0 (15.3)
(2) Not Attached	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.2)	11.0 (6.8)	12.0 (7.3)	13.0 (8.8)	16.0 (11.3)	20.0 (15.3)
b. Ordinarily inaccessible portions of bridges (other than brick, concrete, or masonry) and from abutments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.2)	11.0 (6.8)	12.0 (7.3)	13.0 (8.8)	16.0 (11.3)	20.0 (15.3)
(2) Not Attached	8.0 (4.0)	9.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.2)	11.0 (6.8)	12.0 (7.3)	13.0 (8.8)	16.0 (11.3)	20.0 (15.3)

Table 15 – PacifiCorp Standard Practice (NESC Table 234–2)
Clearances of Wires, Conductors, and Cables From Bridges

Clearances with 6 lbs/sf WIND. See NESC Rules 234D1a and 234H4.

Elevation range for table: 6300 9300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Clearance over bridges.											
a Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.4)	12.0 (7.9)	13.0 (8.5)	15.0 (10.1)	17.0 (12.9)	22.0 (17.1)
b. Not attached	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.4)	19.0 (14.9)	20.0 (15.5)	22.0 (17.1)	24.0 (19.9)	29.0 (24.1)
2. Clearance beside, under or within bridge structure.											
a. Readily accessible portions of any bridge, including wing, walls, and bridge attachments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.4)	11.0 (6.9)	12.0 (7.5)	14.0 (9.1)	16.0 (11.9)	21.0 (16.1)
(2) Not Attached	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.4)	11.0 (6.9)	12.0 (7.5)	14.0 (9.1)	16.0 (11.9)	21.0 (16.1)
b. Ordinarily inaccessible portions of bridges (other than brick, concrete, or masonry) and from abutments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.4)	11.0 (6.9)	12.0 (7.5)	14.0 (9.1)	16.0 (11.9)	21.0 (16.1)
(2) Not Attached	8.0 (4.0)	9.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.4)	11.0 (6.9)	12.0 (7.5)	14.0 (9.1)	16.0 (11.9)	21.0 (16.1)

Table 16 – PacifiCorp Standard Practice (NESC Table 234–2)
Clearances of Wires, Conductors, and Cables From Bridges

Clearances with 6 lbs/sf WIND. See NESC Rules 234D1a and 234H4.

Elevation range for table: 9300 12300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
1. Clearance over bridges.											
a Attached	7.0 (3.0)	8.0 (3.5)	10.0 (5.5)	10.0 (5.7)	11.0 (6.2)	12.0 (7.5)	13.0 (8.1)	13.0 (8.7)	15.0 (10.5)	18.0 (13.5)	23.0 (18.0)
b. Not attached	14.0 (10.0)	15.0 (10.5)	17.0 (12.5)	17.0 (12.7)	18.0 (13.2)	19.0 (14.5)	20.0 (15.1)	20.0 (15.7)	22.0 (17.5)	25.0 (20.5)	30.0 (25.0)
2. Clearance beside, under or within bridge structure.											
a. Readily accessible portions of any bridge, including wing, walls, and bridge attachments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.5)	12.0 (7.1)	12.0 (7.7)	14.0 (9.5)	17.0 (12.5)	22.0 (17.0)
(2) Not Attached	9.0 (5.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.5)	12.0 (7.1)	12.0 (7.7)	14.0 (9.5)	17.0 (12.5)	22.0 (17.0)
b. Ordinarily inaccessible portions of bridges (other than brick, concrete, or masonry) and from abutments.											
(1) Attached	7.0 (3.0)	8.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.5)	12.0 (7.1)	12.0 (7.7)	14.0 (9.5)	17.0 (12.5)	22.0 (17.0)
(2) Not Attached	8.0 (4.0)	9.0 (3.5)	9.0 (4.5)	9.0 (4.7)	10.0 (5.2)	11.0 (6.5)	12.0 (7.1)	12.0 (7.7)	14.0 (9.5)	17.0 (12.5)	22.0 (17.0)

Table 17 – PacifiCorp Standard Practice (NESC Table 234–3)
Clearances of Wires, Conductors, and Cables Passing Over or Near Swimming Pools

Clearances with NO WIND. See NESC Rules 234E1, 234E2. and 234H4.

Elevation range for table: Sea Level to 3300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
A. Clearance in any direction from the water level, edge of pool, base of diving platform, or anchor raft.	27.0 (22.5)	27.0 (23.0)	29.0 (25.0)	30.0 (25.2)	30.0 (25.7)	31.0 (26.6)	32.0 (27.1)	32.0 (27.5)	33.0 (28.9)	36.0 (31.3)	39.0 (34.9)
B Clearance in any direction to the diving platform or tower.	19.0 (14.5)	19.0 (15.0)	21.0 (17.0)	22.0 (17.2)	22.0 (17.7)	23.0 (18.6)	24.0 (19.1)	24.0 (19.5)	25.0 (20.9)	28.0 (23.3)	31.0 (26.9)

C Vertical clearance over adjacent land.
Clearance shall be as required by Rule 232.

Table 18 – PacifiCorp Standard Practice (NESC Table 234–3)
Clearances of Wires, Conductors, and Cables Passing Over or Near Swimming Pools

Clearances with NO WIND. See NESC Rules 234E1, 234E2. and 234H4.

Elevation range for table: 3300 6300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3: open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
A. Clearance in any direction from the water level, edge of pool, base of diving platform, or anchor raft.	27.0 (22.5)	27.0 (23.0)	29.0 (25.0)	30.0 (25.2)	30.0 (25.7)	31.0 (26.7)	32.0 (27.3)	32.0 (27.8)	34.0 (29.3)	36.0 (31.8)	40.0 (35.8)
B Clearance in any direction to the diving platform or tower.	19.0 (14.5)	19.0 (15.0)	21.0 (17.0)	22.0 (17.2)	22.0 (17.7)	23.0 (18.7)	24.0 (19.3)	24.0 (19.8)	26.0 (21.3)	28.0 (23.8)	32.0 (27.8)

C Vertical clearance over adjacent land.

Clearance shall be as required by Rule 232.

Table 19 – PacifiCorp Standard Practice (NESC Table 234–3)
Clearances of Wires, Conductors, and Cables Passing Over or Near Swimming Pools

Clearances with NO WIND. See NESC Rules 234E1, 234E2. and 234H4.

Elevation range for table: 6300 9300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3; open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
A. Clearance in any direction from the water level, edge of pool, base of diving platform, or anchor raft.	27.0 (22.5)	27.0 (23.0)	29.0 (25.0)	30.0 (25.2)	30.0 (25.7)	31.0 (26.9)	32.0 (27.4)	32.0 (28.0)	34.0 (29.6)	37.0 (32.4)	41.0 (36.6)
B Clearance in any direction to the diving platform or tower.	19.0 (14.5)	19.0 (15.0)	21.0 (17.0)	22.0 (17.2)	22.0 (17.7)	23.0 (18.9)	24.0 (19.4)	24.0 (20.0)	26.0 (21.6)	29.0 (24.4)	33.0 (28.6)

C Vertical clearance over adjacent land.
Clearance shall be as required by Rule 232.

Table 20 – PacifiCorp Standard Practice (NESC Table 234–3)

Clearances of Wires, Conductors, and Cables Passing Over or Near Swimming Pools

Clearances with NO WIND. See NESC Rules 234E1, 234E2. and 234H4.

Elevation range for table: 9300 12300
Construction tolerance: 4 feet

	Unguarded rigid live parts, 0 to 750 V; noninsulated communication conductors; supply cables of 0 to 750 V meeting Rules 230C2 or 230C3 (feet)	Supply cables over 750 V meeting Rules 230C2 or 230C3: open supply conductors 0 to 750 V (feet)	Open Supply Conductors								
			over 750 V to 22 kV to ground (34.5 kV to phase) (feet)	over 22 kV to 27 kV to ground (46 kV to phase) (feet)	over 28 kV to 42 kV to ground (69 kV to phase) (feet)	over 42 kV to 70 kV to ground (115 kV to phase) (feet)	over 70 kV to 84 kV to ground (138 kV to phase) (feet)	over 84 kV to 98 kV to ground (161 kV to phase) (feet)	over 98 kV to 140 kV to ground (230 kV to phase) (feet)	over 140 kV to 210 kV to ground (345 kV to phase) (feet)	over 210 kV to 318 kV to ground (500 kV to phase) (feet)
A. Clearance in any direction from the water level, edge of pool, base of diving platform, or anchor raft.	27.0 (22.5)	27.0 (23.0)	29.0 (25.0)	30.0 (25.2)	30.0 (25.7)	32.0 (27.0)	32.0 (27.6)	33.0 (28.2)	34.0 (30.0)	37.0 (33.0)	42.0 (37.5)
B Clearance in any direction to the diving platform or tower.	19.0 (14.5)	19.0 (15.0)	21.0 (17.0)	22.0 (17.2)	22.0 (17.7)	24.0 (19.0)	24.0 (19.6)	25.0 (20.2)	26.0 (22.0)	29.0 (25.0)	34.0 (29.5)

C Vertical clearance over adjacent land.

Clearance shall be as required by Rule 232.

1. Scope

This standard describes the vegetation clearing along rights-of-way (ROW) of the NU operating companies in Connecticut and Massachusetts where overhead transmission lines are to be constructed. The practices described here apply to the construction requirements for all 115kV and 345kV [1] electric transmission lines, and are consistent with the North American Electric Reliability Council (NERC) Vegetation Management Standard FAC-003-1 dated 2/16/2006, The New England Independent System Operator's (ISO-NE) vegetation clearing standard OP-3 dated 2/1/2005, and the National Electrical Safety Code (NESC) Rule 218 as adopted by the Connecticut Department of Public Utility Control (Regulation Sec. 16-11-134).

This standard applies to new construction clearing requirements and practices and not to on-going future vegetation maintenance of the ROW's. The initial clearance requirements outlined in this standard are intended to provide adequate clearances for a period of four (4) years at which time scheduled maintenance will be performed to reestablish or preserve the initial clearances. The maintenance of the vegetation following construction is addressed under the Northeast Utilities Specification for Rights-of-Way Vegetation Management. Low-maturing trees, which are allowed to remain after completion of vegetation clearing, are still subject to future trimming and removals, depending upon their growth and health, as well as the future needs of NU to operate, maintain, and add or replace electric facilities on the ROW.

NU operating companies typically obtain permanent easement rights for the placement of overhead transmission lines, including the right to clear vegetation within the fully defined limits of a ROW. In most locations the right to remove any tree or portion of tree outside the easemented limits of the ROW ("danger tree") that by falling could endanger the transmission line facilities is also obtained. These rights are necessary to provide for the safe and reliable operation and maintenance of any overhead transmission line that is built on a ROW.

Notwithstanding these rights, the standard practice of the NU operation companies is to minimize tree and other vegetation removal that is required for new transmission line construction by:

A. Designing new lines to keep the positions of new conductors as much as possible within any existing cleared ROW corridor, thus minimizing additional clearing

B. Remove non-compatible vegetation (trees and tall growing shrub species) within the conductor clearance zone (area directly under the conductors extending 15 feet horizontally outward from the outermost line conductors)

[1] Except for possible modifications to existing 69kV lines, it is unlikely that NU will construct any new 69kV lines. Therefore, this standard covers 115 and 345kV lines only, and 115kV line clearances would apply to any new 69kV lines.

C. Allowing low-maturing tree species such as dogwoods to remain within the side zones (area outside of the conductor clearance zone extending to the edge of the ROW clearing limits) where these low-maturing species exist

D. Re-establishing pre-existing access roads for construction vehicles to minimize the clearing of low growth within the existing corridor for access

E. Locating new line structures close to old structures and overlapping the work areas of old structures to reduce to the amount of clearing for the new structure work areas

F. Where feasible, using existing conductors to pull in new conductors, thus reducing damage to low growth vegetation along the cleared corridor

G. Engaging an arborist to determine individual "danger trees" for removal considering
   1) Species
   2) Soil conditions
      a) including wetland vs. upland
      b) susceptibility to flooding
      c) depth to rock (and adaptability of the species to those conditions)
   3) Health of the tree
   4) Inclination of trunk
   5) shape of crown

Refer to figures V-1 through V-6 for diagrams of the conductor clearance zone and side zones associated with various line structure types.

2. Clearance between Conductors and Woody Vegetation

Transmission lines within the Northeast Utilities System present a variety of woody vegetation control situations. Regulatory authorities may require "buffers" or "screening" at visually sensitive highway and local road crossings or other locations, and such locations require special attention to achieve and maintain the necessary clearances. At all other locations, standard ROW vegetation clearing practices for new line construction are as follows:

A. Within the ROW limits, as depicted on Figures A, B, and C, cut all tall-maturing tree species of any height while retaining existing compatible woody shrub species (see Appendix 1).

B. Clear-cut construction areas at structure locations and access roads as depicted on Figure C.

C. At road crossings, within side zones and other sensitive areas, as specified by ROW development and management plans, retain existing low-maturing tree species such as Flowering Dogwood (see Appendix 2) to the extent that these trees will not conflict with operation of the transmission line prior to the next scheduled vegetation maintenance.

D. At ravines, river crossings, and similar locations: retain tree species on the ROW where the conductors will be significantly higher than normal and where the

vegetation at full mature height would not violate Figure A clearances and will not cause construction or access problems.

The minimum clearances established in Figures A, B, and C between conductors and woody vegetation includes allowances for re-growth over the periodic maintenance cycle of four (4) years for vegetation within the cleared limits of the ROW, and ten (10) years for vegetation beyond the cleared limits of the ROW. The defined clearances cover all vegetation including natural growth, screens or buffers, orchards, ornamental plantings, nursery stock, and danger trees.

The minimum clearances applicable to woody vegetation are shown in the included figures.

1) Figure A; Minimum Conductor Clearances
2) Figure B; Danger Tree Clearance
3) Figure C; Conductor Clearance Zone, Side Zones and Structure Clearing Areas for New Construction

Where Orchards, ornamental plantings, or nursery stock is permitted by easement or license to exist, the maximum tree heights allowed within the conductor and side zones are shown in Figure A. Agreements with individual property owners may define site-specific maximum allowable tree heights and should be checked prior to scheduled maintenance activities.

Where rights exist beyond the edge of the ROW, any tree designated as a "danger tree," i.e. a tree that can fall within the dimensions noted in Figure B that is determined to be an imminent hazard will be removed at the discretion of the arborist. In sensitive areas adjacent to or within the ROW or where rights or other permission to remove danger trees cannot be obtained, arborists will direct the removal of those portions of the tree canopy projecting into the ROW, and those portions of a tree which, if they become detached, may fall within the minimum clearance distances as shown on Figure B. On side-hill ROW's, danger trees can be found significantly further from the conductors on the uphill side of the ROW.

3. Clearing for New Construction

This clearing consists of clear cutting four distinct areas of the ROW as defined by Figure C. These clearing areas are:

A. Basic clearing of the ROW width, which consists of a conductor clearance zone and side zones. Low-maturing woody shrub species are typically not removed from the side zones, and low maturing tree species such as Flowering Dogwood will be preserved where they do not conflict with construction needs.

B. Clearing at each structure location as required for construction equipment

C. Clearing the full length of all access road and spurs to structure sites for a cleared width of fifteen (15) feet

D. Removal of danger trees that pose an imminent risk to the new line along the new or existing clearing edge

For new line construction, in addition to the cleared area around each structure, a lay-down and assembly area may be required that is considerably larger. The size of this area depends upon topography, the type of structure to be assembled, and the type of foundation required at the site. Also at selected locations spaced several miles apart, setup sites for conductor-pulling equipment are required within the conductor zone and may require some removal of shrub growth.

The process to accomplish the clearing for new construction involves:

A. Field survey and stake the edge of the clearing limits and conductor zone

B. The NU "Owner's Representative" further reviews the survey staking before clearing begins

C. Where specified in an existing agreement with individual landowners, the Owner's Representative or his designee marks acceptable low growing trees they will attempt to retain within a side zone

D. The Owner's Representative contacts landowners before the clearing begins if they wish to discuss the clearing as marked out, and to ask if the property owner wishes to take ownership of the cut wood

E. Where the landowner will take the cut wood, an agreement will specify the contractor's placement of cut wood outside the ROW, or the landowner's schedule for removal if at a location within the ROW

F. Carry out the clearing operation

G. Cut using chain saws within wetland areas, and minimize the use of mechanized equipment for removal (note: mechanized equipment may be used to remove the logs and tree tops from a wetland by positioning equipment outside wetlands to drag out logs and tops using cables)

H. During or shortly after the initial clearing operation, an arborist will evaluate trees beyond the edge of the clearing limits to identify and mark danger trees that pose an imminent risk to the new line

I. The landowner will then be given an opportunity to discuss the danger trees marked for removal with the Owner's Representative who will then give instructions to the contractor

Contracts for clearing will be structured to effectively implement the above process and this standard. Despite efforts to minimize tree and other vegetation removal, there may still be locations where the transmission facility requirements and/or the existing vegetation conditions are such that no substantial vegetation may remain within the ROW limits.

4. Clearing for Structure Maintenance or the Replacement of an Existing Line

Clearing for structure maintenance or replacement of an existing line is similar to that for new line construction with the following exceptions:

A. Clearing needs depend on the relative location of the rebuilt line with respect to the existing maintained area of the ROW and the proposed construction method for installation of conductors and shield wires. These factors may reduce the needed clearing.

B. Structure site and access road clearing will still be required but may also be significantly reduced.

C. When structures from the old line are removed, the cleared area at these sites and the access spurs to them will be allowed to naturally re-vegetate with native plant species, which may include native grasses, forbs or shrubs.

5. Decision Responsibility for Retention of Non-standard Woody Vegetation

The transmission line Construction Manager and Contractor Arborist will be responsible for obtaining approval from the Transmission Supervisor, Vegetation Management before allowing vegetation to remain which conflicts with the clearances shown in Figures A, B, and C.

6. Approving Managers and SME

Dorian Hill
Manager Transmission Line and Civil Engineering
Northeast Utilities

Peter Avery
Manager Transmission Line Construction and MTCE
Northeast Utilities

SME

Anthony Johnson III
Supervisor Transmission Vegetation Management
Northeast Utilities

7. Deviations

This standard sets forth the current NU 'best practices' for most applications of this subject matter. Therefore, deviation from this standard is generally not permitted. However, in unique instances a user may submit a written deviation request including justification to the listed Subject Matter Expert (SME). The SME must approve or deny the request in writing prior to the user commencing any non-standard activities. The SME may consult with his/her supervisor, co-SME if any and co-SME supervisor, and subsequently must copy any approval to them.

Revision History
Rev.0 – original issue
Rev. 1 – Clarified conductor zone and side zone definitions, and clearing practices to address NERC reliability requirements through strict conformance to the ISO-NE OP-3.

APPENDIX 1

SHRUB SPECIES ALLOWED TO REMAIN: (PARTIAL LIST)

COMMON NAME	GENUS/SPECIES
Arrowwood Viburnum	*Viburnum dentatum*
Bayberry	*Myrica pennsylvanica*
Blueberry - Highbush	*Vaccinium corymbosum*
Blueberry - Lowbush	*Vaccinium angustifolium & V. vacillans*
Brambles	*Rubus spp.*
Buttonbush	*Cephalanthus occidentalis*
Dogwood - Gray	*Cornus racemosa*
Dogwood - Redosier	*Cornus stolonifera*
Dogwood - Silky	*Cornus amomum*
Elderberry	*Sambucus spp.*
Hazelnut	*Corylus americana & C. cornuta*
Honeysuckle - Bush	*Diervilla lonicera*
Honeysuckle - Fly	*Lonicera canadensis*
Honeysuckle - Tartarian	*Lonicera tatarica*
Huckleberry	*Gaylussacia spp.*
Maple-leaf Viburnum	*Viburnum acerifolium*
Meadowsweet - Broad-leaved	*Spirea latifolia*
Meadowsweet - Narrow-leaved	*Spirea alba*
Mountain Laurel	*Kalmia spp.*
Oblong Fruited Juneberry	*Amelanchier bartramiana*
Oldfield Common Juniper	*Juniperus depressa*
Pasture Juniper	*Juniperis communis*
Running Shadbush	*Amelanchier stolonifera*
Sheeplaurel	*Kalamia augustifolia*
Spicebush	*Lindera benzoin*
Steeplebush	*Spirea tomentosa*
Sumac - Smooth	*Rhus glabra*
Sweetfern	*Comptonia peregrina*
Sweetpepperbush	*Clethra alnifolia*
Winterberry	*Ilex verticillata*
Witch Hobble	*Vburnum alnifolium*
Witherod	*Viburnum cassinoides*

APPENDIX 2

LOW-MATURING TREE AND SHRUB SPECIES ALLOWED TO REMAIN ALONG THE SIDE ZONES: (PARTIAL LIST)

All species listed above including:

Alder	*Almus spp.*
Dogwood - Alternate-leaved	*Cornus alternifolia*
Dogwood - Flowering	*Cornus florida*
Sumac - Shining	*Rhus copillina*
Sumac - Staghorn	*Rhus typhina*
Willows (except tree species)	*Salix spp.*
Witch-Hazel	*Hamamelis virginiana*

Figure A

Minimum Conductor Clearances

* All Other Woody Species		
Line Voltage	A (ft.)	B (ft.)
69 & 115 kV	12	11
230 & 345 kV	16	15

500kV

* Orchards		
Line Voltage	A (ft.)	B (ft.)
69 & 115 kV	14	11
230 & 345 kV	18	15

500kV

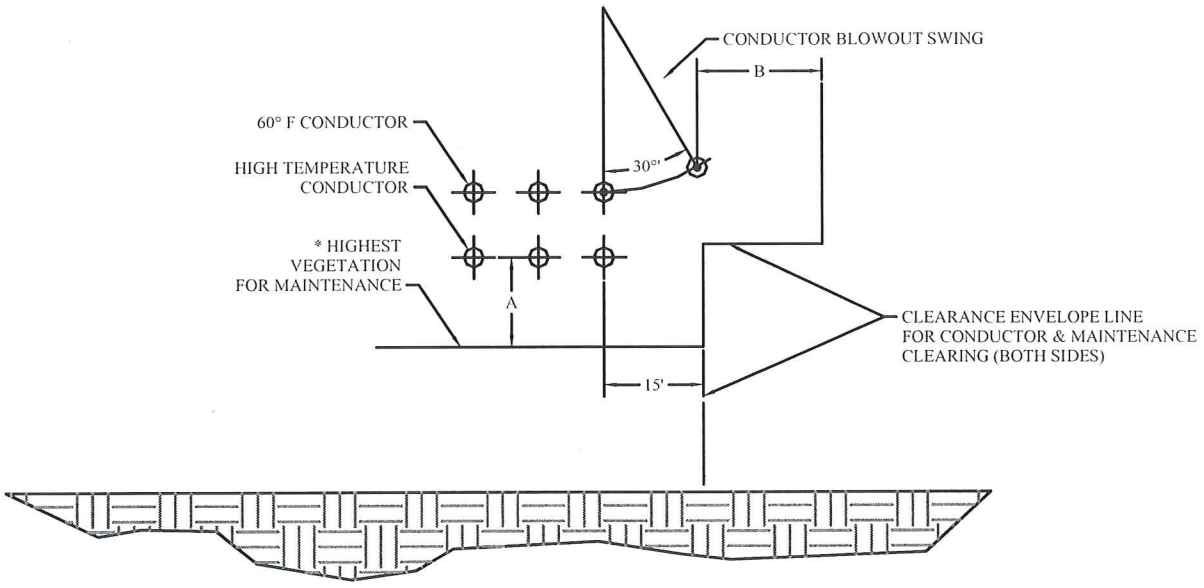


Figure A Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
Northeast Utilities Approved by: DEH, PJA	**Design and Application**	**OTRM** **030.008**	**Rev. 1** **05/16/2008**

Figure B

Danger Tree Clearances

Line Voltage	A (ft.)
69 & 115 kV	6
230 & 345 kV	10

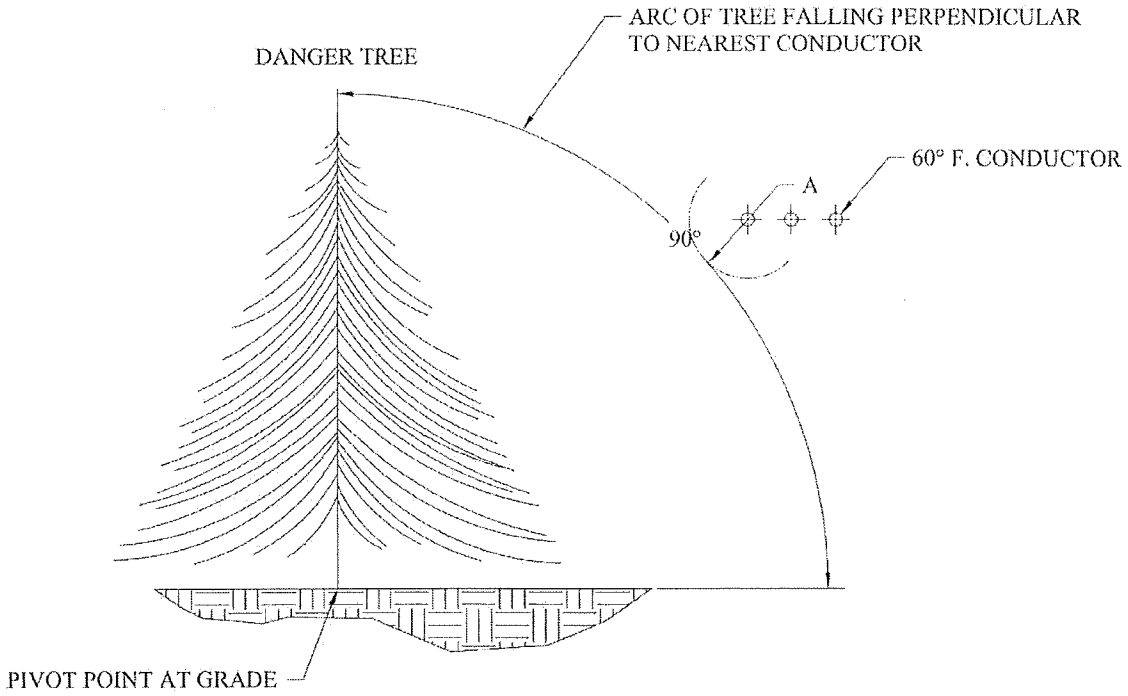


Figure B Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
Northeast Utilities Approved by: DEH, PJA	**Design and Application**	**OTRM** **030.009**	**Rev. 1** **05/16/2008**

Figure C

Conductor Clearance Zone, Side Zones
and Structure Clearing Areas for New Construction

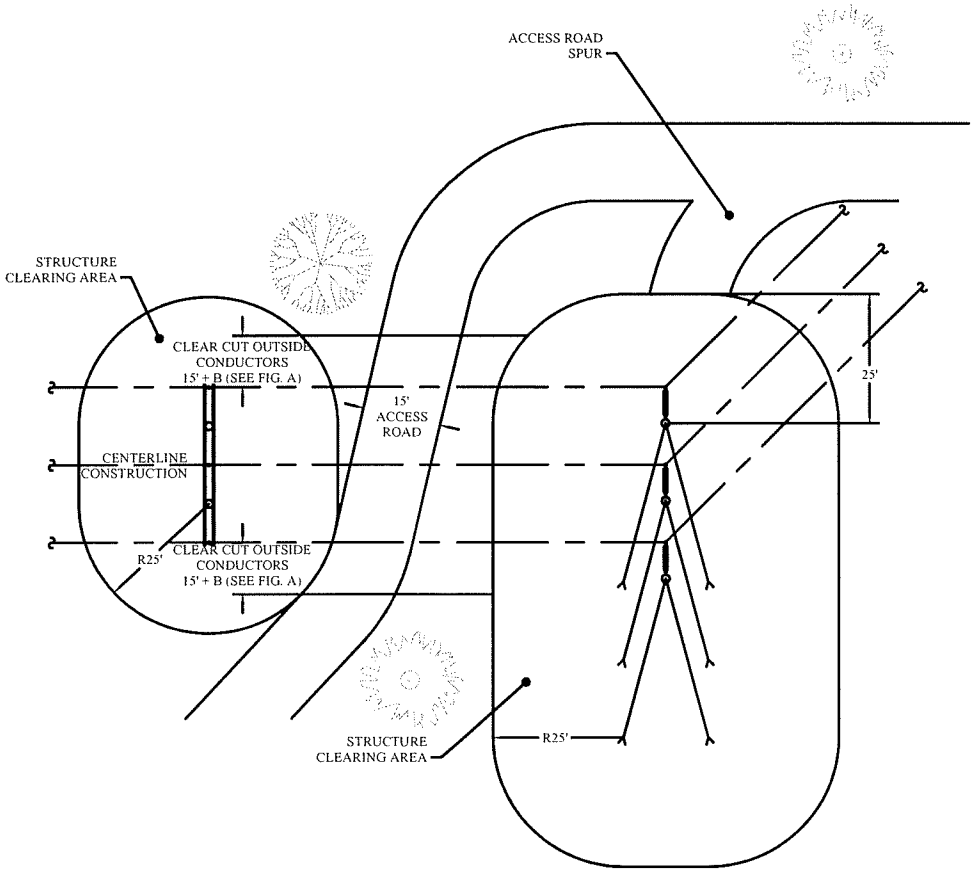
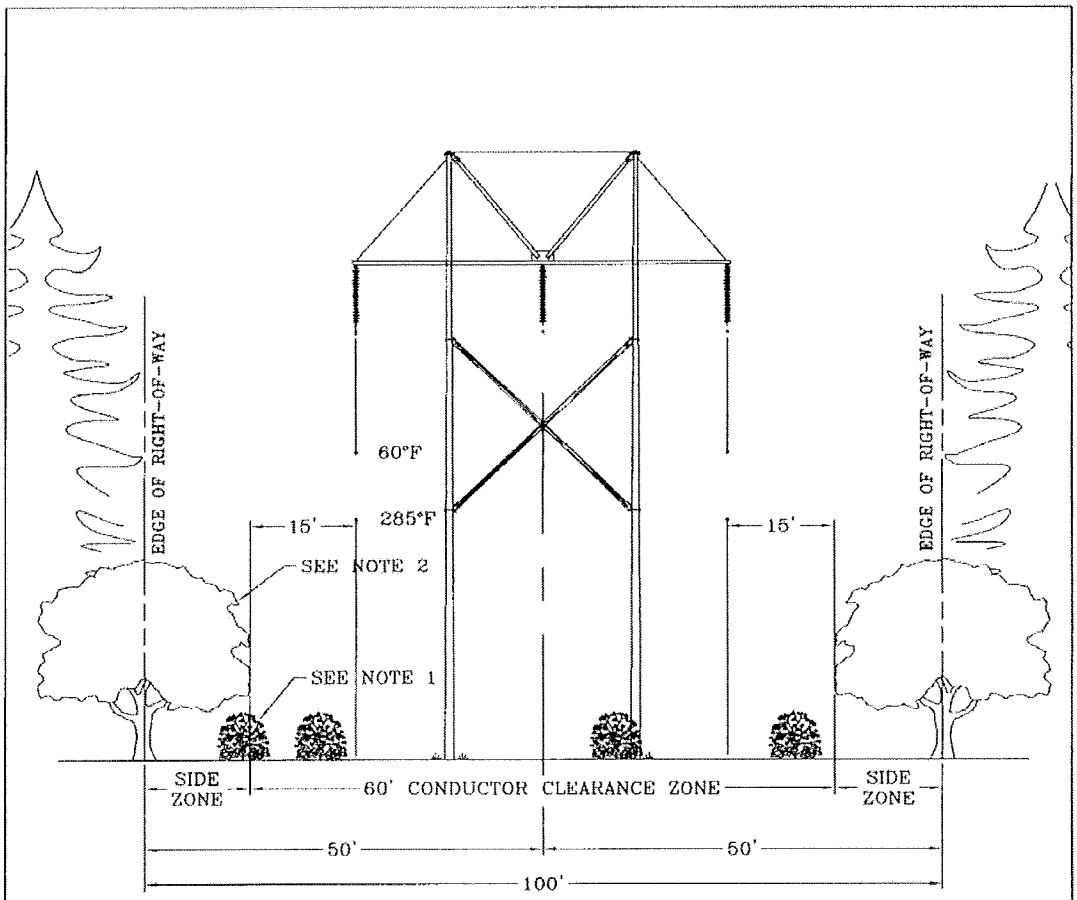


Figure C Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
Northeast Utilities Approved by: DEH, PJA	**Design and Application**	**OTRM** 030.0010	**Rev. 1** 05/16/2008



NOTES:
1) WOODY SHRUB SPECIES
2) LOW MATURING TREE SPECIES SUCH AS DOGWOODS ALLOWED OUTSIDE CONDUCTOR CLEARANCE ZONES.
3) ACTUAL DIMENSION TO R.O.W. EDGE VARIES. ADD UP TO 25' TO SIDE ZONE WHERE EXTRA RIGHT-OF-WAY EXISTS.

NORTHEAST UTILITIES SERVICE CO.

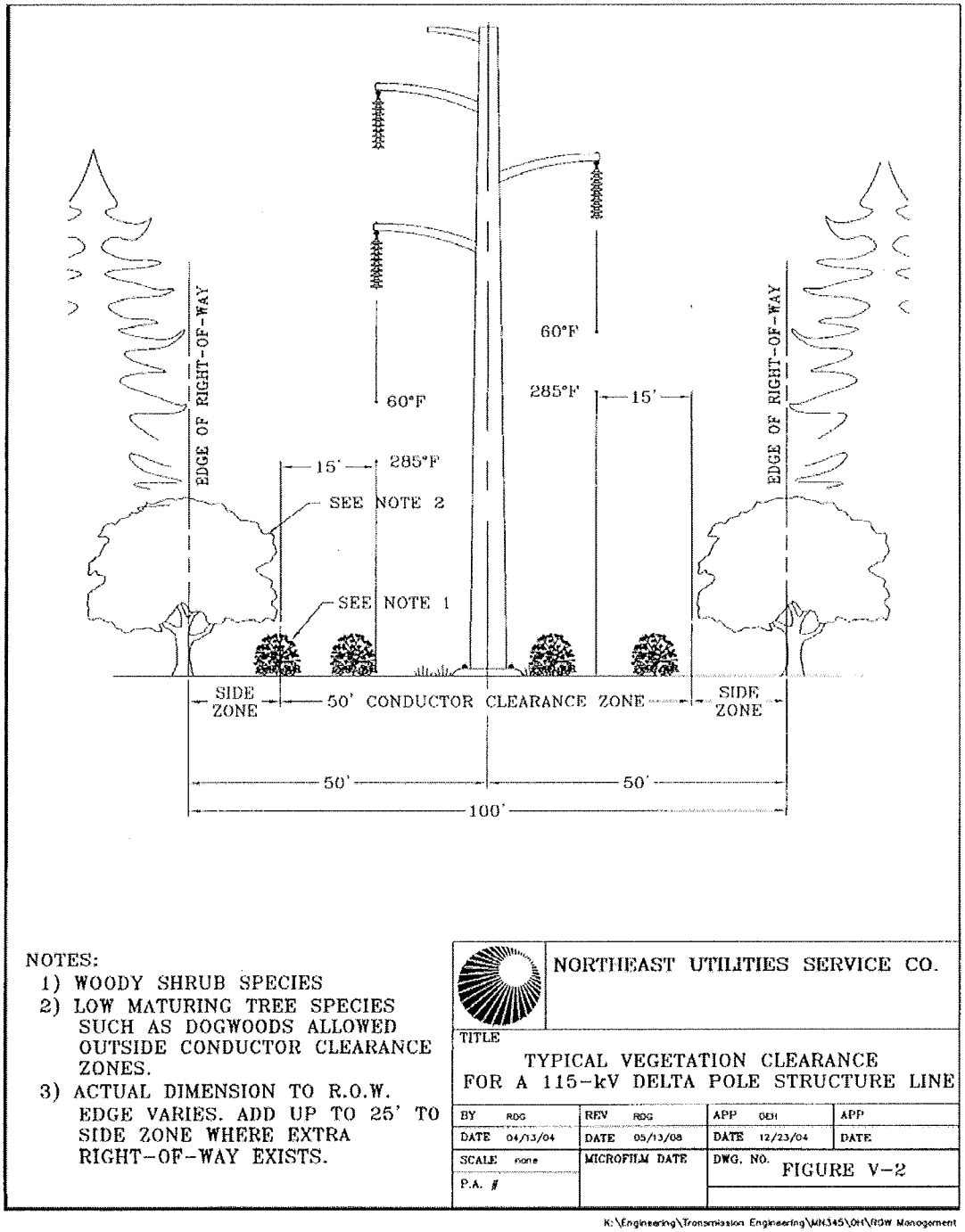
TITLE
TYPICAL VEGETATION CLEARING FOR A 115-kV H-FRAME STRUCTURE LINE

BY RDG	REV A	APP DEH	APP
DATE 04/13/04	DATE 05/13/08	DATE 12/23/04	DATE
SCALE NONE	MICROFILM DATE	DWG. NO. FIGURE V-1	
P.A. #			

K:\Engineering\Transmission Engineering\MN345\GH\ROW Management

Figure V-1
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines

Northeast Utilities Approved by: DEH, PJA	Design and Application	OTRM 030.0011	Rev. 1 05/16/2008



NOTES:
1) WOODY SHRUB SPECIES
2) LOW MATURING TREE SPECIES SUCH AS DOGWOODS ALLOWED OUTSIDE CONDUCTOR CLEARANCE ZONES.
3) ACTUAL DIMENSION TO R.O.W. EDGE VARIES. ADD UP TO 25' TO SIDE ZONE WHERE EXTRA RIGHT-OF-WAY EXISTS.

NORTHEAST UTILITIES SERVICE CO.

TITLE
TYPICAL VEGETATION CLEARANCE
FOR A 115-kV DELTA POLE STRUCTURE LINE

BY RDG	REV RDG	APP DEH	APP
DATE 04/13/04	DATE 05/13/08	DATE 12/23/04	DATE
SCALE none	MICROFILM DATE	DWG. NO. FIGURE V-2	
P.A. #			

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Figure V-2 Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
Northeast Utilities Approved by: DEH, PJA	**Design and Application**	**OTRM** 030.0012	**Rev. 1** 05/16/2008

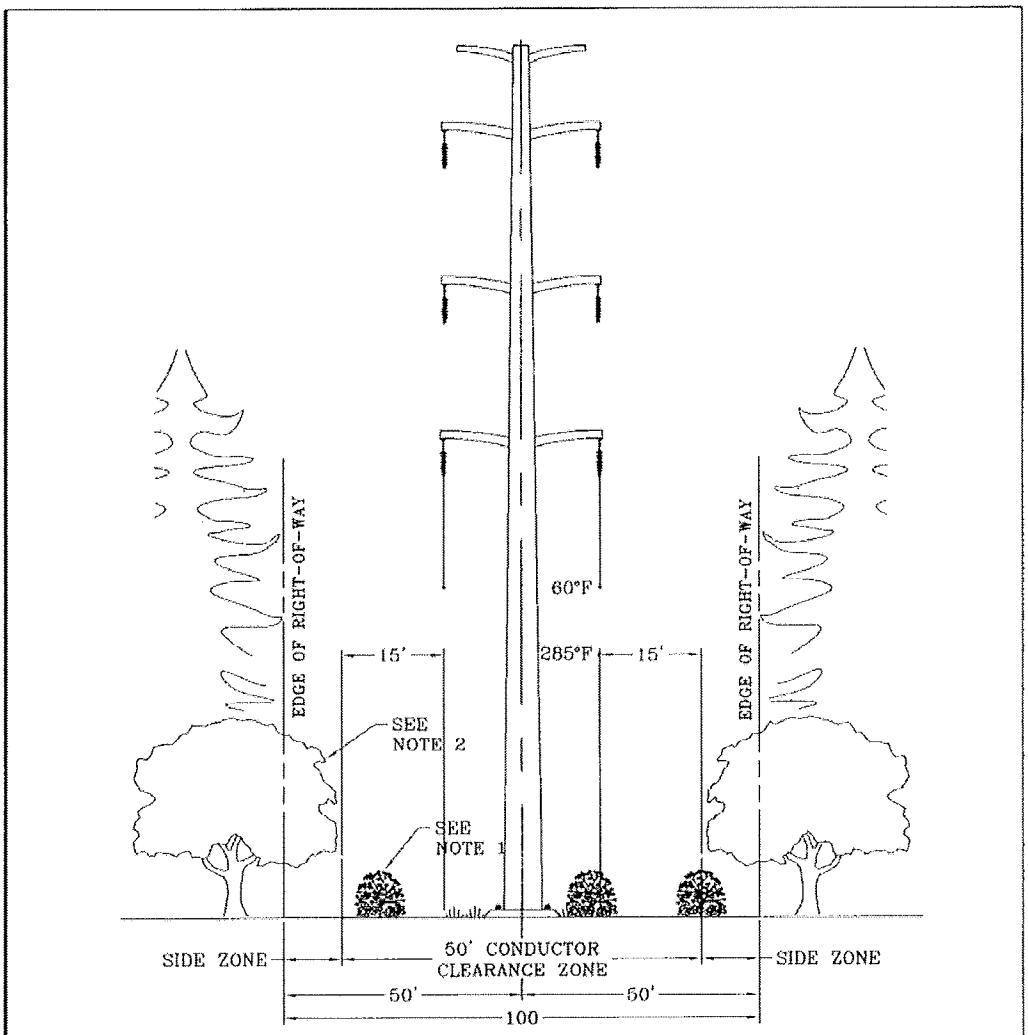
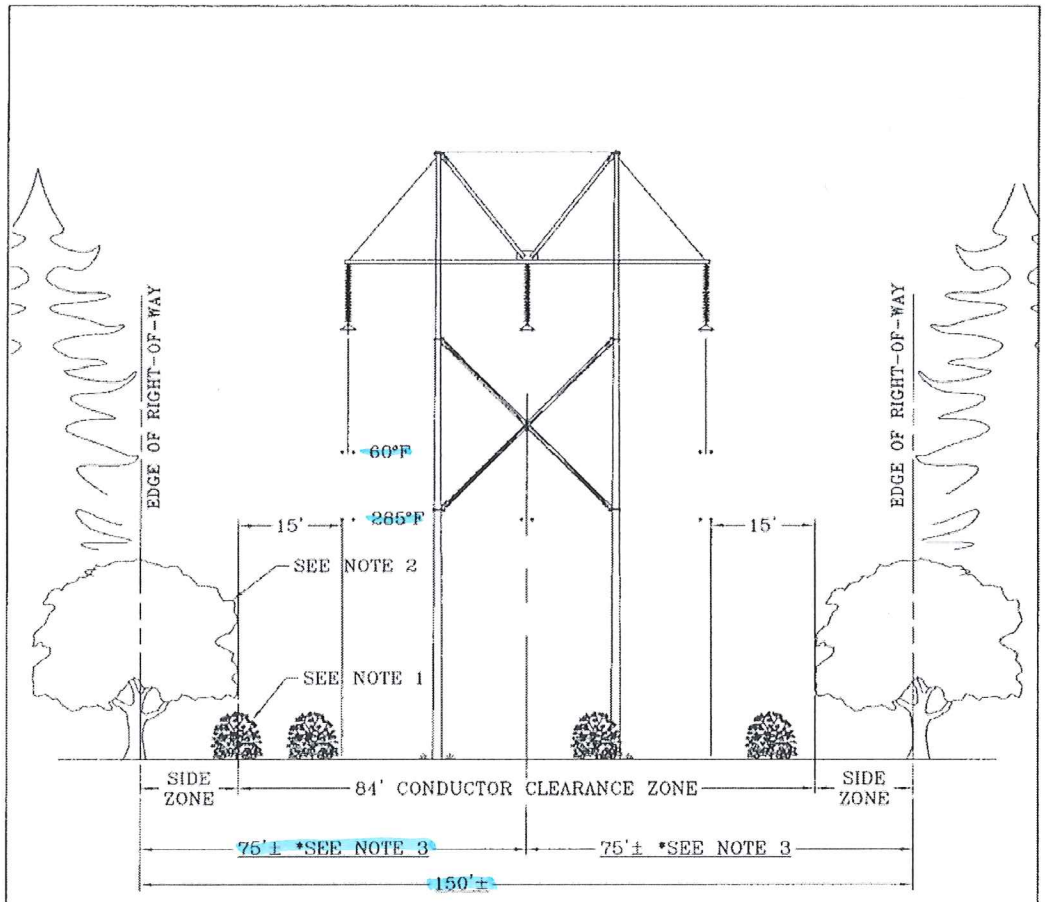


Figure V-3 Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines			
Northeast Utilities Approved by: DEH, PJA	**Design and Application**	**OTRM** **030.0013**	**Rev. 1** **05/16/2008**



NOTES:
1) WOODY SHRUB SPECIES
2) LOW MATURING TREE SPECIES SUCH AS DOGWOODS ALLOWED OUTSIDE CONDUCTOR CLEARANCE ZONES.
3) ACTUAL DIMENSION TO R.O.W. EDGE VARIES. ADD UP TO 25' TO SIDE ZONE WHERE EXTRA RIGHT-OF-WAY EXISTS.

NORTHEAST UTILITIES SERVICE CO.

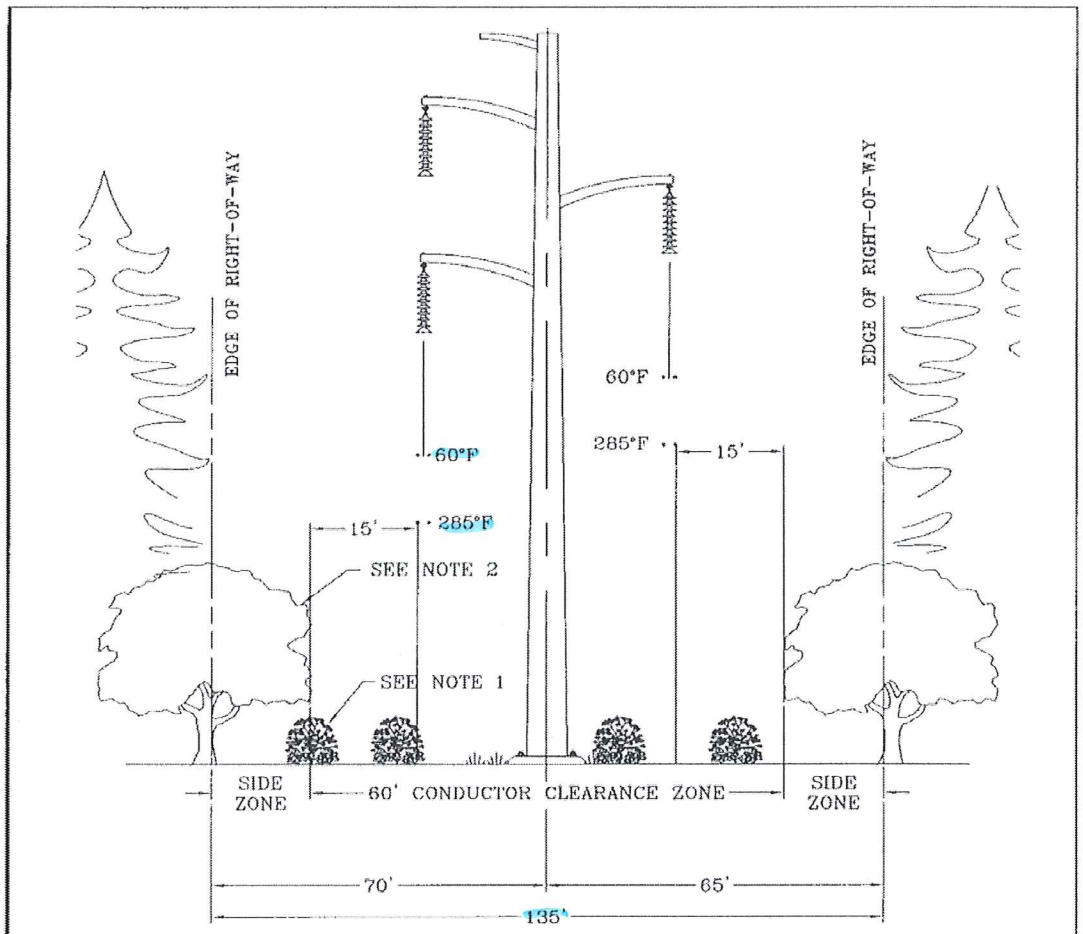
TITLE
TYPICAL VEGETATION CLEARING FOR A 345-kV H-FRAME STRUCTURE LINE

BY ROG	REV A	APP DEH	APP
DATE 04/13/04	DATE 05/13/08	DATE 12/23/04	DATE
SCALE NONE	MICROFILM DATE	DWG. NO. FIGURE V-4	
P.A. #			

K:\Engineering\Transmission Engineering\NN345\OH\ROW Management

Figure V-4
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines

Northeast Utilities Approved by: DEH, PJA	Design and Application	OTRM 030.0014	Rev. 1 05/16/2008



NOTES:
1) WOODY SHRUB SPECIES
2) LOW MATURING TREE SPECIES SUCH AS DOGWOODS ALLOWED OUTSIDE CONDUCTOR CLEARANCE ZONES.
3) ACTUAL DIMENSION TO R.O.W. EDGE VARIES. ADD UP TO 25' TO SIDE ZONE WHERE EXTRA RIGHT-OF-WAY EXISTS.

NORTHEAST UTILITIES SERVICE CO.

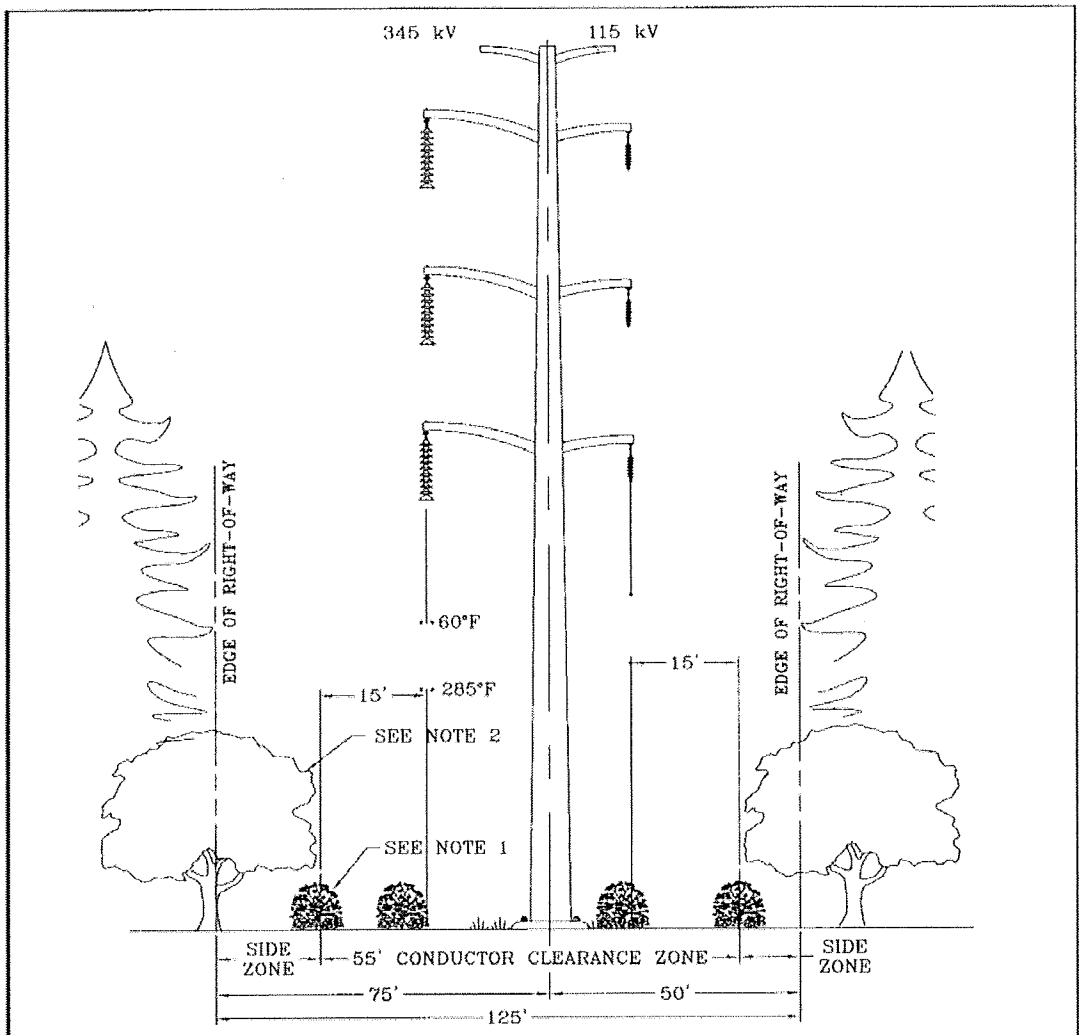
TITLE
TYPICAL VEGETATION CLEARING FOR A 345-kV DELTA POLE STRUCTURE LINE

BY RDG	REV RDG	APP DEH	APP
DATE 04/13/04	DATE 05/13/08	DATE 12/23/04	DATE
SCALE none	MICROFILM DATE	DWG. NO. FIGURE V-5	
P.A. #			

K:\Engineering\Transmission Engineering\MN345\OH\ROW Management

Figure V-5
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines

Northeast Utilities Approved by: DEH, PJA	Design and Application	OTRM 030.0015	Rev. 1 05/16/2008



NOTES:
1) WOODY SHRUB SPECIES
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NORTHEAST UTILITIES SERVICE CO.

TITLE
TYPICAL VEGETATION CLEARING FOR A 345/115-kV VERTICAL POLE STRUCTURE LINE

BY RDG	CHKD A	APP DEH	APP
DATE 04/13/04	DATE 05/13/08	DATE 12/23/04	DATE
SCALE none	MICROFILM DATE	DWG. NO. FIGURE V-6	
P.A. #			

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Figure V-6
Right-of-Way Vegetation Initial Clearance Standard for 115- and 345-kV Transmission Lines

Northeast Utilities Approved by: DEH, PJA	Design and Application	OTRM 030.0016	Rev. 1 05/16/2008

CONCLUSIONS

- While performing several iterations of these Right-of-Way (ROW) width calculations, it became evident that placing twice the number of structures required under normal transmission line design is the only way the applicant could get the proposed 100-foot ROW to meet the National Electric Safety Code (NESC). The proposed 100-foot ROW width would be acceptable with spans under 850 feet. Under any other transmission line scenario the engineer would use a ruling span length in access of 1500 feet, which would greatly reduce the number of structures.

- I made reference to other utilities' general ROW design practices in order to illustrate the minimum widths. Please note that not only do these utilities consider blowout, but they add a buffer and use the National Electric Safety Code to have an adder of 50" for surges or lightning strokes.

- Should you have any questions, concerns or comments regarding the contents of this reference calculation please do not hesitate to contact me at MXWI@deainc.com, or 503.499.1350.

TELEPHONE REPORT

DATE OF CALL:	August 9, 2010	ROUTING: (Name & Location)	
TIME OF CALL:	1330	1.	
CALL PLACED BY:	Patrick Lynch	2.	
CALL PLACED TO:	Steve Herling	3.	
TOPIC OF PHONE CALL:	PJM Interconnect plan to deal with PSEG not going on-line until 2015	4.	
FILE DESIGNATION:		5.	

DISCUSSION:

Today, I called Steve Herling of the PJM interconnect to gather his reaction to the statement of PSEG that because of the permits they need to have in hand, they will not be able to complete construction until 2015.

Mr Herling responded that PJM has two primary concerns in dealing with this issue. One, is the "delivery of energy" and two, "the distribution of that energy." To be able to meet those concerns, PJM, in concert with the power companies is developing a plan that will enable the companies to deliver and distribute energy from the period, 2012 to 2015. As of this date, that plan will "probably" include the stabilization and upgrade of several existing generators in the Roseland, NJ vicinity to meet the PJM needs. This plan must then be submitted to NERC for review and approval. If the plan is deemed "viable" by NERC, the companies should not be penalized.

I thanked Mr Herling for the info and he said "feel free to call my anytime on this project. The total time of the conversation was 5 minutes.

FOLLOW-UP ACTION REQUIRED?	YES _____ NO _____
FOLLOW UP ACTION TO BE TAKEN BY:	
FOLLOW-UP ACTION:	
DATE FOLLOW-UP ACTION COMPLETED:	
FURTHER COMMENTS OR PENDING REQUIREMENTS:	

Gregory J. Smith
Manager-Transmission Expansion

PPL Electric Utilities
Two North Ninth Street, GENN5
Allentown, PA 18101-1179

August 26, 2010

Mr. John J. Donahue
Superintendent
National Park Service
Delaware Water Gap National Recreation Area
Bushkill, PA 18324

Ms. Pamela Underhill
Superintendent
Appalachian National Scenic Trail
PO Box 50
252 McDowell Street
Harper's Ferry, WV 25425

Re: Construction of 500kV Transmission Line Within
PPL Electric Utility Corporation's Existing 100-Foot Right-of-Way

Dear Mr. Donahue and Ms. Underhill:

As you know, PPL Electric Utility Corporation ("PPL Electric") has submitted an application for both a right-of-way permit and a construction permit for the construction and operation of the proposed 500 kV Susquehanna to Roseland Project. As you are also aware, PPL Electric has existing easements rights in Pennsylvania that traverse the Delaware River Water Gap National Recreation Area ("DEWA"). Those easements grant PPL Electric the rights, among other things, to reconstruct its facilities.

There are some areas in the park where PPL Electric has rights that are of a width greater than 100-feet. However, there is an approximate .8 mile stretch where the National Park Service has taken the position that PPL Electric's easement rights are limited to a width of 100 feet.[1] This .8 mile stretch is the area where PPL Electric has requested a right-of-way permit for an additional 25 feet on each side of the existing right of way.

As part of the project, PPL Electric analyzed whether it could safely and reliably construct and operate a 500 kV transmission line pursuant to its existing

[1] PPL Electric maintains that it is not limited to 100 feet for reconstruction for all but one of the easements. However, it has chosen not to challenge the NPS determination on that issue. Therefore, for purposes of this letter it is assuming that the easements in question do limit its construction to within a 100-foot right-of-way.

easement rights, because doing so would eliminate the need for a right-of-way permit. PPL Electric has concluded that it can safely and reliably construct and operate a transmission line pursuant to its existing easement rights (for purposes of this letter, the "100-foot ROW alternative"). That 100-foot ROW alternative would have two more structures than the current proposal, primarily because of issues relating to the 100-foot width in the .8 mile area reference. The structure heights would be approximately the same height as currently proposed.

PPL Electric provided the details of the 100-foot alternative to your consultant, Dave Evans Associates ("DEA"). In initial discussions, DEA questioned whether the 100-foot ROW alternative could meet National Electric Safety Code ("NESC") standards. However, after further discussions, and after PPL Electric provided additional documentation and analysis on that issue, it is our understanding that DEA is in agreement with PPL Electric's position that the 100-foot ROW alternative would meet all NESC standards.

Subsequently, DEA raised additional issues relating to the construction and operation of the 100-foot ROW alternative, which are as follows:

1. Allowable conductor tension.
2. Effect of wind on conductor temperature.
3. PJM criteria.
4. Electric fields.

PPL Electric notes that except for number 3, the above issues are not related to the width of the right-of-way. With regard to number 3, guidelines are provided by PJM in the document, PJM DESIGN AND APPLICATION OF OVERHEAD TRANSMSISSION LINES 69KV AND ABOVE, dated 5/20/2002 and found on the PJM website. This document lists target right-of-way widths of 300 feet for double circuit 500 kV and 150 feet for single or double circuit 230 kV. Clarification is provided by PJM on the TRANSMISSION OWNERS GUIDELINES webpage with the statement

> Transmission Owner Technical Guidelines & Recommendations below, formerly were referred to as the "PJM TSDS Technical Requirements", as published by the PJM Transmission & Substation Design Committee (TSDS).
> The documents included here are still subject to PJM's review and may thus potentially change before being formally published pursuant to Section 1.2c of the PJM Open Access Transmission Tariff (PDF).
> These documents were originally developed for PJM by TSDS member companies when PJM's footprint matched the NERC MAAC Region (contributing companies included AE, BGC, DPL, JCPL, MetEd, PECO, PENELEC, PEPCO, PPL and PSEG.) Many of these companies often reference these documents for their Technical Requirements and Standards as defined in the PJM OATT. PJM now extends into multiple NERC regions. New members typically reference their own documents and therefore these documents no longer represent all of PJM. However, all PJM members are welcome to reference these documents.

And, additional clarification is provided by PJM on the TRANSMISSION OWNERS ENGINEERING AND CONSTRUCTION STANDARDS webpage with the statement

> Applicable engineering and construction standards are specified by each PJM Transmission Owner.

Thus, although PJM has guidelines for transmission line design, it is the Transmission Owners who have the final say, and responsibility for safe and reliable design of transmission lines. It is worth nothing that the currently proposed Susquehanna-Roseland 500 kV Transmission Line will be constructed within rights-of-way that vary from 150 feet to over 300 feet.

PPL Electric has concluded that none of the above items present any issues with respect to the 100-foot ROW alternative. In that regard, enclosed with this letter is a detailed analysis, including calculations, of each of the above items performed by Sargent & Lundy, LLC, the design engineer retained by PPL Electric as part of this project. In summary, that analysis concludes that the design proposed by PPL Electric relating to the 100-foot ROW alternative complies with any concerns raised by DEA.

In conclusion, PPL Electric maintains the design that has been provided for the 100-foot ROW alternative complies with all applicable regulations, including NESC and PJM criteria. Accordingly, the safe and reliable construction and operation of a 500kV transmission line within PPL Electric's existing easements, as demonstrated by the 100-foot ROW alternative, is feasible.

PPL Electric further notes that it, as the utility company providing electric transmission service in the area, has the obligation and responsibility to determine whether a transmission facility can be constructed and maintained in a safe and reliable manner. While PPL Electric appreciates comments and suggestions from DEA, ultimately it is PPL Electric that must determine whether such a facility can be constructed. As indicated above, in this case PPL Electric has determined that the 100-foot ROW alternative can be built safely and reliably.

Accordingly, PPL Electric maintains that the 100-foot ROW alternative should be included as one of the alternatives studied in the Environmental Impact Statement. Quite simply, failure to do so ignores a viable option that can be constructed without the acquisition of any right-of-way permit from the National Park Service.

Thank you for your time and attention.

Sincerely,

Gregory J. Smith
Manager-Transmission Expansion

Enclosure

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

SEP 10 2010

Mr. Keith O' Neal, Director
Division of Electric Reliability Standards
Office of Electric Reliability
Federal Energy Regulatory Commission
88 First Street NE
Washington DC 20426

Dear Mr. O' Neal:

The National Park Service (NPS) has been asked by two regional electric utility companies (PPL in Pennsylvania and PSE&G in New Jersey) to provide permits for access across NPS lands and for construction of an additional 500kV line within their existing Right-of-Way (ROW). The structures would be built to hold a double circuit 500kV line where in some areas the existing width of the ROW is only 100 feet. The ROW of concern runs for 4.2 miles through the Appalachian National Scenic Trail (APPA), Delaware Water Gap National Recreation Area (DEWA), and the Middle Delaware National Scenic and Recreational River (MDSR), all units of the NPS. To evaluate the permit request we are preparing an Environmental Impact Statement (EIS).

The regional electrical energy interconnect group, PJM, has issued a set of Technical Requirements (section V.A of PJM TSDS Technical Requirements dated May 20, 2002) that address the design and application of overhead transmission lines 69kV and above. On Table 1 (page 12) of this document, PJM lists the *requirements* and the *recommendations* for transmission line design parameters. Our question is, are these requirements and recommendations the standard within which the utility companies are mandated to work when siting and planning new transmission lines? Is compliance with these standards optional?

We look forward to your timely reply as we are trying to maintain a tight EIS schedule and this information is vital to our analysis.

Please feel free to contact us or Patrick Lynch of our staff at (570) 426-2428.

Sincerely,

John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6278

Enclosure

Cc:
Andrew Tittler, DOI Office of the Solicitor
Patrick Lynch, National Park Service, DEWA
Kara Deutsch, National Park Service, DEWA
Sarah Bransom, National Park Service, APPA
Amanda Stein, National Park Service, DEWA
Patrick Malone, National Park Service, DSC
Jennifer McConaghie, National Park Service, NER

Clint Riley, U.S. Fish and Wildlife Service
Pamela Shellenberger, U.S. Fish and Wildlife Service

Mr. Gregory Smith
Manager, Transmission Expansion
PPL Electric Utilities
Two North Street, GENN5
Allentown, Pennsylvania 18101-1179

Denver Service Center - TIC
Attn: SRLINE EIS
12795 W. Alameda Parkway
Denver, CO 80225-0287

V.A
PJM Design and Application of Overhead Transmission Lines 69kV and Above

These design criteria have been established to assure acceptable reliability of the bulk transmission system facilities. These set forth the design and service conditions, and establish insulation levels for transmission lines. Some of these parameters were based on requirements for the Keystone, Conemaugh, Susquehanna Eastern, or LDV EHV projects, and others were developed by consensus of the PJM transmission line owners. Specific component requirements are listed in their own sections (in addition to NESC the proposed IEC 61936 could be a good reference). The criteria listed are requirements for lines rated 230 kV and above, and are guidelines for lines below 230 kV.

PJM DESIGN OF
OVERHEAD TRANSMISSION LINES 69 kV AND ABOVE

1.0 SCOPE AND GENERAL REQUIREMENTS

1.1. This document sets forth the requirements and recommendations for the design of overhead electric transmission facilities.

1.1.1. Transmission lines, for the purpose of this document, are those with an operating voltage of 69kV or greater.

1.1.2. The term "TO" in this document refers to the Transmission Owner, the party that will own and be responsible for the maintenance of the subject transmission facility.

1.2. The design and operation of all transmission lines shall meet the requirements of the National Electrical Safety Code (ANSI/IEEE C-2) [NESC]. The edition of the NESC in effect at the time of the design shall govern.

1.3. The electrical and strength requirements of this document shall apply to all new transmission lines; and extensions, taps, or additions to existing transmission lines where the circuit length of the new construction is 1000ft or more.

1.4. The design of modifications to existing transmission lines; or extensions, taps, or additions to existing transmission lines where the circuit length of the new construction is less than 1000ft; shall meet the requirements used for the design of the existing line and shall meet the requirements of the latest edition of the NESC.

1.5. The designs of existing transmission lines may not in all cases meet these criteria. The existing lines themselves are excluded from the scope of this document. However, taps from or extensions to these existing lines are covered under the scope of this document.

1.6. Switch structures are not within the scope of this document. If a switch is to be mounted on a transmission structure, the structure design shall have adequate strength and rigidity to ensure the reliable operation of the line and switch.

1.7. Transmission structures supporting non-electric transmission facilities (telecommunications antennas, fiber-optic cables, etc.) shall be capable of resisting the structural loads resulting from these facilities within the strength requirements of this document. The locating of such non-electric facilities on transmission structures shall not jeopardize the operation, maintenance, and reliability of the transmission lines.

1.8. While this document provides detailed criteria for the design of transmission lines on the PJM system, these do not represent the only issues to consider in the design of such lines. Other issues must also be considered such as: maintenance, inspection, and repair on both the structures and the wires of these lines. This will ensure the reliability of the line at a minimal cost well into the future.

1.9. In some instances, the requirements or recommendations specified in this document may come into conflict with other issues such as permitting or local issues. These specifications may be adjusted and negotiated with the specific and written approval of the TO. The agreed negotiation of a relaxation of any specification for an individual project or circumstance does not automatically result in a subsequent revision in this guide. Subsequent instances must be addressed individually on a case-by-case basis.

1.10. The use of structure guys, and wood structures shall be approved by the TO.

2.0 CONDUCTORS

Conductors must be selected with sufficient thermal capability to meet continuous and emergency current ratings. Ratings of conductors applied to the PJM system should be determined using the PJM TSDS "Bare Overhead Transmission Conductor Ratings, November 2000".

The overhead line conductor and static wire should be chosen from those used by the TO. This provides the ability to quickly repair a section of line with utility stock material should an emergency arise. Standard transmission conductor types are ACSR, ACSR/AW, ACSS, and ACAR. Other conductor types will be reviewed by the TO.

The ambient temperature range listed in Table 1 covers the PJM system and is used for the electrical ratings of the conductors as well as the structural loads upon the towers or poles.

3.0 CONDUCTOR SAG & TENSION CRITERIA

3.1 Alcoa – Sag & Tension Common Point

The maximum tension case shall be allowed to default as the common point between the initial and final sag tables. No other common point shall be allowed. An example would be a common point based upon NESC Heavy conditions when calculated tensions for the 1-1/2" Heavy Ice case exceed those for the NESC case.

4.0 STRENGTH REQUIREMENTS

4.1. **Structure Types** – the following descriptions of structure types shall apply to the provisions for strength requirements

4.1.1. *Suspension Structure* – A structure where the phase conductors and static wires are attached through the use of suspension insulators and hardware or, in the case of the static wire, with a clamp not capable of resisting the full design tension of the wire.

4.1.2. *Strain Structure* – A structure where the phase conductors and static wires are attached to the structure by use of dead-end insulators and hardware but where the ability of the structure to resist a condition where all wires are broken on one side under full loading is not required or desired. Typically, strain structures would be used where the line deflection angle is 45 degrees or less. Structures subject to strain structure requirement shall be as identified by the Utility.

4.1.3. *Dead-end Structure* - A structure where the phase conductors and static wires are attached to the structure by use of dead-end insulators and hardware and where the ability of the structure to resist a condition where all wires are broken on one side under full loading is required or desired. Typically, dead-end structures would be used where the line deflection angle is greater than 45 degrees. Structures subject to dead-end structure requirement shall be as identified by the Utility.

4.1.4. *Line Termination Structure* – A structure where the phase conductors and static wires are to be installed on one side only for the purpose of terminating the line, usually at a substation or switchyard. This permanent dead-end condition is assumed in the application of all applicable loading conditions.

4.2. **Loading Definitions**

4.2.1. *Wind Pressure* – The pressure resulting from the exposure of a surface to wind. The pressure values provided are for wind acting upon objects with circular cross section. Pressure adjustments for other shapes shall be as set forth by the ASCE Guidelines for Electrical Transmission Line Structural Loading (ASCE Publication 74) [ASCE 74].

4.2.2. *Radial Ice* – Radial ice is an equal thickness of ice applied about the circumference of the conductors and static wires. Ice density is assumed to be 57 lbs per cubic foot. For the purpose of transmission line design, ice is not applied to the surface of the structure, insulators, or line hardware.

4.2.3. *Temperature* – Used for calculating conductor and static wire sag and tension.

4.2.4. *Transverse load* – Forces or pressures acting perpendicular to the direction of the line. For angle structures, the transverse direction is parallel to the bisector of the angle of the transmission centerline.

4.2.5. *Longitudinal load* – Forces or pressures acting parallel to the direction of the line. For angle structures, the longitudinal direction is perpendicular to the bisector of the angle of the transmission centerline.

4.2.6. *All wires intact* – A condition where all intended spans of conductors and static wires are assumed to be in place. In the case of a Line Termination Structure, conductor and static wire spans are only on one side of the structure.

4.2.7. *Broken Conductor or Static Wire* – A condition where one or more conductors or static wires are specified as broken. It is assumed that the broken conductor or static wire is in place on one side of the tower, and is removed from the other side. The span length for determination of loads from the conductor or static wire weight, wind pressure, and radial ice shall be not less than 60% of the design span length for the intact condition.

4.2.8. *Load Factor* – A value by which calculated loads are multiplied in order of provide increased structural reliability. For the purpose of structural design, Overload Capacity Factors as specified by NESC shall be considered Load Factors.

4.3. **Design Loading Conditions**

4.3.1. *NESC* – The provisions of the NESC Heavy Loading District, Class B Construction shall apply to all structure types. All wires intact. The latest NESC edition in effect at the time of line design shall apply. For informational purposes, the 1997 edition of NESC specifies the following requirements. Wind pressure – 4psf. Radial Ice – 0.5in. Temperature - 0°F. For the purpose of calculating conductor or static wire tensions, a load constant of 0.3lbs shall be added to the resultant of the per linear foot weight, wind, and ice loads on the conductor or static wire. For steel structures, the load factor for wind load is 2.50; the load factor for vertical loads (dead weight and ice) is 1.50; and the load factor for conductor and static wire tension is 1.65. The associated factors for wooden transmission line structures shall be obtained from the TO.

4.3.2. *Extreme Wind Loading Condition* – Applies to all structure types. All wires intact.

4.3.2.1. *Line voltage 230kV and greater.* Wind pressure applied to the wires shall be 25psf. The ambient temperature is to be 60°F. The wind pressure applied to the structure shall be 31.25psf. Load factor is 1.00.

4.3.2.2. *Line voltage less than 230kV.* The provisions of the NESC Extreme Wind loading shall be applied, subject to a minimum wind pressure of 17psf. The load factor is 1.00. The provision in NESC permitting exclusion of structures less than 60ft in height from extreme wind criteria shall not apply.

4.3.3. *Heavy Ice Loading Condition* – Applies to all structure types. All wires intact.

4.3.3.1. *Line voltage 230kV and greater.* Radial ice thickness on the wires only is to be 1.50in. No wind pressure. Temperature is 32°F. Load factor is 1.00.

4.3.3.2. *Line voltage less than 230kV.* Heavy ice loading (if any) shall be as specified by the TO. Ice loading will not be more severe than that required for voltages 230kV or greater.

4.3.4. *Longitudinal Loading Conditions for Suspension Structures* (line voltage 230kV or greater) – The TO will specify one or more of the following loading conditions for design of Suspension Structures.

4.3.4.1. *One broken conductor or static wire.* Any one phase conductor or static wire is assumed broken. For construction using bundled phase conductors, one subconductor of any one phase bundle shall be assumed broken, the other subconductor(s) of that phase shall be assumed intact. All other conductors and static wires are intact. Loading condition is NESC Heavy. The longitudinal load shall be the tension of the broken static wire or broken conductor or subconductor. Tensions shall not be reduced by assumed insulator swing. For the intact phases and static wires, the wind on the structure, and the structure dead weight, the NESC load factors shall apply. For the broken static wire or the phase with the broken conductor or broken subconductor, the load factor shall be 1.10.

4.3.4.2. *Differential Ice Loading.* All wires intact. No Wind. Temperature 32°F. All conductors and static wires on one side of the structure shall be assumed to have 1.0in radial ice. All conductors and static wires on the other side of the tower shall be assumed to have no ice. The determination of differential tension may include calculated swing of suspension insulator or static wire assemblies. Load factor 1.10.

4.3.4.3. *Bound stringing block* – All wires intact. 2psf wind. No ice. 30°F. Any one static wire or phase conductor (or all subconductors of any one phase) are assumed to bind in a running block during installation. The block is assumed to swing 45° in-line. This swing will result in a longitudinal load equal to the calculated vertical load of the static wire or phase conductor(s) under this loading condition. Load factor is 2.00.

4.3.5. *Longitudinal Loading Conditions for Strain Structures* – The TO will specify one or more of the following loading conditions for design of Strain Structures.

4.3.5.1. *One broken conductor or static wire.* Any one phase conductor or static wire is assumed broken. For construction using bundled phase conductors, one subconductor of any one phase bundle shall be assumed broken, the other subconductor(s) of that phase shall be assumed intact. All other conductors and static wires are intact. Loading condition is NESC Heavy. The longitudinal load shall be the tension of the broken static wire or broken conductor or subconductor. For the intact phases and static wires, the wind on the structure, and the structure dead weight, the NESC load factors shall apply. For the broken static wire or the phase with the broken conductor or broken subconductor, the load factor shall be 1.10.

OR

4.3.5.2. *All conductors and static wires broken.* Loading condition is NESC Heavy. Load factor is 1.00.

4.3.6. *Longitudinal Loading Condition for Dead End Structures* – All conductors and static wires are to be intact on one side of the structure only. Loading condition is NESC Heavy. Load factors are those specified by NESC.

4.3.7. *Longitudinal Loading Condition for Line Termination Structures* – Conductors and static wires are to be intact on one side of the structure only. All loading conditions and load factors set forth by Section 4.3.1, 4.3.2, and 4.3.3 shall apply.

4.3.8. *Foundation Loading* – The ultimate strength of overturning moment and uplift foundations shall be not less than 1.25 times the design factored load reactions of the structure. The ultimate strength of foundations subjected to primarily to compression load shall be not less than 1.10 times the design factored load reactions of the structure. Overturning moment foundations designed by rotation or pier deflection performance criteria shall use unfactored structure reactions for determination of the foundation performance, but shall use factored reactions for the 1.25 time ultimate strength check.

4.3.9. *Personnel Support Loading* – Structures shall be designed to support a point load of 350 lb at any point where a construction or maintenance person could stand or otherwise be supported.

5.0 ELECTRICAL DESIGN PARAMETERS

5.1 **Right-Of-Way Width**

The transmission line is to be designed with adequate right-of-way width to provide access for line maintenance, repair, and vegetation management as shown in Table 1. These widths are based upon the listed number of circuits on the right-of-way. For additional circuits, a wider right-of-way should be utilized.

Vehicle or other means of access to each structure site is required for both construction and maintenance activities.

5.2 **Wire to Ground Clearance**

The minimum allowed clearance between the lowest transmission line conductor(s) shall meet the required NESC minimum plus a safety envelope of 3 feet. (The safety envelope is required to allow for sag and clearance uncertainties due to: actual conductor operating temperature, conductor sagging error, ground topography accuracy, plotting accuracy and other sources of error. The inclusion of a safety envelope is considered to be prudent). The NESC minimum shall be calculated with the conductor at maximum operating voltage and the maximum operating temperature or maximum conductor loading. The minimum clearances should take into account the limitation of a 5 mA shock current as given in NESC Rule 232D3c. All areas beneath the line shall be assumed to allow vehicle access beneath the line. For agricultural areas that may utilize farming equipment, additional clearance will be provided to assure public safety and line reliability during the periods of farming and harvesting activities.

5.3 **Wire to Signs, Structures, etc Under the Wires**

The minimum allowed clearance between the lowest transmission line conductor(s) shall meet the required NESC minimum plus a safety envelope of 3 feet. The NESC minimum shall be calculated with the conductor at maximum operating voltage and the maximum operating temperature.

5.4 **Wire to Structure Clearances**

The minimum clearances between the phase conductors and the supporting tower or pole shall not be less than shown in Table 1. These clearances are to apply for all anticipated conductor positions from an every day condition to a displaced condition due to a 9-psf wind or ice loading. These clearances do not have any adders provided for birds or other animals, but are based upon the switching surge values listed in Table #1.

5.5 **Wire-to-Wire Clearances**

Clearance between the bottom transmission conductor and any lower wire shall meet the required clearance of NESC Rule 233 and 235as a minimum. When the lower wire is a non transmission wire, then the clearance should be at least 10 feet for voltages less than or equal to 230 kV, and 20 feet for voltages above 230 kV. This will allow safe personnel access to the non-transmission conductors. These clearances should be calculated with the transmission conductor at maximum operating temperatures or heavy ice, whichever provides greater conductor sag, and the non-transmission conductor at 0°F.

Clearances between transmission conductors should be either the larger of clearances based upon switching surges, or clearances based on the NESC. The per unit switching surges to use for the calculation are shown in Table #1.

Using switching surge values, the method used to determine the actual required clearance is given in section 5 of the EPRI Transmission Line Reference Book 115 kV - 138 kV Compact Line Design.

For transmission conductors of different circuits, the clearances should be increased so that any wind induced dynamic conductor movement does not result in any breaker operations and subsequent reduction in transmission circuit reliability.

5.6 **Conductor Operating Temperature and Conductor Sag**

The conductor will be assumed to operate at or above the minimum temperature shown below, and at temperatures less than the maximum shown below. While the line conductor may be designed to operate at a lower temperature, the line must be sagged assuming the conductor temperature is at or above the minimum shown. For designed operating temperatures above the minimum shown, and still below the maximum, the line sag and clearances will be calculated for that operating temperature after rounding up to the nearest 10°C. In no case will a conductor operating temperature be allowed above the maximum shown in the table. Refer to the PJM "Bare Overhead Transmission Conductor Ratings" for the ampacity and temperatures of conductors.

Conductor Type	Minimum Conductor Operating Temperature for Sagging and Clearance Purposes	Maximum Operating Temperature
ACAR	100°C	140°C
ACSR, ACSS	125°C	180°C

Consult with the local transmission utility for the maximum operating temperature since some companies use slightly different values. Higher values for ACSS conductors may only be used with specific approval from the TO. Studies of the long-term high temperature operation of all conductor-connected hardware must be investigated prior to the request for approval from the local transmission utility.

5.7 **Insulation Requirements**

The insulation system for the transmission line shall have values in excess of the leakage distance, 60 Hz wet, and Critical Impulse flashover specified in Table 1. These values shown are minimum conditions and may need to be increased in specific locations such as coastal environments, industrial smokestack sites, or high altitudes. (BIL values are not included here as they are associated with substation insulation and not transmission line insulation,)

5.8 **Lightning Performance and Grounding**

All transmission structures will be individually grounded through a dedicated earth driven grounding system composed of ground rods and / or buried counterpoise. This system is to be measured on each individual structure prior to the installation of any overhead conductors or wires. The maximum acceptable resistance measurement of this grounding system for voltages up to and including 230 kV is 25 Ohms, and 15 ohms for voltages 345 kV and greater. The grounding system may include radial counterpoise wires, equipotential rings, or both. The TO must approve all grounding methods, and connections to the grounding system that are below grade. These resistance requirements are to assure acceptable lightning performance on the line as well as provide for the safe grounding of the line by construction and maintenance forces.

Individual tower grounding measurements will be allowed to exceed the 25 or 15 Ohms required only if the average value for the 5 adjacent structures along the line is less than the 25 or 15-Ohm restriction.

To assure acceptable lightning performance, a shield wire is required above each transmission line. The number of shield wires and the maximum shielding angles between the shield wire and phase conductor are shown in Table 1. Each new structure design is to be analyzed using the EPRI MULTIFLASH or equivalent software to determine that the line design and actual grounding design provides the required lightning performance shown in Table 1.

In instances where it is very difficult to provide the required lightning performance, the TO may grant permission to utilize a limited application of transmission lines arresters. In no case will chemical ground treatments be allowed to improve structure grounding.

5.9 **EMF, RFI, TVI, and Audible Noise**

The transmission line system is to be designed so that radio and TV interference is just perceptible at the edge of the right-of-way. This is typically the case with radio signal to noise ratios above 20 db, and TV signal to noise ratios above 40 db. The achievement of this level of performance is more of a problem for lines above 230 kV, so a radio frequency survey and investigation should be performed to measure actual radio and TV signal strength and calculate the signal to noise ratio.

Audible noise at the edge of the right-of-way should be calculated for the designed transmission line using wet conductor as the design condition. The resultant noise level must not exceed the level limited by the state and local authorities. Typically the limitation is 55 dbA during the daylight hours, and 50 dbA at night.

Electric and Magnetic Field (EMF) levels are to be calculated using the EPRI ENVIRO or equivalent software and compared to any state or local limits. Modifications are to be made through phasing, structure height, ground clearance, etc. to assure these limitations are met. If no specific limitations exist, the line should be designed to the level of EMF on and adjacent to the right-of-way. A typical example of such an effort is the appropriate choice of phasing on the right-of-way.

5.10 **Inductive Interference**

A study should be done to determine the inductive impact upon other utilities due to the power flow in the new transmission line. The power flow may induce unusual currents and voltages in magnetic and electrical conductors that run parallel to the transmission line.

When it is determined that the currents or voltages are being induced in nearby utilities or other facilities, the engineer for the new or modified line being constructed must take the appropriate corrective actions to eliminate or lower the currents or voltages to an acceptable level.

5.11 **Line Transpositions**

The transmission line designer may be required to transpose the geometry of a new transmission line if the voltage imbalance exceeds the tolerance of the TO at the substations the line connect s to. If transpositions structures are required, they shall be designed to provide for easy routine maintenance of the structure.

5.12 **Line Crossings**

Line crossings should be avoided if possible, but when line crossings are unavoidable they should be configured such that the most important circuits to the transmission network are on top. Additionally, crossings must be configured such that a single component failure will not outage more than one other circuit (beyond the circuit with the failed component). This is in accordance with MAAC Criteria.

6.0 OTHER DESIGN PARAMETERS

6.1 Line Cascade Mitigation

Transmission line failures that cascade beyond the original structural failure must be avoided. To accomplish this, the design of a new or modified line shall incorporate dead-end strain structures routinely employed along the line. An alternative is to utilize suspension structures that are longitudinally guyed to resist full line tension if all wires on one side were broken. For wood construction, the strain structures shall also have in-line storm guys utilized to provide the structural strength. The line tensions assumed for this condition are the NESC Heavy loadings on one side of the structure as defined above, and no tension on the other. The structures shall be placed routinely along the line to resist a line cascade, but in no case shall these structures be placed farther than 5 miles apart.

6.2 Corrosion Protection

Corrosion protection will be evaluated for all buried structural steel on transmission structures. This covers buried grillage, driven caissons, etc. The line designer will submit a recommendation to the TO for the corrosion mitigation method to be used for buried structural steel. The proposed method must show at least a 50 year durability before any degradation of structural strength is allowed. It is acceptable to include systems that require some routine maintenance such as cathodic protection using buried sacrificial anodes.

Above grade steel will be protected from corrosion using a coating acceptable to the TO. Typical alternatives that have been used include weathering steel, galvanized steel, or painted steel.

6.3 Climbing Devices

6.3.1 Steel pole structures shall utilize climbing ladders. The TO shall specify the requirements and placement of the climbing ladders.

6.3.2 All steel towers shall be designed with step bolts as the provision for climbing. The TO shall specify the requirements and placement of the step bolts.

7.0 MAINTENANCE

For maintenance see section V.L.2.A

TABLE 1
Transmission Line Design Parameters

Parameter	Requirements			Recommendations		
	500 kV	345 kV	230 kV	138 kV	115 kV	69 kV
Ambient Temperature Range	-30°C to +40°C (from –40°C N & W of Blue Mountain)			-30°C to +40°C (from –40°C N & W of Blue Mountain)		
Minimum Extreme Wind Loading	25 PSF		**New Line** NESC Figure 250-2 or a minimum wind pressure of 17 psf. **Existing Line** **Larger of**: NESC Figure 250-2 **OR** the original line design parameters	New Line: NESC Figure 250-2 Existing Line: **Larger of**: NESC Figure 250-2 **OR** the original line design parameters		
Heavy Ice Load (No Wind)	1½"			Consult the TO for applicable heavy ice loading requirements		
Code Requirements	NESC Grade "B" Heavy			NESC Grade "B" Heavy		
Flood Plain	The line shall meet the applicable Local, State and Federal regulations.			The line shall meet the applicable Local, State and Federal regulations.		
Sag and tension Calculation Method	Alcoa Sag & Tension Software or equivalent			Alcoa Sag & Tension Software or equivalent		
Damper Requirements	<18% RBS (No dampers Required) 18% -20% RBS (Dampers Required)			<18% RBS (No dampers Required) 18% -20% RBS (Dampers Required)		
Galloping Mitigation	Provide adequate clearance so that 12" of clearance exists between wire galloping ellipses to minimize conductor or structure damage. The TO may revise this requirement for areas with significant galloping history.			Provide adequate clearance so that 12" of clearance exists between wire galloping ellipses to minimize conductor or structure damage. The TO may revise this requirement for areas with significant galloping history.		
Spacers	18" spacing - NO Preformed wire spacers allowed.			18" spacing - NO Preformed wire spacers allowed.		
Provisions for Live Line Maintenance	As required by the TO.			As required by the TO.		
Access Requirements	Construction and maintenance access is required to each structure.			Construction and maintenance access is required to each structure.		
Approved conductor sizes for NEW Construction	Match approved conductor sizes and bundle configuration with local utility company			Match approved conductor sizes and bundle configuration with local utility company		

TABLE 1
Transmission Line Design Parameters

	Requirements			Recommendations		
Parameter	**500 kV**	**345 kV**	**230 kV**	**138 kV**	**115 kV**	**69 kV**
Approved static and OPGW wire sizes for NEW Construction	Match approved conductor sizes with the TO.			Match approved conductor sizes with the TO.		
Right-of-way width (Target values)	200 Ft. – 1 ckt. 300 Ft.(min.) – 2 ckts	170 Ft – 1 ckt	150 Ft 1 & 2 ckts	100 Ft 1 & 2 ckts	100 Ft 1& 2 ckts	60 - 100 Ft
Max. Number of circuits per structure	1 unless specifically approved by TO		2 unless specifically approved by TO	2 unless specifically approved by TO		
Min. design ground clearance at Max. Sag	NESC minimum requirements PLUS an additional 3 feet			NESC minimum requirements PLUS an additional 3 feet		
Conductor to structure steel clearance (min.)	125 in.	91 in.	69 in.	52 in.	42 in.	28 in.
Insulation Requirements						
Leakage distance	360 in.	250 in.	167in.	100 in.	83 in.	50 in.
60 Hz WET	950 kV	635 kV	490 kV	375 kV	295 kV	170 kV
Switching Surge	2.2 per unit.	2.4 per unit	2.5 per unit	3.0 per unit	3.0 per unit	3.5 per unit
Critical Impulse Flashover	2145 kV	1440 kV	1105 kV	860 kV	670 kV	440 kV
Maximum Structure Ground Resistance	15 Ohms	15 Ohms	25 Ohms	25 Ohms		
Step & Touch Potential Issues	Provide a structure grounding system that meets the step and touch requirements of the TO.			Provide a structure grounding system that meets the step and touch requirements of the TO.		
Minimum Number of Static Wires Required	Minimum of 1 per **circuit**			Minimum of 1 per **structure**		
Isokeraunic Level	40			40		
Maximum Shielding Angle	15°	20°	25°	30°	30°	30°
Target Lightning Outage Performance	1.0 per 100 ckt mi. / yr	1.0 per 100 ckt mi. / yr	2.0 per 100 ckt mi. / yr	3.0 per 100 ckt mi. / yr	3.0 per 100 ckt mi. / yr	4.0 per 100 ckt mi. / yr
EMF Limits	As Required by TO and State Regulatory Agencies			As Required by TO and State Regulatory Agencies		
Radio Interference at edge of right-of-way	300 µV @ 1 MHz (350 kV to gnd)	300 µV @ 1 MHz (230 kV to gnd)	No limits specified	No limits specified		
Audible Noise	Per applicable state laws for noise at edge of right-of-way			Per applicable state laws for noise at edge of right-of-way		

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

SEP 13 2010

Mr. Steve Herling, Vice President
PJM Interconnection L.L.C.
955 Jefferson Avenue
Valley Forge Corporate Center
Norristown, Pennsylvania 19403-2497

Dear Mr. Herling:

The National Park Service (NPS) has been asked by two regional electric utility companies (PPL in Pennsylvania and PSE&G in New Jersey) to provide permits for access across NPS lands and for construction of an additional 500kV line within their existing Right of Way (ROW). The structures would be built to hold a double circuit 500kV line where in some areas the existing width of the ROW is only 100 feet. The ROW of concern runs for 4.2 miles through the Appalachian National Scenic Trail (APPA), Delaware Water Gap National Recreation Area (DEWA), and the Middle Delaware National Scenic and Recreational River (MDSR), all units of the NPS. To evaluate the permit request we are preparing an Environmental Impact Statement (EIS).

We have a question regarding PJM's Technical Requirements that address the design and application of overhead transmission lines 69kV and above (section V.A of PJM TSDS Technical Requirements dated May 20, 2002). On Table 1 (page 12) of this document, PJM lists the *requirements* and the *recommendations* for transmission line design parameters. Our question is, are these requirements and recommendations the standard within which the utility companies are mandated to work when siting and planning new transmission lines?

We look forward to your timely reply as we are trying to maintain an efficient EIS schedule and this information is vital to our analysis.

Please feel free to contact us or Patrick Lynch of our staff at (570) 426-2428.

Sincerely,

John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6278

Enclosure

Cc:
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V.A
PJM Design and Application of Overhead Transmission Lines 69kV and Above

These design criteria have been established to assure acceptable reliability of the bulk transmission system facilities. These set forth the design and service conditions, and establish insulation levels for transmission lines. Some of these parameters were based on requirements for the Keystone, Conemaugh, Susquehanna Eastern, or LDV EHV projects, and others were developed by consensus of the PJM transmission line owners. Specific component requirements are listed in their own sections (in addition to NESC the proposed IEC 61936 could be a good reference). The criteria listed are requirements for lines rated 230 kV and above, and are guidelines for lines below 230 kV.

PJM DESIGN OF
OVERHEAD TRANSMISSION LINES 69 kV AND ABOVE

1.0 SCOPE AND GENERAL REQUIREMENTS

1.1. This document sets forth the requirements and recommendations for the design of overhead electric transmission facilities.

1.1.1. Transmission lines, for the purpose of this document, are those with an operating voltage of 69kV or greater.

1.1.2. The term "TO" in this document refers to the Transmission Owner, the party that will own and be responsible for the maintenance of the subject transmission facility.

1.2. The design and operation of all transmission lines shall meet the requirements of the National Electrical Safety Code (ANSI/IEEE C-2) [NESC]. The edition of the NESC in effect at the time of the design shall govern.

1.3. The electrical and strength requirements of this document shall apply to all new transmission lines; and extensions, taps, or additions to existing transmission lines where the circuit length of the new construction is 1000ft or more.

1.4. The design of modifications to existing transmission lines; or extensions, taps, or additions to existing transmission lines where the circuit length of the new construction is less than 1000ft; shall meet the requirements used for the design of the existing line and shall meet the requirements of the latest edition of the NESC.

1.5. The designs of existing transmission lines may not in all cases meet these criteria. The existing lines themselves are excluded from the scope of this document. However, taps from or extensions to these existing lines are covered under the scope of this document.

1.6. Switch structures are not within the scope of this document. If a switch is to be mounted on a transmission structure, the structure design shall have adequate strength and rigidity to ensure the reliable operation of the line and switch.

1.7. Transmission structures supporting non-electric transmission facilities (telecommunications antennas, fiber-optic cables, etc.) shall be capable of resisting the structural loads resulting from these facilities within the strength requirements of this document. The locating of such non-electric facilities on transmission structures shall not jeopardize the operation, maintenance, and reliability of the transmission lines.

1.8. While this document provides detailed criteria for the design of transmission lines on the PJM system, these do not represent the only issues to consider in the design of such lines. Other issues must also be considered such as: maintenance, inspection, and repair on both the structures and the wires of these lines. This will ensure the reliability of the line at a minimal cost well into the future.

1.9. In some instances, the requirements or recommendations specified in this document may come into conflict with other issues such as permitting or local issues. These specifications may be adjusted and negotiated with the specific and written approval of the TO. The agreed negotiation of a relaxation of any specification for an individual project or circumstance does not automatically result in a subsequent revision in this guide. Subsequent instances must be addressed individually on a case-by-case basis.

1.10. The use of structure guys, and wood structures shall be approved by the TO.

2.0 CONDUCTORS

Conductors must be selected with sufficient thermal capability to meet continuous and emergency current ratings. Ratings of conductors applied to the PJM system should be determined using the PJM TSDS "Bare Overhead Transmission Conductor Ratings, November 2000".

The overhead line conductor and static wire should be chosen from those used by the TO. This provides the ability to quickly repair a section of line with utility stock material should an emergency arise. Standard transmission conductor types are ACSR, ACSR/AW, ACSS, and ACAR. Other conductor types will be reviewed by the TO.

The ambient temperature range listed in Table 1 covers the PJM system and is used for the electrical ratings of the conductors as well as the structural loads upon the towers or poles.

3.0 CONDUCTOR SAG & TENSION CRITERIA

3.1 Alcoa – Sag & Tension Common Point
The maximum tension case shall be allowed to default as the common point between the initial and final sag tables. No other common point shall be allowed. An example would be a common point based upon NESC Heavy conditions when calculated tensions for the 1-1/2" Heavy Ice case exceed those for the NESC case.

4.0 STRENGTH REQUIREMENTS

4.1. **Structure Types** – the following descriptions of structure types shall apply to the provisions for strength requirements

4.1.1. *Suspension Structure* – A structure where the phase conductors and static wires are attached through the use of suspension insulators and hardware or, in the case of the static wire, with a clamp not capable of resisting the full design tension of the wire.

4.1.2. *Strain Structure* – A structure where the phase conductors and static wires are attached to the structure by use of dead-end insulators and hardware but where the ability of the structure to resist a condition where all wires are broken on one side under full loading is not required or desired. Typically, strain structures would be used where the line deflection angle is 45 degrees or less. Structures subject to strain structure requirement shall be as identified by the Utility.

4.1.3. *Dead-end Structure* - A structure where the phase conductors and static wires are attached to the structure by use of dead-end insulators and hardware and where the ability of the structure to resist a condition where all wires are broken on one side under full loading is required or desired. Typically, dead-end structures would be used where the line deflection angle is greater than 45 degrees. Structures subject to dead-end structure requirement shall be as identified by the Utility.

4.1.4. *Line Termination Structure* – A structure where the phase conductors and static wires are to be installed on one side only for the purpose of terminating the line, usually at a substation or switchyard. This permanent dead-end condition is assumed in the application of all applicable loading conditions.

4.2. **Loading Definitions**

4.2.1. *Wind Pressure* – The pressure resulting from the exposure of a surface to wind. The pressure values provided are for wind acting upon objects with circular cross section. Pressure adjustments for other shapes shall be as set forth by the ASCE Guidelines for Electrical Transmission Line Structural Loading (ASCE Publication 74) [ASCE 74].

4.2.2. *Radial Ice* – Radial ice is an equal thickness of ice applied about the circumference of the conductors and static wires. Ice density is assumed to be 57 lbs per cubic foot. For the purpose of transmission line design, ice is not applied to the surface of the structure, insulators, or line hardware.

4.2.3. *Temperature* – Used for calculating conductor and static wire sag and tension.

4.2.4. *Transverse load* – Forces or pressures acting perpendicular to the direction of the line. For angle structures, the transverse direction is parallel to the bisector of the angle of the transmission centerline.

4.2.5. *Longitudinal load* – Forces or pressures acting parallel to the direction of the line. For angle structures, the longitudinal direction is perpendicular to the bisector of the angle of the transmission centerline.

4.2.6. *All wires intact* – A condition where all intended spans of conductors and static wires are assumed to be in place. In the case of a Line Termination Structure, conductor and static wire spans are only on one side of the structure.

4.2.7. *Broken Conductor or Static Wire* – A condition where one or more conductors or static wires are specified as broken. It is assumed that the broken conductor or static wire is in place on one side of the tower, and is removed from the other side. The span length for determination of loads from the conductor or static wire weight, wind pressure, and radial ice shall be not less than 60% of the design span length for the intact condition.

4.2.8. *Load Factor* – A value by which calculated loads are multiplied in order of provide increased structural reliability. For the purpose of structural design, Overload Capacity Factors as specified by NESC shall be considered Load Factors.

4.3. **Design Loading Conditions**

4.3.1. *NESC* – The provisions of the NESC Heavy Loading District, Class B Construction shall apply to all structure types. All wires intact. The latest NESC edition in effect at the time of line design shall apply. For informational purposes, the 1997 edition of NESC specifies the following requirements. Wind pressure – 4psf. Radial Ice – 0.5in. Temperature - 0°F. For the purpose of calculating conductor or static wire tensions, a load constant of 0.3lbs shall be added to the resultant of the per linear foot weight, wind, and ice loads on the conductor or static wire. For steel structures, the load factor for wind load is 2.50; the load factor for vertical loads (dead weight and ice) is 1.50; and the load factor for conductor and static wire tension is 1.65. The associated factors for wooden transmission line structures shall be obtained from the TO.

4.3.2. *Extreme Wind Loading Condition* – Applies to all structure types. All wires intact.

4.3.2.1. *Line voltage 230kV and greater.* Wind pressure applied to the wires shall be 25psf. The ambient temperature is to be 60°F. The wind pressure applied to the structure shall be 31.25psf. Load factor is 1.00.

4.3.2.2. *Line voltage less than 230kV.* The provisions of the NESC Extreme Wind loading shall be applied, subject to a minimum wind pressure of 17psf. The load factor is 1.00. The provision in NESC permitting exclusion of structures less than 60ft in height from extreme wind criteria shall not apply.

4.3.3. *Heavy Ice Loading Condition* – Applies to all structure types. All wires intact.

4.3.3.1. *Line voltage 230kV and greater.* Radial ice thickness on the wires only is to be 1.50in. No wind pressure. Temperature is 32°F. Load factor is 1.00.

4.3.3.2. *Line voltage less than 230kV.* Heavy ice loading (if any) shall be as specified by the TO. Ice loading will not be more severe than that required for voltages 230kV or greater.

4.3.4. <u>Longitudinal Loading Conditions for Suspension Structures</u> (line voltage 230kV or greater) – The TO will specify one or more of the following loading conditions for design of Suspension Structures.

4.3.4.1. *One broken conductor or static wire.* Any one phase conductor or static wire is assumed broken. For construction using bundled phase conductors, one subconductor of any one phase bundle shall be assumed broken, the other subconductor(s) of that phase shall be assumed intact. All other conductors and static wires are intact. Loading condition is NESC Heavy. The longitudinal load shall be the tension of the broken static wire or broken conductor or subconductor. Tensions shall not be reduced by assumed insulator swing. For the intact phases and static wires, the wind on the structure, and the structure dead weight, the NESC load factors shall apply. For the broken static wire or the phase with the broken conductor or broken subconductor, the load factor shall be 1.10.

4.3.4.2. *Differential Ice Loading.* All wires intact. No Wind. Temperature 32°F. All conductors and static wires on one side of the structure shall be assumed to have 1.0in radial ice. All conductors and static wires on the other side of the tower shall be assumed to have no ice. The determination of differential tension may include calculated swing of suspension insulator or static wire assemblies. Load factor 1.10.

4.3.4.3. *Bound stringing block* – All wires intact. 2psf wind. No ice. 30°F. Any one static wire or phase conductor (or all subconductors of any one phase) are assumed to bind in a running block during installation. The block is assumed to swing 45° in-line. This swing will result in a longitudinal load equal to the calculated vertical load of the static wire or phase conductor(s) under this loading condition. Load factor is 2.00.

4.3.5. <u>Longitudinal Loading Conditions for Strain Structures</u> – The TO will specify one or more of the following loading conditions for design of Strain Structures.

4.3.5.1. *One broken conductor or static wire.* Any one phase conductor or static wire is assumed broken. For construction using bundled phase conductors, one subconductor of any one phase bundle shall be assumed broken, the other subconductor(s) of that phase shall be assumed intact. All other conductors and static wires are intact. Loading condition is NESC Heavy. The longitudinal load shall be the tension of the broken static wire or broken conductor or subconductor. For the intact phases and static wires, the wind on the structure, and the structure dead weight, the NESC load factors shall apply. For the broken static wire or the phase with the broken conductor or broken subconductor, the load factor shall be 1.10.

OR

4.3.5.2. *All conductors and static wires broken.* Loading condition is NESC Heavy. Load factor is 1.00.

4.3.6. <u>Longitudinal Loading Condition for Dead End Structures</u> – All conductors and static wires are to be intact on one side of the structure only. Loading condition is NESC Heavy. Load factors are those specified by NESC.

4.3.7. *Longitudinal Loading Condition for Line Termination Structures* – Conductors and static wires are to be intact on one side of the structure only. All loading conditions and load factors set forth by Section 4.3.1, 4.3.2, and 4.3.3 shall apply.

4.3.8. *Foundation Loading* – The ultimate strength of overturning moment and uplift foundations shall be not less than 1.25 times the design factored load reactions of the structure. The ultimate strength of foundations subjected to primarily to compression load shall be not less than 1.10 times the design factored load reactions of the structure. Overturning moment foundations designed by rotation or pier deflection performance criteria shall use unfactored structure reactions for determination of the foundation performance, but shall use factored reactions for the 1.25 time ultimate strength check.

4.3.9. *Personnel Support Loading* – Structures shall be designed to support a point load of 350 lb at any point where a construction or maintenance person could stand or otherwise be supported.

5.0 ELECTRICAL DESIGN PARAMETERS

5.1 **Right-Of-Way Width**

The transmission line is to be designed with adequate right-of-way width to provide access for line maintenance, repair, and vegetation management as shown in Table 1. These widths are based upon the listed number of circuits on the right-of-way. For additional circuits, a wider right-of-way should be utilized.

Vehicle or other means of access to each structure site is required for both construction and maintenance activities.

5.2 **Wire to Ground Clearance**

The minimum allowed clearance between the lowest transmission line conductor(s) shall meet the required NESC minimum plus a safety envelope of 3 feet. (The safety envelope is required to allow for sag and clearance uncertainties due to: actual conductor operating temperature, conductor sagging error, ground topography accuracy, plotting accuracy and other sources of error. The inclusion of a safety envelope is considered to be prudent). The NESC minimum shall be calculated with the conductor at maximum operating voltage and the maximum operating temperature or maximum conductor loading. The minimum clearances should take into account the limitation of a 5 mA shock current as given in NESC Rule 232D3c. All areas beneath the line shall be assumed to allow vehicle access beneath the line. For agricultural areas that may utilize farming equipment, additional clearance will be provided to assure public safety and line reliability during the periods of farming and harvesting activities.

5.3 **Wire to Signs, Structures, etc Under the Wires**

The minimum allowed clearance between the lowest transmission line conductor(s) shall meet the required NESC minimum plus a safety envelope of 3 feet. The NESC minimum shall be calculated with the conductor at maximum operating voltage and the maximum operating temperature.

5.4 **Wire to Structure Clearances**

The minimum clearances between the phase conductors and the supporting tower or pole shall not be less than shown in Table 1. These clearances are to apply for all anticipated conductor positions from an every day condition to a displaced condition due to a 9-psf wind or ice loading. These clearances do not have any adders provided for birds or other animals, but are based upon the switching surge values listed in Table #1.

5.5 **Wire-to-Wire Clearances**

Clearance between the bottom transmission conductor and any lower wire shall meet the required clearance of NESC Rule 233 and 235as a minimum. When the lower wire is a non transmission wire, then the clearance should be at least 10 feet for voltages less than or equal to 230 kV, and 20 feet for voltages above 230 kV. This will allow safe personnel access to the non-transmission conductors. These clearances should be calculated with the transmission conductor at maximum operating temperatures or heavy ice, whichever provides greater conductor sag, and the non-transmission conductor at 0°F.

Clearances between transmission conductors should be either the larger of clearances based upon switching surges, or clearances based on the NESC. The per unit switching surges to use for the calculation are shown in Table #1.

Using switching surge values, the method used to determine the actual required clearance is given in section 5 of the EPRI Transmission Line Reference Book 115 kV - 138 kV Compact Line Design.

For transmission conductors of different circuits, the clearances should be increased so that any wind induced dynamic conductor movement does not result in any breaker operations and subsequent reduction in transmission circuit reliability.

5.6 **Conductor Operating Temperature and Conductor Sag**

The conductor will be assumed to operate at or above the minimum temperature shown below, and at temperatures less than the maximum shown below. While the line conductor may be designed to operate at a lower temperature, the line must be sagged assuming the conductor temperature is at or above the minimum shown. For designed operating temperatures above the minimum shown, and still below the maximum, the line sag and clearances will be calculated for that operating temperature after rounding up to the nearest 10°C. In no case will a conductor operating temperature be allowed above the maximum shown in the table. Refer to the PJM "Bare Overhead Transmission Conductor Ratings" for the ampacity and temperatures of conductors.

Conductor Type	Minimum Conductor Operating Temperature for Sagging and Clearance Purposes	Maximum Operating Temperature
ACAR	100°C	140°C
ACSR, ACSS	125°C	180°C

Consult with the local transmission utility for the maximum operating temperature since some companies use slightly different values. Higher values for ACSS conductors may only be used with specific approval from the TO. Studies of the long-term high temperature operation of all conductor-connected hardware must be investigated prior to the request for approval from the local transmission utility.

5.7 **Insulation Requirements**

The insulation system for the transmission line shall have values in excess of the leakage distance, 60 Hz wet, and Critical Impulse flashover specified in Table 1. These values shown are minimum conditions and may need to be increased in specific locations such as coastal environments, industrial smokestack sites, or high altitudes. (BIL values are not included here as they are associated with substation insulation and not transmission line insulation,)

5.8 **Lightning Performance and Grounding**

All transmission structures will be individually grounded through a dedicated earth driven grounding system composed of ground rods and / or buried counterpoise. This system is to be measured on each individual structure prior to the installation of any overhead conductors or wires. The maximum acceptable resistance measurement of this grounding system for voltages up to and including 230 kV is 25 Ohms, and 15 ohms for voltages 345 kV and greater. The grounding system may include radial counterpoise wires, equipotential rings, or both. The TO must approve all grounding methods, and connections to the grounding system that are below grade. These resistance requirements are to assure acceptable lightning performance on the line as well as provide for the safe grounding of the line by construction and maintenance forces.

Individual tower grounding measurements will be allowed to exceed the 25 or 15 Ohms required only if the average value for the 5 adjacent structures along the line is less than the 25 or 15-Ohm restriction.

To assure acceptable lightning performance, a shield wire is required above each transmission line. The number of shield wires and the maximum shielding angles between the shield wire and phase conductor are shown in Table 1. Each new structure design is to be analyzed using the EPRI MULTIFLASH or equivalent software to determine that the line design and actual grounding design provides the required lightning performance shown in Table 1.

In instances where it is very difficult to provide the required lightning performance, the TO may grant permission to utilize a limited application of transmission lines arresters. In no case will chemical ground treatments be allowed to improve structure grounding.

5.9 **EMF, RFI, TVI, and Audible Noise**

The transmission line system is to be designed so that radio and TV interference is just perceptible at the edge of the right-of-way. This is typically the case with radio signal to noise ratios above 20 db, and TV signal to noise ratios above 40 db. The achievement of this level of performance is more of a problem for lines above 230 kV, so a radio frequency survey and investigation should be performed to measure actual radio and TV signal strength and calculate the signal to noise ratio.

Audible noise at the edge of the right-of-way should be calculated for the designed transmission line using wet conductor as the design condition. The resultant noise level must not exceed the level limited by the state and local authorities. Typically the limitation is 55 dbA during the daylight hours, and 50 dbA at night.

Electric and Magnetic Field (EMF) levels are to be calculated using the EPRI ENVIRO or equivalent software and compared to any state or local limits. Modifications are to be made through phasing, structure height, ground clearance, etc. to assure these limitations are met. If no specific limitations exist, the line should be designed to the level of EMF on and adjacent to the right-of-way. A typical example of such an effort is the appropriate choice of phasing on the right-of-way.

5.10 **Inductive Interference**

A study should be done to determine the inductive impact upon other utilities due to the power flow in the new transmission line. The power flow may induce unusual currents and voltages in magnetic and electrical conductors that run parallel to the transmission line.

When it is determined that the currents or voltages are being induced in nearby utilities or other facilities, the engineer for the new or modified line being constructed must take the appropriate corrective actions to eliminate or lower the currents or voltages to an acceptable level.

5.11 **Line Transpositions**

The transmission line designer may be required to transpose the geometry of a new transmission line if the voltage imbalance exceeds the tolerance of the TO at the substations the line connect s to. If transpositions structures are required, they shall be designed to provide for easy routine maintenance of the structure.

5.12 **Line Crossings**

Line crossings should be avoided if possible, but when line crossings are unavoidable they should be configured such that the most important circuits to the transmission network are on top. Additionally, crossings must be configured such that a single component failure will not outage more than one other circuit (beyond the circuit with the failed component). This is in accordance with MAAC Criteria.

6.0 OTHER DESIGN PARAMETERS

6.1 Line Cascade Mitigation

Transmission line failures that cascade beyond the original structural failure must be avoided. To accomplish this, the design of a new or modified line shall incorporate dead-end strain structures routinely employed along the line. An alternative is to utilize suspension structures that are longitudinally guyed to resist full line tension if all wires on one side were broken. For wood construction, the strain structures shall also have in-line storm guys utilized to provide the structural strength. The line tensions assumed for this condition are the NESC Heavy loadings on one side of the structure as defined above, and no tension on the other. The structures shall be placed routinely along the line to resist a line cascade, but in no case shall these structures be placed farther than 5 miles apart.

6.2 Corrosion Protection

Corrosion protection will be evaluated for all buried structural steel on transmission structures. This covers buried grillage, driven caissons, etc. The line designer will submit a recommendation to the TO for the corrosion mitigation method to be used for buried structural steel. The proposed method must show at least a 50 year durability before any degradation of structural strength is allowed. It is acceptable to include systems that require some routine maintenance such as cathodic protection using buried sacrificial anodes.

Above grade steel will be protected from corrosion using a coating acceptable to the TO. Typical alternatives that have been used include weathering steel, galvanized steel, or painted steel.

6.3 Climbing Devices

6.3.1 Steel pole structures shall utilize climbing ladders. The TO shall specify the requirements and placement of the climbing ladders.

6.3.2 All steel towers shall be designed with step bolts as the provision for climbing. The TO shall specify the requirements and placement of the step bolts.

7.0 MAINTENANCE

For maintenance see section V.L.2.A

TABLE 1
Transmission Line Design Parameters

Parameter	Requirements			Recommendations		
	500 kV	345 kV	230 kV	138 kV	115 kV	69 kV
Ambient Temperature Range	-30°C to +40°C (from –40°C N & W of Blue Mountain)			-30°C to +40°C (from –40°C N & W of Blue Mountain)		
Minimum Extreme Wind Loading	25 PSF		**New Line** NESC Figure 250-2 or a minimum wind pressure of 17 psf. **Existing Line** **Larger of**: NESC Figure 250-2 **OR** the original line design parameters	New Line: NESC Figure 250-2 Existing Line: **Larger of**: NESC Figure 250-2 **OR** the original line design parameters		
Heavy Ice Load (No Wind)	1½"			Consult the TO for applicable heavy ice loading requirements		
Code Requirements	NESC Grade "B" Heavy			NESC Grade "B" Heavy		
Flood Plain	The line shall meet the applicable Local, State and Federal regulations.			The line shall meet the applicable Local, State and Federal regulations.		
Sag and tension Calculation Method	Alcoa Sag & Tension Software or equivalent			Alcoa Sag & Tension Software or equivalent		
Damper Requirements	<18% RBS (No dampers Required) 18% -20% RBS (Dampers Required)			<18% RBS (No dampers Required) 18% -20% RBS (Dampers Required)		
Galloping Mitigation	Provide adequate clearance so that 12" of clearance exists between wire galloping ellipses to minimize conductor or structure damage. The TO may revise this requirement for areas with significant galloping history.			Provide adequate clearance so that 12" of clearance exists between wire galloping ellipses to minimize conductor or structure damage. The TO may revise this requirement for areas with significant galloping history.		
Spacers	18" spacing - NO Preformed wire spacers allowed.			18" spacing - NO Preformed wire spacers allowed.		
Provisions for Live Line Maintenance	As required by the TO.			As required by the TO.		
Access Requirements	Construction and maintenance access is required to each structure.			Construction and maintenance access is required to each structure.		
Approved conductor sizes for NEW Construction	Match approved conductor sizes and bundle configuration with local utility company			Match approved conductor sizes and bundle configuration with local utility company		

TABLE 1
Transmission Line Design Parameters

	Requirements			Recommendations		
Parameter	**500 kV**	**345 kV**	**230 kV**	**138 kV**	**115 kV**	**69 kV**
Approved static and OPGW wire sizes for NEW Construction	Match approved conductor sizes with the TO.			Match approved conductor sizes with the TO.		
Right-of-way width (Target values)	200 Ft. – 1 ckt. 300 Ft.(min.) – 2 ckts	170 Ft – 1 ckt	150 Ft 1 & 2 ckts	100 Ft 1 & 2 ckts	100 Ft 1& 2 ckts	60 - 100 Ft
Max. Number of circuits per structure	1 unless specifically approved by TO		2 unless specifically approved by TO	2 unless specifically approved by TO		
Min. design ground clearance at Max. Sag	NESC minimum requirements PLUS an additional 3 feet			NESC minimum requirements PLUS an additional 3 feet		
Conductor to structure steel clearance (min.)	125 in.	91 in.	69 in.	52 in.	42 in.	28 in.
Insulation Requirements						
Leakage distance	360 in.	250 in.	167in.	100 in.	83 in.	50 in.
60 Hz WET	950 kV	635 kV	490 kV	375 kV	295 kV	170 kV
Switching Surge	2.2 per unit.	2.4 per unit	2.5 per unit	3.0 per unit	3.0 per unit	3.5 per unit
Critical Impulse Flashover	2145 kV	1440 kV	1105 kV	860 kV	670 kV	440 kV
Maximum Structure Ground Resistance	15 Ohms	15 Ohms	25 Ohms	25 Ohms		
Step & Touch Potential Issues	Provide a structure grounding system that meets the step and touch requirements of the TO.			Provide a structure grounding system that meets the step and touch requirements of the TO.		
Minimum Number of Static Wires Required	Minimum of 1 per **circuit**			Minimum of 1 per **structure**		
Isokeraunic Level	40			40		
Maximum Shielding Angle	15°	20°	25°	30°	30°	30°
Target Lightning Outage Performance	1.0 per 100 ckt mi. / yr	1.0 per 100 ckt mi. / yr	2.0 per 100 ckt mi. / yr	3.0 per 100 ckt mi. / yr	3.0 per 100 ckt mi. / yr	4.0 per 100 ckt mi. / yr
EMF Limits	As Required by TO and State Regulatory Agencies			As Required by TO and State Regulatory Agencies		
Radio Interference at edge of right-of-way	300 µV @ 1 MHz (350 kV to gnd)	300 µV @ 1 MHz (230 kV to gnd)	No limits specified	No limits specified		
Audible Noise	Per applicable state laws for noise at edge of right-of-way			Per applicable state laws for noise at edge of right-of-way		

955 Jefferson Ave.
Valley Forge Corporate Center
Norristown, PA 19403-2497

RECEIVED
SEP 21 2010
BY:

September 20, 2010

Ms. Pamela Underhill
Superintendant
Appalachian National Scenic Trail
PO Box 50 252 McDowell Street
Harper's Ferry, WV 25425

Mr. John J Donahue
Superintendant
National Park Service
Delaware Water Gap National Recreation Area Bushkill, PA 18324

RE: PJM TSDS TECHNICAL REQUIREMENTS

Dear Ms Underhill and Mr. Donahue:

I have reviewed the PJM TSDS Technical Requirements document, the subject of your September 13, 2010 letter, with our technical staff and with our Legal Department. That document was under development in the 2001 – 2002 timeframe among the transmission owners in the Mid-Atlantic portion of PJM, then the entirety of the PJM footprint. With the integration of a number of Western and Southern transmission owner systems into PJM the document was never finalized and approved for use. At this time, it serves only as a set of guidelines and the controlling document is the ANSI/IEEE National Electrical Safety Code.

If you have any further questions, please call me at 610-666-8834.

Sincerely,

Steven R. Herling
Vice President – Planning

SRH/nbm: 611587

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

NOV 18 2010

Mr. Gregory Smith
Manager - Transmission Expansion
PPL Electric Utilities
Two North Ninth Street, GENPL3
Allentown, PA 18101-1179

Dear Mr. Smith:

As we review the draft alternatives and associated comments, we need to clarify a point regarding the contention that the proposal can be constructed within the existing one hundred (100) foot right of way. All other discussions of safety and regulatory requirements aside, our understanding from previous discussion with you and your team is that you believe you can construct the proposed project within the existing ROW with one caveat. That caveat is that you also have the right to clear what you deem to be "danger trees" found outside of your deeded ROW and located on National Park Service Lands. Please verify or correct our understanding of your assertion in this matter at the earliest possible date. Thank you for your kind attention to this matter.

Sincerely,

John Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pam Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6279

Cc: Andrew Tittler, DOI Office of the Solicitor
Patrick Lynch, National Park Service, DEWA
Kara Deutsch, National Park Service, DEWA
Sarah Bransom, National Park Service, APPA
Amanda Stein, National Park Service, DEWA
Patrick Malone, National Park Service, DSC
Jennifer McConaghie, National Park Service, NER

Clint Riley, U.S. Fish and Wildlife Service
Pamela Shellenberger, U.S. Fish and Wildlife Service

Denver Service Center - TIC
Attn: SRLINE EIS
12795 W. Alameda Parkway
Denver, CO 80225-0287

Gregory J. Smith
Manager-Transmission Expansion

PPL Electric Utilities
Two North Ninth Street, GENN5
Allentown, PA 18101-1179

December 7, 2010

Mr. John J. Donahue
Superintendent
National Park Service
Delaware Water Gap National Recreation Area
Bushkill, PA 18324

Ms. Pamela Underhill
Superintendent
Appalachian National Scenic Trail
National Park Service
P.O. Box 50
Harpers Ferry, WV 25425

Re: PPL Electric Utilities Corporation/Vegetation Management
In the Delaware Water Gap National Recreation Area ("DEWA")

Dear Mr. Donahue and Ms. Underhill:

Thank you for the opportunity to respond to your letter of November 18, 2010, regarding the need and right of PPL Electric Utilities Corporation ("PPL Electric") to clear what PPL Electric identifies as "danger trees." The answer to your question is that PPL Electric does need to remove danger trees with respect to the 100-foot alternative and, in fact, has the right to remove danger trees under its existing easements.

The relevant easement agreements include the following language:

> And, further, in consideration of said payments, we do hereby release and quit claim the said Pennsylvania Power & Light Company, its successors, assigns and lessees, of, and from any and all damages, loss or injury that maybe at any time caused by or result from the construction, reconstruction, operation and maintenance of the said lines, or the trimming or cutting down of any and all trees which, in the judgment of the said Company, its successors, assigns and lessees, may interfere with the construction, reconstruction, maintenance or operation of the said lines or menace the same.

Based on the above language, PPL Electric has the right to cut and remove danger trees. Further, as you are aware, PPL Electric has been removing danger trees as part of its vegetation management program for many years.

PPL Electric also has the right to remove danger trees consistent with the Stipulation and Order of Settlement that was entered into between PPL Electric and the National Park Service that was approved by the District Court for the Middle District of Pennsylvania on August 19, 2010. In that stipulation it was agreed that PPL Electric has the right to perform vegetation management consistent with its easement rights and its Transmission Vegetation Management Program ("TVMP"). That Stipulation also indicated that the work this past year would be done consistent with the Scope of Work provided to NPS on May 19, 2010. Both the TVMP and the Scope of Work includes the removal of danger trees and, consistent with its easement rights and historical practice, PPL Electric removed 11 danger trees when the work was performed this past year.

Finally, PPL Electric notes that it is required by federal regulation to protect all of its transmission lines from trees and other vegetation that could come in contact with or otherwise impair the reliability or safety of the lines. Failure to protect the lines would subject PPL to fines under federal regulation.

Again, thank you for the opportunity to respond to your question. If you are in disagreement with PPL Electric's position, please advise at your earliest convenience.

Very truly yours,

Gregory J. Smith

cc: Ronald J. Reybitz, Esq.
John Lain, Esq.

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12/07/10 4:04 PM

Patrick J. McMackin
Project Director – Susquehanna Roseland

PPL Electric Utilities
Two North Ninth Street, Plaza 3
Allentown, PA 18101-1179

February 14, 2011

In regards to: SRLINE EIS 25147

Delaware Water Gap National Recreation Area
c/o Amanda Stein
HQ River Road, Off Route 209
Bushkill, PA 18324

Dear Ms. Stein:

Thank you again for taking the time to conference call with us on 18 January 2011. Hopefully, NPS and EA found this time well spent. As a follow-up to the discussion during that call and in an effort to further help the NPS and EA with the EIS process, we reviewed the information that was provided on File-Works over the last several years. We thought it might be helpful to consolidate all associated files in a new, single folder titled "Existing 100 foot ROW Alternative."

In regards to your specific information requests, we also reviewed each of the documents and identified the exact location of the information and provided a summary below. Lastly, we have updated some of the documents to remove outdated information.

The following summary should help provide some clarity and assist with locating the specific information requested on the existing 100' ROW alternative. Attachment 1 contains detailed references to the documents and pages that contain the information we believe will help in your analysis.

Access Routes/Roads:

All associated access routes/roads for the existing 100' ROW alternative are the same in location and size as those that would be utilized for the Applicants' original proposed route. Although there are additional transmission structures needed for this alternative, the same access routes/roads needed to access and remove existing structures will be utilized for access to these additional transmission structures. Reference Attachment 1 for additional information, including references to existing documents posted in File Works.

Transmission Structure Locations, Heights and Spans

The associated transmission structures B17-4, B17-5 and B17-6 for the existing 100' ROW alternative are the same as those that would be utilized for the Applicants' original proposed route. There are two additional transmission structures needed on NPS property for this alternative: B17-3A and B17-5A. Reference Attachment 1 for additional information, including references to existing documents posted in File Works.

Transmission Structure Crane Pads:

The associated transmission structure crane pads for B17-3, B17-4, B17-5 and B17-6 for the existing 100' ROW alternative are the same in location and size as those that would be utilized for the Applicants' original proposed route. However, there are two additional transmission structures (B17-3A and B17-5A) that will require crane pads that will be entirely on NPS property. Additionally, an additional transmission structure (B17-2A) located outside NPS property will require an extra crane pad that will be approximately one-half on NPS property. Lastly, no new crane pads will be required for the removal of the existing structure on NPS property. Reference Attachment 1 for additional information, including references to existing documents posted in File Works.

100' Right-of-Way Boundaries

These are the same ROW boundaries currently granted PPL for the operations of the existing 230 kV transmission line.

The document titled "DEWA_existing_ROW_Alternative_12142009.pdf" identifies the boundaries for the current PPL ROW for the existing 100' ROW alternative. The ROW boundaries are identified on both page 1 and 2 by solid black lines, as noted in the Legend.

Vegetation Management - Access Road Construction

All construction vegetation clearing associated with the construction of the access routes/roads for the existing 100' ROW alternative are the same in location and size as those that would be utilized for the Applicants' original proposed route. Although there are additional transmission structures needed for this alternative, the same access routes/roads needed to access and remove existing structures will be utilized for access to these additional transmission structures.

The document titled "DEWA_existing_ROW_Alternative_12142009.pdf" identifies the proposed access roads for the existing 100' ROW alternative. This document provides an aerial view of the portion of the line that would be modified to accommodate construction of the new transmission line within the existing ROW. Reference the "Access Routes/Roads" section in Attachment 1 for more details.

Vegetation Management - Transmission Structure Construction and Removal

It is expected that additional clearing for the construction vegetation clearing associated with the construction and removal of transmission structures for the existing 100' ROW alternative will be very minimal, depending on the time passed since the last wire zone/border zone routine vegetation management associated with the existing 230 kV transmission line ROW currently operating on NPS property. The primary difference between the existing 100' ROW alternative and the Applicants' original proposed route is that the width of the ROW and associated clearing will be reduced by twenty-five (25) feet on each side. Additionally, more clearing including grubbing, would be required in the additional crane pad areas (B17-2A, B17-3A and B17-5A). There will be no additional clearing beyond what is presently required from the last structure in Pennsylvania, B17-6, to the Delaware River and the New Jersey border.

The document titled "DEWA_existing_ROW_Alternative_12142009.pdf" identifies the proposed transmission structures and crane pads for the existing 100' ROW alternative. Reference the "Transmission Structure Locations" and "Transmission Structure Crane Pads" sections in Attachment 1 for more details.

Vegetation Management - Transmission Line Operations

It is expected that additional vegetation management for the operations of the existing 100' ROW alternative will be very minimal compared to the ongoing wire zone/border zone routine vegetation management associated with the existing 230 kV transmission line ROW currently operating on NPS property. The primary difference between operations of the existing 100' ROW alternative and the Applicants' original proposed route is that the width of the ROW and associated clearing will be reduced by twenty-five (25) feet on each side. Additionally, as a result of the reduced ROW and clearing, vegetation management activities will be more routine (likely annually), there will be a lower tolerance for danger trees outside the ROW, the option for aerial clearing and maintenance will be eliminated, and access roads will need to be maintained in a more functional state. There will be no additional clearing from the last structure in Pennsylvania, B17-6, to the Delaware River than would be required for the existing 230 kV transmission line ROW currently operating on NPS property.

Additionally, the document titled "100' ROW Information.PDF" contains more information on the minimum vegetation management cycle. Assuming an annual two (2) foot growth rate, the minimum cycle for all spans is currently expected to be every three years. However, for the span between B173-A and B17-4 it is expected to be every year. This is based on the remaining buffer from tree line. This span is primarily over the existing Arnott Fen which currently does not promote the growth of tall vegetation.

Transmission Structure Maintenance

The steel mono-pole structures proposed for use do not require routine painting. Therefore, the associated routine maintenance that has historically been performed on the existing transmission structures, specifically the lattice towers, will no longer be required. Painting will also not be required for the structures in the Applicants' original proposal.

Traffic and Visitor Impacts

Due to the additional structures required for the 100' ROW alternative, construction duration is currently estimated to be an additional 2 weeks. Impacts to traffic and visitors should be relatively minor as work is anticipated to be scheduled during the winter months. Also reference the Follow-up to Data Request: #108, included in the data request response package dated September 15, 2010 and posted in File Works. To access this document (Followup Data Request 09152010 Responses.pdf) in File Works, open the "DEWA" folder, then the "Data Gap Responses" folder and lastly, the "Followup 9-15-10 Responses" folder.

Updated Documents

The document titled "DEWA_existing_ROW_Alternative_12142009.pdf," which provides an aerial view and identifies the proposed access roads for the existing 100' ROW alternative, has been updated. A new document titled "B17_PA_DEWA_Access_01272011.pdf" has been prepared. Obsolete project information has been removed and additional data labels added. We hope this further helps support the NPS and EA in their efforts.

Lastly, the latest version of the PPL EU "Specification for Initial Clearing and Control Maintenance of Vegetation On or Adjacent To Electric Line Right-of-Way through Use Of Herbicides, Mechanical, and Hand-clearing Technique - LA-79827-8" has been uploaded to File-Works in the folder titled "Vegetation". Changes associated with this latest revision are noted on page 2 of the document.

The Applicants stand ready to continue to provide any additional support needed to ensure a timely, accurate and complete EIS process. Should NPS or EA require any additional information or wish to discuss this or any other information provided, please feel free to contact Jeff Luzenski, 610-774-4184, or myself.

These documents are also available electronically on the enclosed CD, and have been uploaded today to the project's File-Works site.

In addition, two hard copies and one CD have been sent to the Appalachian National Scenic Trail c/o Sarah Bransom, and a hard copy to the Denver Service Center for inclusion in the administrative record. Additionally, one CD has been sent to Andrew Tittler at the Office of the Solicitor and one CD to EA Engineering Science and Technology, Inc.

Please let me know if additional copies are needed.

Sincerely,

Patrick J. McMackin

Patrick J. McMackin, P.E.

Project Director
Susquehanna-Roseland Project
PPL Electric Utilities
2 N. Ninth Street (Plaza)
Allentown, PA 18101
pjmcmackin@pplweb.com
Office: 610-774-3526
Cell: 610-577-6715

Attachment 1

100 Foot ROW Alternative Details

The following provides additional information from documents referenced above.

Access Routes/Roads:

The document titled "DEWA_existing_ROW_Alternative_12142009.pdf" identifies the proposed access roads for the existing 100' ROW alternative. This document provides an aerial view of the portion of the line that would be modified to accommodate construction of the new transmission line within the existing ROW. The document identifies the Delaware Water Gap NRA boundaries, the boundaries of the ROW (including the proposed 100' ROW sections), existing transmission structures, proposed transmission structures, the proposed transmission line, surveyed wetlands, proposed crane pad locations and sizes, the proposed access routes/roads and associated, approximate clearing area needed for the access routes/roads.

Page 1 identifies the "Existing Alternate Route" as a dotted yellow line, as noted in the Legend. Specifically identified are the access routes/roads off of:

River Road to proposed new transmission structure B17-2. (Note: This proposed new transmission structure and its associated access route/road are not on NPS property. The access route/road and new transmission structure B17-2 are identical to those for the proposed route originally submitted by the applicants. The associated access route/road to this structure already exists and is utilized for routine maintenance of the existing transmission line.)

River Road to existing structure 37-2 and to proposed new transmission structure B17-2A (Note: This transmission structure, B17-2A, and a majority of its associated access route/road are not on NPS property). Only approximately 250' of the access route/road will be on NPS property and on the existing PPL ROW. Approximately only one-half of the crane pad for the new transmission structure B17-2A will be on the NPS property and within the existing PPL ROW. The associated access route/road to this structure already exists and is utilized for routine maintenance of the existing transmission line.)

River Road to existing structure 37-3 and to proposed new transmission structure B17-3 (Note: This proposed new transmission structure and its associated access route/road are not on NPS property. The access route/road, its crane pad and new transmission structure B17-3 are identical to those for the proposed route originally submitted by the applicants. The associated access route/road to this structure already exists and is utilized for routine maintenance of the existing transmission line. However, approximately only one-half of the crane pad for the new transmission structure B17-3 will be on the NPS property and within the existing PPL ROW.)

Community Drive to existing structure 38-1 and to proposed new transmission structure B17-3A. (Note: This new transmission structure, B17-3A, its crane pad and its associated access route/road are all on NPS property. The crane pad for the new transmission structure B17-3A

will be on the NPS property and within the existing PPL ROW. The associated access route/road to these structures already exists and is utilized for routine maintenance of the existing transmission line.)

Page 1 also identifies the "New Preferred Route" as a dashed yellow line, as noted in the Legend. Specifically identified is the access route/road off of:

Community Drive to existing structure 38-1 and to proposed new transmission structure B17-4. (Note: Page 1 only shows the initial portion of a USFWS preferred access route/road that the applicants are currently planning to utilize. This new access route/road is on NPS property. The applicants are currently planning to utilize this access route/road as a result of an onsite investigation and consultation with the PA FBC and USFWS that occurred subsequent to the applicants' original submittal. This new preferred route will help further minimize any potential bog turtle issues as identified by the PA FBC and USFWS. Additionally, the removal of a stream crossing grate on the existing proposed access route/road by NPS personnel subsequent to the applicants' original submittal, further supports the use of this new preferred access route/road.)

Page 2 identifies an "Existing Alternate Route" as a dotted yellow line, as noted in the Legend (The same as page 1.). Specifically identified are the access routes/roads from:

Proposed new transmission structure B17-4 to proposed new transmission structure B17-5. (Note: This proposed new transmission structures and its associated access route/road are all on NPS property. The access route/road, new transmission structures B17-4 and B17-5, and associated crane pads are identical to those for the proposed route submitted by the applicants. The associated access route/road between these structures already exists and is utilized for routine maintenance of the existing transmission line.)

Proposed new transmission structure B17-5 to existing transmission structure 38-3. (Note: This proposed new transmission structure and its associated access route/road are all on NPS property. The associated access route/road between these structures already exists and is utilized for routine maintenance of the existing transmission line.)

Existing transmission structure 38-3 to proposed new transmission structure B17-5A. (Note: This proposed new transmission structure and its associated access route/road are all on NPS property. The access route/road between the existing structure and the proposed new transmission structure B17-5A is identical to the proposed route submitted by the applicants. The associated access route/road between these structures already exists and is utilized for routine maintenance of the existing transmission line.)

Proposed new transmission structure B17-5A to proposed new transmission structure B17-6 and existing transmission structure 38-4. (Note: This proposed new transmission structures and its associated access route/road are all on NPS property. The access route/road, the new transmission structure B17-6 and its associated crane pad are identical to those for the proposed route submitted by the applicants. The associated access route/road between these structures already exists and is utilized for routine maintenance of the existing transmission line.)

Page 2 also identifies a "New Preferred Route" as a dashed yellow line, as noted in the Legend. Specifically identified is the remaining section of the access route/road off of:

> Community Drive to existing structure 38-2 and to proposed new transmission structure B17-4. (Note: Page 2 only shows the final portion of a USFWS preferred access route/road that the applicants are currently planning to utilize. As stated above, this new access route/road is on NPS property. The applicants are currently planning to utilize this access route/road as a result of an onsite investigation and consultation with the USFWS that occurred subsequent to the applicants' original submittal. This new preferred route will help further minimize any potential Bog Turtle issues as identified by USFWS. Additionally, the removal of a stream crossing grate on the existing proposed access route/road by NPS personnel subsequent to the applicants' original submittal, further supports the use of this new preferred access route/road.)

Transmission Structure Locations

The document titled "DEWA_existing_ROW_Alternative_12142009.pdf" identifies the proposed transmission structures for the existing 100' ROW alternative.

Page 1 identifies the approximate location of each "Existing Transmission Structure" as an orange box, as noted in the Legend. Specifically identified are two existing transmission structures currently on NPS property.

Page 1 also identifies the approximate location of each "Proposed Transmission Structure" as red box, as noted in the Legend. Specifically identified on page 1 are:

- B17-3A (Note: This is an additional structure on NPS property that would be needed to support the existing 100' ROW design and operations. All other proposed transmission structures on page 1 are not on NPS property.)

Page 2 identifies the approximate location of each "Existing Transmission Structure" as an orange box, as noted in the Legend (same as page 1). Specifically identified are three existing transmission structures currently on NPS property.

Page 2 also identifies the approximate location of each "Proposed Transmission Structure" as red box, as noted in the Legend (same as page 1). Specifically identified on page 2 are:

- B17-4 (Note: This proposed transmission structures on NPS property and its location are identical to the same transmission structure for the proposed route submitted by the applicants.)

- B17-5 (Note: This proposed transmission structures on NPS property and its location are identical to the same transmission structure for the proposed route submitted by the applicants.)

- B17-5A (Note: This is an additional structure on NPS property that would be needed to support the existing 100' ROW design and operations. All other proposed transmission structures on page 1 are not on NPS property.)

- B17-6 (Note: This proposed transmission structures on NPS property and its location are identical to the same transmission structure for the proposed route submitted by the applicants.)

Transmission Structure Heights

The document titled "Blowout Rev2.pdf" is the Finite Element Sag Tension Report. Page 11 of this report has a plan and profile of the existing 100' ROW alternative. The respective height and elevation of each structure is noted on this page.

Summary of information in document "Blowout Rev2.pdf" follows:

- B17-3A: "ht =184.01 ele = 528.00"
- B17-4: "ht =184.01 ele = 533.00"
- B17-5: "ht =184.01 ele = 509.00"
- B17-5A: "ht =184.01 ele = 695.00"
- B17-6: "ht =184.01 ele = 532.00"

Transmission Line Spans:

The document titled "Blowout Rev2.pdf" is the Finite Element Sag Tension Report. Page 11 of this report has a plan and profile of the existing 100' ROW alternative. The respective span between each structure is noted on this page.

Summary of information in document "Blowout Rev2.pdf" follows:

- B17-2 to B17-2A: "417.58"
- B17-3 to B17-3A: "573.51""
- B17-3A to B17-4: "1058.11"
- B17-4 to B17-5: "587.82" (Note: Same as Applicants' proposed route.)
- B17-5 to B17-5A: "528.21"
- B17-5A to B17-6: "749.86"

Transmission Structure Crane Pads:

The document titled "DEWA_existing_ROW_Alternative_12142009.pdf" identifies the proposed transmission structure crane pads for the existing 100' ROW alternative.

Summary of information in document "DEWA_existing_ROW_Alternative_12142009.pdf" follows:

Page 1 identifies the approximate location of each "Crane Pad" as a gray rectangle, as noted in the Legend. Specifically identified on page 1 are:

- B17-2A crane pad (Note: This additional crane pad, a portion (approximately one-half) of which is on NPS property and entirely located within PPL's existing ROW, would be needed to support the existing 100' ROW design and construction.)

- B17-3 crane pad (Note: This is crane pad, a portion (approximately one-half) of which is on NPS property and entirely located within PPL's existing ROW would the same as the same one that would be utilized for the Applicants' original proposed route.)

- B17-3A (Note: This additional crane pad, located entirely on NPS property and PPL's existing ROW, would be needed to support the existing 100' ROW design and construction.)

Page 2 identifies the approximate location of each "Crane Pad" as gray rectangle, as noted in the Legend (same as page 1). Specifically identified on page 2 are:

- B17-4 crane pad (Note: This crane pad, located entirely on NPS property and within the existing PPL ROW, would be the same as the one that would be utilized for the Applicants' original proposed route.)

- B17-5 crane pad (Note: This crane pad, located entirely on NPS property and within the existing PPL ROW, would be the same as the one that would be utilized for the Applicants' original proposed route.)

- B17-5A crane pad (Note: This additional crane pad, located entirely on NPS property and within the existing PPL ROW, would be needed to support the existing 100' ROW design and construction.)

- B17-6 crane pad (Note: This is crane pad, located entirely on NPS property and within the existing PPL ROW, would be the same as the one that would be utilized for the Applicants' original proposed route.)

Appendix E

Cost Estimates for
All Action Alternatives

APPENDIX E:
CONSTRUCTION COST ESTIMATES FOR ALL ACTION ALTERNATIVES

CLASS C CONSTRUCTION COST ESTIMATE[1]

Project: Susquehanna to Roseland Double 500-kV Transmission Line

Park: Delaware Water Gap National Recreation Area, Middle Delaware National Scenic and Recreational River, Appalachian National Scenic Trail

PMIS (Project Management Information System): None identified

BASIS OF ESTIMATE

Date of Estimate: 06/09/10

Estimated By: Matt Williams/Laura Meyer

David Evans and Associates, Inc.

Supporting Material: Alternatives designs 06/04/10

Alternatives screening meeting at park 04/18/10-04/30/10

PPL and PSE&G's alternative 1 (alternative B) route Form 299, 11/08

Cost Data: Cost per mile

Unit Prices based on 2010 commodity pricing data

MARK-UPS AND ADD-ONS

Published Location Factor:

Average of surrounding location factors (RS Means [1])

Alternatives 2, 3, and 4: Average of surrounding location factors (Summit, Dover, Stroudsburg, Hazelton, and Scranton) = 2.7 percent

Alternatives 5, 6, and 7: Average of surrounding location factors (Summit, Dover, Stroudsburg, and Hazelton) = 4 percent

Project Remoteness:

Average distance from published location factors in the vicinity

Alternatives 2, 3, and 4: Average of 22 miles from published location factors

Alternative 5: Average of 13 miles from published location factors

Alternatives 6 and 7: Average of 20 miles from published location factors

Federal Wage Rate Factor:

32 Percent (Bureau of Labor Statistics [2])

[1] The construction cost estimates are for construction only and do not include any costs associated with acquisition of ROW.

Design Contingency:

In preliminary planning stage; therefore contingency set high

Of a range of 15-30%, assume 30%

Taxes:

NJ: 7%;

PA: 6% state sales tax + up to 1% for local jurisdictions; assume 7% included in unit costs

Standard General Conditions:

Expected to be high due to project size and complexity; of a range of 4-20%, assume 20%

Government General Conditions:

10 Percent within NPS Guidance Recommendations [3]

Bonds and Permits:

1.5 percent bond included in General Conditions.

Historic Preservation Factor:

Not applicable.

Overhead:

Included in unit cost

Profit:

Included in unit cost

Contracting Method Adjustment:

10 Percent within NPS Guidance Recommendations [3]

Inflation Escalation:

Assume start of construction to be October 2012.

38 months to mid-point of construction. Escalation assumed to be 7.6% over that period [4]

Comments:

Sitework detail included for transmission routes within NPS jurisdiction only.

1 - RS Means 2008 Building Construction Cost Data, 66th Annual Edition. Used an average of the published location factors in the vicinity of the proposed alignments.

2 - Bureau of Labor Statistics, National Compensation Survey, July 2008, Table 1. Pay relatives for major occupational groups in metropolitan areas: MSA for New York-Newark-Bridgeport, NY-NJ-CT-PA

3 - Applied only to portion of alternative within NPS units

4 - Reed Construction Data estimated 1%-2% for 2010; used 1.5%. Assumptions for future years are 2% for 2011 and 2012 and 4% for 2013

Alternative 2
Project: Susquehana to Roseland 500kV Transmission Line
Park: Delaware Water Gap NRA, Middle Delaware National Scenic and Recreational River, Appalachiar
PMIS: None identified

Estimate By: Laura Meyer
Date: 06/25/10

Reviewed By: Rebecca Smith
Date: 07/07/10

Estimate is based on 2010 costs

Item No.	Description	Quantity	Unit	Cost/Unit	Total
1	Right-of-Way (42 acres per mile)	6165.6	acres	$20,000.00	$123,312,000
2	Construction	146.8	linear mile	$6,793,218.96	$997,244,543
3	Decommission 230kV Line	4.21	linear mile	$150,000.00	$631,500
	Subtotal Direct Construction Costs				**$1,121,188,043**
	Published Location Factor (4 Percent)				$44,847,522
	Remoteness Factor (22 miles)				$24,666,137
	Federal Wage Rate Factor (32 Percent)				$143,512,069
	Design Contingency (30 Percent)				$336,356,413
	Total Direct Construction Costs				**$1,670,570,184**
	Standard General Conditions (20 Percent)				$334,114,037
	Government General Conditions (10 Percent within NPS units)				$4,844,654
	Historic Preservation Factor (N/A)				$0
	Subtotal NET Construction Cost				**$2,009,528,874**
	Overhead (included in unit costs)				$0
	Profit (included in unit costs)				$0
	Estimated NET Construction Cost				**$2,009,528,874**
	Contracting Method Adjustment (10 percent within NPS units)				$5,827,634
	Inflation Escalation (38 mos to construction mid-point)				$152,607,957
	Total Estimated NET Cost of Construction				**$2,167,964,465**

Assumptions for Alternative 2									*Resource:*
Mobilization			LS	25000	per mile				
Towers:	Deadend	67282	2	134564	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
	Angle	57670	2	115340	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
	Tangent	48058	7	336409	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
Foundations:	Deadend	50000	2	100000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Angle	30000	2	60000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Tangent	10000	7	70000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
Access Roads	$/mile	350000	3	1050000	per mile				DEA Highway Division
ROW	42 acre/mile	$20000/ac		840000	per mile				Estimated land value
Conductor	114800	26		2984800	Cost of conductor per mile per phase			ACCC	Conductor: 5280 ft/mi * 1.15 * 3 wire/phase * 3 phase * 2 circuits
Shield wire	6400	3		19200	1 phase per mile				Shield Wire: 5280 * 1.2 + waste
OPGW	6400	17		108800	1 phase per mile				OPGW: 5280 * 1.2 + waste
Insulators	96	1200		115200	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Hardware	48	1000		48000	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Dampers	36	300		10800	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Spacers	48	750		36000	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Anti-galloping	16	500		8000	As required by the engineer				Hubbell Power Systems
Decommission 230kV Line	4.21	150,000		4302	total cost divided by alignment length = per mile				Previous expereince
Equipment:									
D9	500	18		9000	cost/day	days/mile		cost/mile	Means Cost Data
Excavator	400	18		7200	cost/day	days/mile		cost/mile	Means Cost Data
Grader	400	16		6400	cost/day	days/mile		cost/mile	Means Cost Data
Dump trucks	350	22		7700	cost/day	days/mile		cost/mile	Means Cost Data
Crane	500	22		11000	cost/day	days/mile		cost/mile	Means Cost Data
Line truck	355	22		7810	cost/day	days/mile		cost/mile	Means Cost Data
Foreman trucks	310	22		6820	cost/day	days/mile		cost/mile	Means Cost Data
Safety Supervisor	310	22		6820	cost/day	days/mile		cost/mile	Means Cost Data
Puller/Tensioner	335	21		7035	cost/day	days/mile		cost/mile	Means Cost Data
Reel rigs	225	21		4725	cost/day	days/mile		cost/mile	Means Cost Data
Auger	400	10		4000	cost/day	days/mile		cost/mile	Means Cost Data
Grounding				45000	per mile				Various Utility Contacts
Rods	100	8	3.12	2496	per mile				Various Utility Contacts
4/o copper	10000	2.25		22500	per mile				Various Utility Contacts
mats	32000	2.25		72000	per mile				Various Utility Contacts
Grounding Labor				20000	per mile				Various Utility Contacts
Guard Structures	4000	1 LS		4000	per mile				Various Utility Contacts
Splicing	18000	0.25	mile	4500	Cost per splice site per mile				Various Utility Contacts
Geotechnical	350000	1	LS	350000	per mile				Various Utility Contacts
Drainage	1500	27.5	LF	41250	per mile				Various Utility Contacts
Erosion control/BMP			LS	23500	per mile				Various Utility Contacts
Line Mechanics	475	22	4	41800	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Line Supervisor	525	22	1	11550	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Ground men	375	22	2	16500	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Concrete Laborer	300	18	4	21600	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Concrete Supervisor	350	18	1	6300	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Safety Supervisor	400	22	2	17600	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Construction Manager	450	22	1	9900	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Project Manager	550	22	1	12100	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Engineering	500	20	1	10000	per day/per month/per mile				DEA
Clean up			LS	35000	per mile				Means Cost Data
Demobolization			LS	25000	per mile				Means Cost Data
Reclaim Restablize			LS	50000	per mile				
Contingency			5-10%	650000	per mile				Estimated
Total Cost per mile				**7637521**					
				6793219					
Estimate By: Matthew Williams				TRUE					
Review By: Rebecca Smith									

Alternative 2b
Project: Susquehana to Roseland 500kV Transmission Line
Park: Delaware Water Gap NRA, Middle Delaware National Scenic and Recreational River, Appalachiar
PMIS: None identified

Estimate By: Becky Smith
Date: 08/12/11

Reviewed By:
Date:

Estimate is based on 2010 costs

Item No.	Description	Quantity	Unit	Cost/Unit	Total
1	Right-of-Way (42 acres per mile)	6132	acres	$20,000.00	$122,640,000
2	Construction	146.8	linear mile	$6,933,944.82	$1,017,903,099
3	Decommission 230kV Line	4.21	linear mile	$150,000.00	$631,500
	Subtotal Direct Construction Costs				**$1,141,174,599**
	Published Location Factor (4 Percent)				$45,646,984
	Remoteness Factor (22 miles)				$25,105,841
	Federal Wage Rate Factor (32 Percent)				$146,070,349
	Design Contingency (30 Percent)				$342,352,380
	Total Direct Construction Costs				**$1,700,350,153**
	Standard General Conditions (20 Percent)				$340,070,031
	Government General Conditions (10 Percent within NPS units)				$4,931,015
	Historic Preservation Factor (N/A)				$0
	Subtotal NET Construction Cost				**$2,045,351,199**
	Overhead (included in unit costs)				$0
	Profit (included in unit costs)				$0
	Estimated NET Construction Cost				**$2,045,351,199**
	Contracting Method Adjustment (10 percent within NPS units)				$5,931,518
	Inflation Escalation (38 mos to construction mid-point)				$155,328,382
	Total Estimated NET Cost of Construction				**$2,206,611,099**

Assumptions for Alternative 2b									Resource:
Mobilization			LS	25000	per mile				
Towers:	Deadend	67282	2	134564	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
	Angle	57670	2	115340	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
	Tangent	48058	7.014	337064	per mile (reflect two add'l on NPS land)				Previous 2012 cost brought back to 2010 (2% assumed)
Foundations:	Deadend	50000	2	100000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Angle	30000	2	60000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Tangent	10000	7.014	70136.24	per mile (reflect two add'l on NPS land)				Concrete: $900/cy * (π/4(D^2)* Depth)/27
Access Roads	$/mile	350000	3	1050000	per mile				DEA Highway Division
ROW	42 acre/mile	$20000/ac		840000	per mile				Estimated land value
Conductor	114800	26		2984800	Cost of conductor per mile per phase			ACCC	Conductor: 5280 ft/mi * 1.15 * 3 wire/phase * 3 phase * 2 circuits
Shield wire	6400	3		19200	1 phase per mile				Shield Wire: 5280 * 1.2 + waste
OPGW	6400	17		108800	1 phase per mile				OPGW: 5280 * 1.2 + waste
Insulators	96	1200		115200	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Hardware	48	1000		48000	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Dampers	36	300		10800	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Spacers	48	750		36000	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Anti-galloping	16	500		8000	As required by the engineer				Hubbell Power Systems
Decommission 230kV Line	4.21	150,000		4302	total cost divided by alignment length = per mile				Previous expereince
New 230kV line									
Poles	83	$ 1,875		1060	total cost divided by alignment length = per mile				assume 40' poles every 360'. Includes augered hole and crossbar
Foundation	83	$ 20,896		11814	total cost divided by alignment length = per mile				assume same deadend/angle/tangent distribution as high-V
Cable	5.6	3,330,800		127060	total cost divided by alignment length = per mile				assume same materials as high-V
Equipment:									
D9	500	18		9000	cost/day	days/mile		cost/mile	Means Cost Data
Excavator	400	18		7200	cost/day	days/mile		cost/mile	Means Cost Data
Grader	400	16		6400	cost/day	days/mile		cost/mile	Means Cost Data
Dump trucks	350	22		7700	cost/day	days/mile		cost/mile	Means Cost Data
Crane	500	22		11000	cost/day	days/mile		cost/mile	Means Cost Data
Line truck	355	22		7810	cost/day	days/mile		cost/mile	Means Cost Data
Foreman trucks	310	22		6820	cost/day	days/mile		cost/mile	Means Cost Data
Safety Supervisor	310	22		6820	cost/day	days/mile		cost/mile	Means Cost Data
Puller/Tensioner	335	21		7035	cost/day	days/mile		cost/mile	Means Cost Data
Reel rigs	225	21		4725	cost/day	days/mile		cost/mile	Means Cost Data
Auger	400	10		4000	cost/day	days/mile		cost/mile	Means Cost Data
Grounding				45000	per mile				Various Utility Contacts
Rods	100	8	3.12	2496	per mile				Various Utility Contacts
4/o copper	10000	2.25		22500	per mile				Various Utility Contacts
mats	32000	2.25		72000	per mile				Various Utility Contacts
Grounding Labor				20000	per mile				Various Utility Contacts
Guard Structures	4000	1 LS		4000	per mile				Various Utility Contacts
Splicing	18000	0.25	mile	4500	Cost per splice site per mile				Various Utility Contacts
Geotechnical	350000	1	LS	350000	per mile				Various Utility Contacts
Drainage	1500	27.5	LF	41250	per mile				Various Utility Contacts
Erosion control/BMP			LS	23500	per mile				Various Utility Contacts
Line Mechanics	475	22	4	41800	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Line Supervisor	525	22	1	11550	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Ground men	375	22	2	16500	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Concrete Laborer	300	18	4	21600	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Concrete Supervisor	350	18	1	6300	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Safety Supervisor	400	22	2	17600	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Construction Manager	450	22	1	9900	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Project Manager	550	22	1	12100	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Engineering	500	20	1	10000	per day/per month/per mile				DEA
Clean up			LS	35000	per mile				Means Cost Data
Demobolization			LS	25000	per mile				Means Cost Data
Reclaim Restablize			LS	50000	per mile				
Contingency			5-10%	650000	per mile				Estimated
Total Cost per mile				**7778247**					
				6933945					
				TRUE					

Estimate By: Matthew Williams
Revised By: Rebecca Smith

Alternative 3
Project: Susquehana to Roseland 500kV Transmission Line
Park: Delaware Water Gap NRA, Middle Delaware National Scenic and Recreational River, Appalachiar
PMIS: None identified

Estimate By: Laura Meyer
Date: 06/25/10

Reviewed By: Rebecca Smith
Date: 08/23/11

Estimate is based on 2010 costs

Item No.	Description	Quantity	Unit	Cost/Unit	Total
1	Right-of-Way (42 acres per mile)	6610.8	acres	$24,000.00	$158,659,200
2	Construction	157.4	linear mile	$6,501,505.70	$1,023,336,998
3	Decommission 230kV Line	3.61	linear mile	$150,000.00	$541,500
	Subtotal Direct Construction Costs				**$1,182,537,698**
	Published Location Factor (2.7 Percent)				$31,928,518
	Remoteness Factor (22 miles)				$26,015,829
	Federal Wage Rate Factor (32 Percent)				$151,364,825
	Design Contingency (30 Percent)				$354,761,309
	Total Direct Construction Costs				**$1,746,608,179**
	Standard General Conditions (20 Percent)				$349,321,636
	Government General Conditions (10 Percent within NPS units)				$5,239,825
	Historic Preservation Factor (N/A)				$0
	Subtotal NET Construction Cost				**$2,101,169,640**
	Overhead (included in unit costs)				$0
	Profit (included in unit costs)				$0
	Estimated NET Construction Cost				**$2,101,169,640**
	Contracting Method Adjustment (10 percent within NPS units)				$6,303,509
	Inflation Escalation (38 mos to construction mid-point)				$159,567,355
	Total Estimated NET Cost of Construction				**$2,267,040,504**

Assumptions for Alternative 3									*Resource:*
Mobilization			LS	25000	per mile				
Towers:	Deadend	67282	2	134564	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
	Angle	57670	2	115340	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
	Tangent	48058	6	288351	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
Foundations:	Deadend	50000	1	50000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Angle	30000	2	60000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Tangent	10000	6	60000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
Access Roads	$/mile	350000	2	700000	per mile				DEA Highway Division
ROW	42 acre/mile	$24000/ac		1008000	per mile				Estimated land value
Conductor	114800	26		2984800	Cost of conductor per mile per phase			ACCC	Conductor: 5280 ft/mi * 1.15 * 3 wire/phase * 3 phase * 2 circuits
Shield wire	6400	3		19200	1 phase per mile				Shield Wire: 5280 * 1.2 + waste
OPGW	6400	17		108800	1 phase per mile				OPGW: 5280 * 1.2 + waste
Insulators	96	1200		115200	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Hardware	48	1000		48000	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Dampers	36	300		10800	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Spacers	48	750		36000	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Anti-galloping	16	500		8000	As required by the engineer				Hubbell Power Systems
Decommission 230kV Line	3.61	150000		3440.28	total cost divided by alignment length = per mile				Previous expereince
New 230kV line									
Poles	106	$ 1,875		1263	total cost divided by alignment length = per mile				assume 40' poles every 360'. Includes augered hole and crossbar
Foundation	106	$ 18,889		12721	total cost divided by alignment length = per mile				assume same deadend/angle/tangent distribution as high-V
Cable	7.2	3,330,800		152362	total cost divided by alignment length = per mile				assume same materials as high-V
Equipment:									
D9	500	18		9000	cost/day	days/mile		cost/mile	Means Cost Data
Excavator	400	18		7200	cost/day	days/mile		cost/mile	Means Cost Data
Grader	400	16		6400	cost/day	days/mile		cost/mile	Means Cost Data
Dump trucks	350	22		7700	cost/day	days/mile		cost/mile	Means Cost Data
Crane	500	22		11000	cost/day	days/mile		cost/mile	Means Cost Data
Line truck	355	22		7810	cost/day	days/mile		cost/mile	Means Cost Data
Foreman trucks	310	22		6820	cost/day	days/mile		cost/mile	Means Cost Data
Safety Supervisor	310	22		6820	cost/day	days/mile		cost/mile	Means Cost Data
Puller/Tensioner	335	21		7035	cost/day	days/mile		cost/mile	Means Cost Data
Reel rigs	225	21		4725	cost/day	days/mile		cost/mile	Means Cost Data
Auger	400	10		4000	cost/day	days/mile		cost/mile	Means Cost Data
Grounding				45000	per mile				Various Utility Contacts
Rods	100	8	3.12	2496	per mile				Various Utility Contacts
4/o copper	10000	2.25		22500	per mile				Various Utility Contacts
mats	32000	2.25		72000	per mile				Various Utility Contacts
Grounding Labor				20000	per mile				Various Utility Contacts
Guard Structures	4000	1 LS		4000	per mile				Various Utility Contacts
Splicing	18000	0.25	mile	4500	Cost per splice site per mile				Various Utility Contacts
Geotechnical	350000	1	LS	350000	per mile				Various Utility Contacts
Drainage	1500	27.5	LF	41250	per mile				Various Utility Contacts
erosion control/BMP			LS	23500	per mile				Various Utility Contacts
Line Mechanics	475	22	4	41800	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Line Supervisor	525	22	1	11550	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Ground men	375	22	2	16500	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Concrete Laborer	300	18	4	21600	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Concrete Supervisor	350	18	1	6300	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Safety Supervisor	400	22	2	17600	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Construction Manager	450	22	1	9900	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Project Manager	550	22	1	12100	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Engineering	500	20	1	10000	per day/per month/per mile				DEA
Clean up			LS	35000	per mile				Means Cost Data
Demobolization			LS	25000	per mile				Means Cost Data
Reclaim Restablize			LS	50000	per mile				
Contingency				650000	per mile				Estimated
Total Cost per mile				**7512946**					
				6501506					
Estimate By: Matthew Williams				TRUE					
Review By: Rebecca Smith									

Alternative 4
Project: Susquehana to Roseland 500kV Transmission Line
Park: Delaware Water Gap NRA, Middle Delaware National Scenic and Recreational River, Appalachiar
PMIS: None identified

Estimate By: Laura Meyer
Date: 06/25/10

Reviewed By: Rebecca Smith
Date: 08/23/11

Estimate is based on 2010 costs

Item No.	Description	Quantity	Unit	Cost/Unit	Total
1	Right-of-Way (42 acres per mile)	6804	acres	$23,000.00	$156,492,000
2	Construction	162	linear mile	$6,734,179.15	$1,090,937,022
3	Decommission 230kV Line	3.61	linear mile	$150,000.00	$541,500
	Subtotal Direct Construction Costs				**$1,247,970,522**
	Published Location Factor (2.7 Percent)				$33,695,204
	Remoteness Factor (22 miles)				$27,455,351
	Federal Wage Rate Factor (32 Percent)				$159,740,227
	Design Contingency (30 Percent)				$374,391,157
	Total Direct Construction Costs				**$1,843,252,461**
	Standard General Conditions (20 Percent)				$368,650,492
	Government General Conditions (10 Percent within NPS units)				$1,290,277
	Historic Preservation Factor (N/A)				$0
	Subtotal NET Construction Cost				**$2,213,193,230**
	Overhead (included in unit costs)				$0
	Profit (included in unit costs)				$0
	Estimated NET Construction Cost				**$2,213,193,230**
	Contracting Method Adjustment (10 percent within NPS units)				$1,549,235
	Inflation Escalation (38 mos to construction mid-point)				$168,074,668
	Total Estimated NET Cost of Construction				**$2,382,817,133**

Assumptions for Alternative 4				Total					Resource:
Mobilization			LS	25000	per mile				
Towers:	Deadend	67282	1	67282	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
	Angle	57670	2	115340	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
	Tangent	48058	7	336409	per mile				Previous 2012 cost brought back to 2010 (2% assumed)
Foundations:	Deadend	50000	1	50000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Angle	30000	2	60000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Tangent	10000	7	70000	per mile				Concrete: $900/cy * (π/4(D^2)* Depth)/27
Access Roads	$/mile	350000	3	1050000	per mile				DEA Highway Division
ROW	42 acre/mile	$23000/ac		966000	per mile				Estimated land value
Conductor	114800	26		2984800	Cost of conductor per mile per phase			ACCC	Conductor: 5280 ft/mi * 1.15 * 3 wire/phase * 3 phase * 2 circuits
Shield wire	6400	3		19200	1 phase per mile				Shield Wire: 5280 * 1.2 + waste
OPGW	6400	17		108800	1 phase per mile				OPGW: 5280 * 1.2 + waste
Insulators	96	1200		115200	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Hardware	48	1000		48000	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Dampers	36	300		10800	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Spacers	48	750		36000	3 phase 3 bundled conductor per mile				Hubbell Power Systems
Anti-galloping	16	500		8000	As required by the engineer				Hubbell Power Systems
Decommission 230kV Line	3.61	150,000		3343	total cost divided by alignment length = per mile				Previous expereince
New 230kV line									
Poles	39	$ 1,875		451	total cost divided by alignment length = per mile				assume 40' poles every 360'. Includes augered hole and crossbar
Foundation	39	$ 18,000		4333	total cost divided by alignment length = per mile				assume same deadend/angle/tangent distribution as high-V
Cable	2.6	3,330,800		53457	total cost divided by alignment length = per mile				assume same materials as high-V
Equipment:									
D9	500	18		9000	cost/day	days/mile		cost/mile	Means Cost Data
Excavator	400	18		7200	cost/day	days/mile		cost/mile	Means Cost Data
Grader	400	16		6400	cost/day	days/mile		cost/mile	Means Cost Data
Dump trucks	350	22		7700	cost/day	days/mile		cost/mile	Means Cost Data
Crane	500	22		11000	cost/day	days/mile		cost/mile	Means Cost Data
Line truck	355	22		7810	cost/day	days/mile		cost/mile	Means Cost Data
Foreman trucks	310	22		6820	cost/day	days/mile		cost/mile	Means Cost Data
Safety Supervisor	310	22		6820	cost/day	days/mile		cost/mile	Means Cost Data
Puller/Tensioner	335	21		7035	cost/day	days/mile		cost/mile	Means Cost Data
Reel rigs	225	21		4725	cost/day	days/mile		cost/mile	Means Cost Data
Auger	400	10		4000	cost/day	days/mile		cost/mile	Means Cost Data
Grounding				45000	per mile				Various Utility Contacts
Rods	100	8	3.12	2496	per mile				Various Utility Contacts
4/o copper	10000	2.25		22500	per mile				Various Utility Contacts
mats	32000	2.25		72000	per mile				Various Utility Contacts
Grounding Labor				20000	per mile				Various Utility Contacts
Guard Structures	4000	1 LS		4000	per mile				Various Utility Contacts
Splicing	18000	0.25	mile	4500	Cost per splice site per mile				Various Utility Contacts
Geotechnical	350000	1	LS	350000	per mile				Various Utility Contacts
Drainage	1500	27.5	LF	41250	per mile				Various Utility Contacts
Erosion control/BMP			LS	23500	per mile				Various Utility Contacts
Line Mechanics	475	22	4	41800	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Line Supervisor	525	22	1	11550	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Ground men	375	22	2	16500	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Concrete Laborer	300	18	4	21600	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Concrete Supervisor	350	18	1	6300	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Safety Supervisor	400	22	2	17600	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Construction Manager	450	22	1	9900	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Project Manager	550	22	1	12100	cost/day	days/mile	FTE	cost/mile	Various Utility Contacts
Engineering	500	20	1	10000	per day/per month/per mile				DEA
Clean up			LS	35000	per mile				Means Cost Data
Demobolization			LS	25000	per mile				Means Cost Data
Reclaim Restablize			LS	50000	per mile				
Contingency			5 - 10%	650000	per mile				Estimated
Total Cost per mile				**7703522**					
				6734179					
Estimate By: Matthew Williams				TRUE					
Review By: Rebecca Smith									

Alternative 5
Project: Susquehana to Roseland 500kV Transmission Line
Park: Delaware Water Gap NRA, Middle Delaware National Scenic and Recreational River, Appalachiar
PMIS: None identified

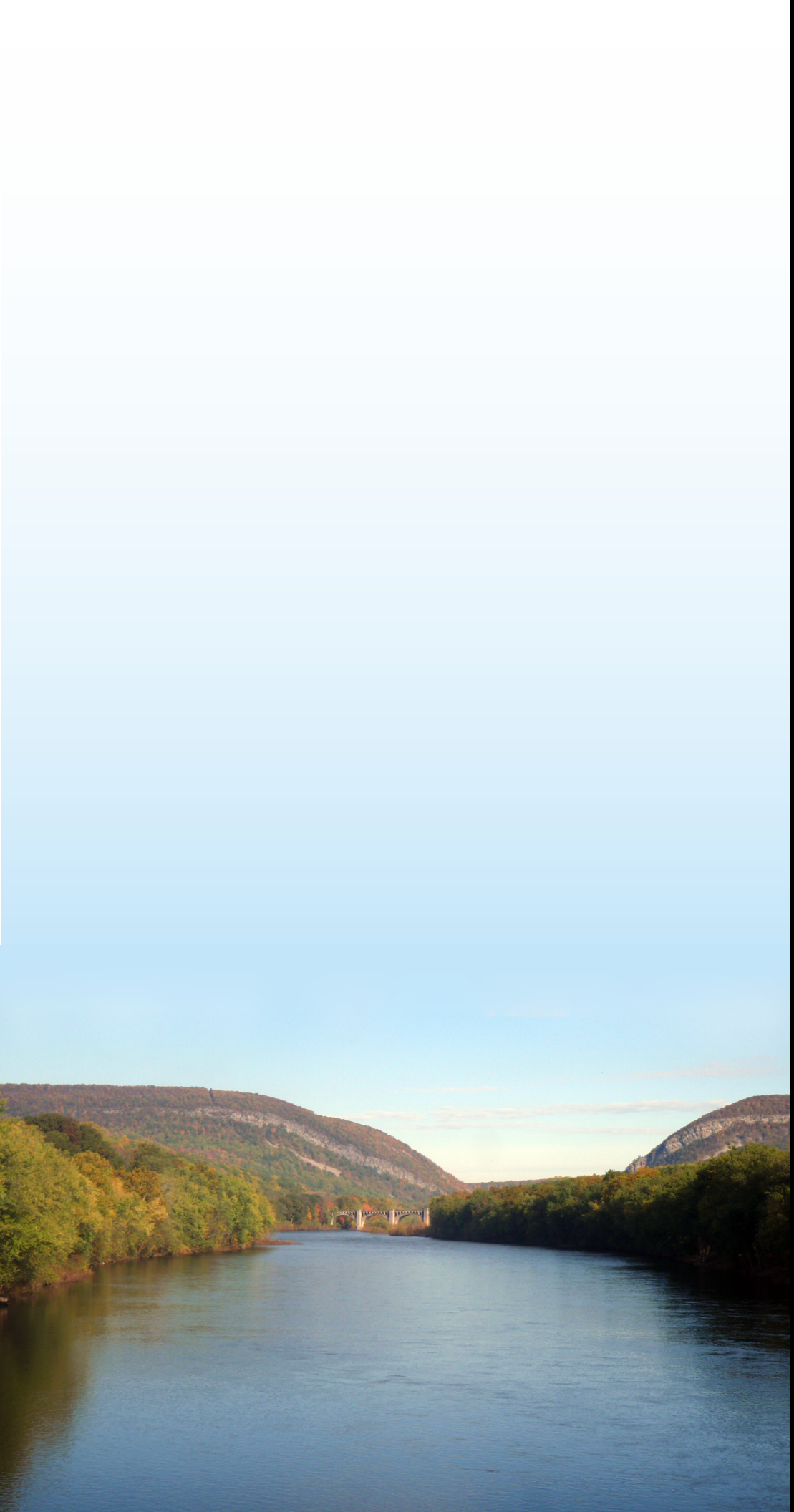
Estimate By: Laura Meyer
Date: 06/25/10

Reviewed By: Rebecca Smith
Date: 08/23/11

Estimate is based on 2010 costs

Item No.	Description	Quantity	Unit	Cost/Unit	Total
1	Right-of-Way (42 acres per mile)	4620	acres	$23,000.00	$106,260,000
2	Construction	110	linear mile	$5,820,286.76	$640,231,544
3	Decommission 230kV Line	3.61	linear mile	$150,000.00	$541,500
	Subtotal Direct Construction Costs				**$747,033,044**
	Published Location Factor (4 Percent)				$29,881,322
	Remoteness Factor (13 miles)				$9,711,430
	Federal Wage Rate Factor (32 Percent)				$95,620,230
	Design Contingency (30 Percent)				$224,109,913
	Total Direct Construction Costs				**$1,106,355,938**
	Standard General Conditions (20 Percent)				$221,271,188
	Government General Conditions (10 Percent within NPS units)				$1,216,992
	Historic Preservation Factor (N/A)				$0
	Subtotal NET Construction Cost				**$1,328,844,117**
	Overhead (included in unit costs)				$0
	Profit (included in unit costs)				$0
	Estimated NET Construction Cost				**$1,328,844,117**
	Contracting Method Adjustment (10 percent within NPS units)				$1,461,729
	Inflation Escalation (38 mos to construction mid-point)				$100,915,289
	Total Estimated NET Cost of Construction				**$1,431,221,135**

Assumptions for Alternative 5										*Resource:*
Mobilization			LS	25000	per mile					
Towers:	Deadend	67282	1	67282	per mile					Previous 2012 cost brought back to 2010 (2% assumed)
	Angle	57670	1	57670	per mile					Previous 2012 cost brought back to 2010 (2% assumed)
	Tangent	48058	4	192234	per mile					Previous 2012 cost brought back to 2010 (2% assumed)
Foundations:	Deadend	50000	1	50000	per mile					Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Angle	30000	2	60000	per mile					Concrete: $900/cy * (π/4(D^2)* Depth)/27
	Tangent	10000	6	60000	per mile					Concrete: $900/cy * (π/4(D^2)* Depth)/27
Access Roads	$/mile	350000	1	350000	per mile					DEA Highway Division
ROW	42 acre/mile	$23000/ac		966000	per mile					Estimated land value
Conductor	114800	26		2984800	Cost of conductor per mile per phase				ACCC	Conductor: 5280 ft/mi * 1.15 * 3 wire/phase * 3 phase * 2 circuits
Shield wire	6400	3		19200	1 phase per mile					Shield Wire: 5280 * 1.2 + waste
OPGW	6400	17		108800	1 phase per mile					OPGW: 5280 * 1.2 + waste
Insulators	96	1200		115200	3 phase 3 bundled conductor per mile					Hubbell Power Systems
Hardware	48	1000		48000	3 phase 3 bundled conductor per mile					Hubbell Power Systems
Dampers	36	300		10800	3 phase 3 bundled conductor per mile					Hubbell Power Systems
Spacers	48	750		36000	3 phase 3 bundled conductor per mile					Hubbell Power Systems
Anti-galloping	16	500		8000	As required by the engineer					Hubbell Power Systems
Decommission 230kV Line	3.61	150,000		4923	total cost divided by alignment length = per mile					Previous expereince
New 230kV line										
Poles	25	$ 1,875		426	total cost divided by alignment length = per mile					assume 40' poles every 360'. Includes augered hole and crossbar
Foundation	25	$ 18,889		4293	total cost divided by alignment length = per mile					assume same deadend/angle/tangent distribution as high-V
Cable	1.7	3,330,800		51476	total cost divided by alignment length = per mile					assume same materials as high-V
Equipment:										
D9	500	18		9000	cost/day	days/mile		cost/mile		Means Cost Data
Excavator	400	18		7200	cost/day	days/mile		cost/mile		Means Cost Data
Grader	400	16		6400	cost/day	days/mile		cost/mile		Means Cost Data
Dump trucks	350	22		7700	cost/day	days/mile		cost/mile		Means Cost Data
Crane	500	22		11000	cost/day	days/mile		cost/mile		Means Cost Data
Line truck	355	22		7810	cost/day	days/mile		cost/mile		Means Cost Data
Foreman trucks	310	22		6820	cost/day	days/mile		cost/mile		Means Cost Data
Safety Supervisor	310	22		6820	cost/day	days/mile		cost/mile		Means Cost Data
Puller/Tensioner	335	21		7035	cost/day	days/mile		cost/mile		Means Cost Data
Reel rigs	225	21		4725	cost/day	days/mile		cost/mile		Means Cost Data
Auger	400	10		4000	cost/day	days/mile		cost/mile		Means Cost Data
Grounding				45000	per mile					Various Utility Contacts
Rods	100	8	3.12	2496	per mile					Various Utility Contacts
4/o copper	10000	2.25		22500	per mile					Various Utility Contacts
mats	32000	2.25		72000	per mile					Various Utility Contacts
Grounding Labor				20000	per mile					Various Utility Contacts
Guard Structures	4000	1 LS		4000	per mile					Various Utility Contacts
Splicing	18000	0.25	mile	4500	Cost per splice site per mile					Various Utility Contacts
Geotechnical	350000	1	LS	350000	per mile					Various Utility Contacts
Drainage	1500	27.5	LF	41250	per mile					Various Utility Contacts
Erosion control/BMP			LS	23500	per mile					Various Utility Contacts
Line Mechanics	475	22	4	41800	cost/day	days/mile	FTE	cost/mile		Various Utility Contacts
Line Supervisor	525	22	1	11550	cost/day	days/mile	FTE	cost/mile		Various Utility Contacts
Ground men	375	22	2	16500	cost/day	days/mile	FTE	cost/mile		Various Utility Contacts
Concrete Laborer	300	18	4	21600	cost/day	days/mile	FTE	cost/mile		Various Utility Contacts
Concrete Supervisor	350	18	1	6300	cost/day	days/mile	FTE	cost/mile		Various Utility Contacts
Safety Supervisor	400	22	2	17600	cost/day	days/mile	FTE	cost/mile		Various Utility Contacts
Construction Manager	450	22	1	9900	cost/day	days/mile	FTE	cost/mile		Various Utility Contacts
Project Manager	550	22	1	12100	cost/day	days/mile	FTE	cost/mile		Various Utility Contacts
Engineering	500	20	1	10000	per day/per month/per mile					DEA
Clean up			LS	35000	per mile					Means Cost Data
Demobolization			LS	25000	per mile					Means Cost Data
Reclaim Restablize			LS	50000	per mile					
Contingency			5-10%	650000	per mile					Estimated
Total Cost per mile				**6791209**						
				5820287						
Estimate By: Matthew Williams				TRUE						
Review By: Rebecca Smith										



Appendix F

Mitigation Measures

APPENDIX F:
MITIGATION MEASURES

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APPENDIX F-1: MITIGATION MEASURES

While some alternatives may require specific mitigation measures, some best management practices (BMPs) are common to all action alternatives (alternatives 2-5). Correspondence regarding mitigation between the applicant and the National Park Service (NPS) can be found at the end of this appendix. The NPS would require the applicant to follow certain BMPs/mitigation measures for all action alternatives.

GEOLOGY

- Submit a detailed drilling plan for NPS review and approval for all drilling activities prior to drilling and construction activities.
- Complete geotechnical boring before construction to determine the appropriate depth needed to remove soils and weathered bedrock before reaching sound material where substantial excavation would occur. This would reduce the impacts of drilling in unstable material.
- Haul all tailings from geotechnical borings and drillings offsite, unless the NPS determines that there is a park need for the tailings.
- Use excavated rock as substrate for the access roads.
- Complete a preconstruction surface assessment prior to disturbance. If any paleontological resources are found, they would be avoided. If the resources are unavoidable, they would be collected and properly cared for before the start of construction.
- Monitor areas with potential paleontological resources during construction activities.
- Develop a buffer zone around areas of sensitive geologic resources. This buffer zone would protect these areas from drilling and excavation activities, limiting impacts.

Water and Soil Resources

- Prepare a spill prevention and response plan (SPRP) to reduce impacts on surface water, ground water, and aquatic species if equipment leaks or hazardous spills occur. The goal of the plan is to minimize the potential for a spill, contain any spillage to the smallest area possible, and to protect environmentally sensitive areas, including streams, rivers, and wetlands. The SPRP would include the following:
  - Procedures for fuel storage location, fueling activities, and construction equipment maintenance.
  - Lines of communication to facilitate the prevention, response, containment, and cleanup of spills during construction activities.
- Construct access roads with a gravel surface that is semipermeable to reduce the amount of stormwater runoff. A reduction in sheet flow would decrease the amount of sedimentation, total suspended soils, contaminants, nutrients, and turbidity in surface waters and impacts on aquatic species.
- Construct spur roads using geotextile fabric and stone, which would be removed at the conclusion of construction and revegetated.
- Construct road grades and alignments to follow the contour of the land with smooth, gradual curves; this would reduce the runoff potential of soils along the access roads outside the right-of-way (ROW).

- Inspect potential erosion areas weekly. Additionally inspect potential erosion areas immediately after storm events. The applicant would smooth out ruts and spread gravel to stabilize the roadway and prevent erosion.
- Develop and implement soil and erosion control plans as mandated in state permits for Pennsylvania Department of Environmental Protection (PADEP) and New Jersey Department of Environmental Protection (NJDEP).
- Implement erosion control methods, such as silt fences and straw bales, during and after construction to reduce impacts of increased soil runoff on water resources. By retaining soil on-site, sediment and attached nutrients are prevented from leaving disturbed areas and polluting streams. The use of BMPs is estimated to reduce total suspended solids (TSS) by 40 percent, total nitrogen by 25 percent, and total phosphorus by 40 percent (Baldwin n.d., 1).
- Use only those herbicides approved by the NPS for aquatic environments for removal of vegetation.
- Establish a 50-foot buffer near intermittent streams and a 100-foot buffer near perennial streams to reduce impacts on water quality and aquatic species (PPL and PSE&G 2008, 7).
- Drill during winter months (when not in areas with known snake dens) to reduce impacts of drilling on aquatic communities. Winter is when the least number of aquatic species and individuals are present in nearby water bodies.

FLOODPLAINS

- Avoid construction or clearing vegetation within floodplains and floodplain buffers.
- Construct dikes or conveyance ditches to divert or carry flood flows away from the site.
- Modify structures to provide sufficient elevation above the flood crest (e.g., place structures on columns, walls, piles, or piers).
- Restore watershed conditions to eliminate accelerated runoff caused by soil compaction, poor vegetation cover, or the unnatural conveyance of water by roads, ditches, or trails.
- Compensate lost natural floodplain values.
- Revegetate certain areas as directed in an NPS-approved, NPS-specific vegetation plan to reduce erosion into streams, wetlands, and floodplains.

WETLANDS

- Design access roads to avoid wetlands, including 50-foot buffers surrounding wetland areas where construction and full vegetation clearing would not occur.
- Use timber mats in areas outside the access roads during construction to minimize soil compaction.
- Except for those roads and towers identified in the final environmental impact statement (FEIS) and statement of findings (SOF), locate staging, tower, and pulling and splicing locations to avoid wetlands and rare and unique communities inside and outside the study area. During planning, design engineers would work closely with park staff to avoid these areas within park boundaries.
- Span wetlands with towers.

- Limit construction to winter months when soil and water are more likely to be frozen and vegetation is dormant.
- Use mats and wide-track vehicles when crossing wetlands because some wetlands never freeze.
- Carefully clean construction equipment after working in areas infested with known invasive and/or exotic plant species.
- Develop compensatory mitigation where clearing in a wetland would occur, as clearing is considered a loss. Director's Order 77-1 states that for new actions where impacts on wetlands cannot be avoided, proposals must include plans for compensatory mitigation that restores wetlands on NPS lands, where possible, at a minimum acreage ratio of 1:1.
- Establish a groundwater monitoring system, and conduct pre- and post-construction monitoring at Arnott Fen / Community Drive wetlands to assess the effects of drilling and excavation on groundwater dynamics and supply.
- Disinfect machinery, equipment, boots, and other gear when working or monitoring project activities in or near wetlands, following NPS-approved disinfection protocols to avoid spreading disease from wetland to wetland.
- Submit wetland delineations to the NPS for approval. The wetland delineations must be approved before any activity can take place.

VEGETATION

- Develop and implement an NPS approved, long-term, park-specific vegetation management plan for the operation and maintenance of the line. Separate vegetation management plans are needed from Public Service Electric and Gas Company (PSE&G) and Pennsylvania Power and Light Electric Utilities Corporation (PPL). These plans would focus on retaining habitat within the constraints of the North American Electric Reliability Corporation (NERC) guidelines, and the control of invasive species. These plans would address invasive species management, including early detection, monitoring, and treatment for target invasive species using an integrated pest management approach. Additionally, an invasive species management plan would address the possible spread of invasive species via wooden spools used to supply wire. Other topics in the vegetation management plan would include vegetation restoration (native seeding and plantings, with annual monitoring and re-treatment as needed to achieve minimum acceptable outcomes, including an increase in biodiversity); management of sensitive species and sensitive habitats during routine maintenance; management of the ROW vegetation that would increase habitat for scrub shrub species; the use of best management practices to include restrictions on use of machinery and equipment time-of-year restrictions on vegetation in sensitive areas; pre-approval by NPS on pesticide and herbicide use; and off-site compensation. The vegetation management plan would also include an equipment cleaning plan that would address techniques for removal of any invasive seed sources prior to entering the parks.
- Clearly delineate the area to be cleared to minimize the amount of vegetation removed; the NPS would approve delineations prior to any action taking place.
- Clearly delineate wetlands prior to clearing activities and avoid these areas during these activities; however, wooded wetlands would be subject to tree clearing if non-compatible species are present.
- Use existing roads with minimal development of new access roads.

- Promptly seed areas disturbed during construction of the transmission line with a conservation mix approved by NPS, and monitor these areas for the spread of invasive plant species.
- Require that maintenance crews enter the ROW on foot and use handheld equipment for vegetation maintenance in sensitive areas.
- Minimize disturbance to native plant species to the greatest extent possible during construction and maintenance to prevent the spread of non-native species.
- Clean equipment after leaving areas where invasive species are known to occur and before entering sensitive areas.
- Use construction materials (e.g., gravel) from sources that had been inspected and found to be free of invasive species.
- Refrain from using mulched or chipped vegetation in areas of the parks outside the area in which the vegetation was removed to decrease the potential for spreading invasive species.
- Use timber mats during construction in areas outside the access roads to minimize soil compaction.
- Complete measures for the annual suppression of invasive plants within the ROW for the life of the project. Additionally, the applicant would be required to complete this same suppression in the decommissioned ROW for the applicable alternatives (3-5).

LANDSCAPE CONNECTIVITY, WILDLIFE HABITAT, AND WILDLIFE

- Impose a seasonal restriction on maintenance activities from March 15 through July 31 to prevent unauthorized take of nests and unfledged chicks protected under the Migratory Bird Treaty Act (MBTA). An avian protection plan (APP) would be developed and would be a condition of the applicant's permit. A summary of an example APP is included in appendix F-2.
- Impose a seasonal restriction on maintenance activities in March and April in areas of known amphibian migration to prevent direct mortality of spring peepers, wood frogs, spotted salamanders, red spotted newts, and Jefferson salamanders.
- Leave brush piles alongside the ROW to provide habitat for a variety of wildlife species following the clearing of vegetation.
- Remove spur roads following construction and maintain the ROW to provide bird habitat.
- Employ the following bird-safe standards and design components to minimize bird electrocution (PSE&G 2010, 23):
  - Use Avian Power Line Interaction Committee (APLIC) recommended eagle-safe standards in areas that contain known eagle nests or foraging habitats; these standards require at least 60 inches of horizontal and 48 inches of vertical separation of energized and grounded parts of electrical equipment.
  - Use an alternative raptor-safe design standard in areas where eagles are unlikely to occur but that contain nests or habitats for raptor species; this design standard includes a clearance of 48 inches to minimize electrocution potential based on the wing length (and wrist-to-wrist distance) of certain raptors.
  - Use APLIC-recommended bird-safe standards for areas with concentrations of tall birds (wading birds, including herons and egrets); these standards require at least 60 inches of

horizontal and 60 inches of vertical separation of energized and grounded parts of electrical equipment.

- Employ the following design components to minimize bird collisions with the lines (PSE&G 2010, 23):
  - Use flight diverters or transmission line markers where technically feasible for the static wires to reduce collision hazards in areas known to support species of birds that are at higher risk of collision and areas with topographic features and habitats that could attract concentrations of breeding or migrating birds.
  - Use optical ground wire for the transmission line, which is larger in profile than typical stand-alone ground wire and would be roughly 0.2 inch thicker than the existing wires on the S-R Line and should be more visible to birds.
  - Use bundled conductors to make the transmission lines more visible to birds than a nonbundled configuration; each bundled conductor would consist of three wires grouped together with spacers separating the wires.

SPECIAL STATUS SPECIES

- Conduct preconstruction surveys for presence of special-status species, habitat, nests, dens, and new hibernacula. This is particularly important because construction would not occur for some time following the completion of the NEPA process and special-status species could begin using habitat between site surveys and construction activity. If special-status species, nests, dens, or habitats are found, then consultation measures would be developed and implemented in consultation with state and federal regulatory agencies.
- Develop and implement an NPS-approved, long-term, park-specific vegetation management plans for the operation and maintenance of the line. Separate vegetation management plans are needed for both from PSE&G and PPL. This plan would help reduce impacts to the bog turtle and potential bog turtle habitat.
- Modify the placement of towers, access roads, laydown areas, and other ground-disturbing activities in order to avoid areas that support special-status species.
- Obtain a qualified biologist to conduct pre-construction surveys for special status species and determine if relocation would be an appropriate mitigation measure for any species found; these surveys would occur prior to any ground-disturbing or vegetation clearing activities. It is possible that some species such as reptiles, amphibians, and mussels identified during the preconstruction surveys could be collected and relocated prior to or during construction activities, if this were found to be beneficial or appropriate for the species present at the site. If relocation were to be undertaken, a plan for the relocation of the special status species would be designed in accordance with the appropriate federal and state agencies and a qualified and permitted biologist would collect and relocate individuals to nearby suitable habitat.
- Consult with appropriate federal and state agencies if special-status plant populations cannot be avoided, depending on the listing status of the species present. These consultations would determine appropriate mitigation measures for any populations affected by the proposed project. Appropriate measures could include the creation of offsite populations through seed collection or transplanting, preservation, and enhancement of existing populations, or restoration or creation of suitable habitat in sufficient quantities to compensate for the impact.
  - Translocation includes digging up plants and moving them to appropriate portions of the corridor that would not be affected by the proposed construction activities.

  - Seeds can also be collected from plants that would be removed and either planted directly or germinated in a nursery and then planted in appropriate locations.

- Develop and implement (by recognized and qualified zoologists including individuals certified by the U.S. Fish and Wildlife Service or state conservation agencies) species-specific Conservation and Mitigation plans if special–status wildlife species or occupied habitat cannot be avoided. These individuals would complete on-site monitoring. The plans would include:
  - Conservation measures, such as time-of-year restrictions.
  - Pre-construction surveys.
  - Construction monitoring.
  - Habitat preservation habitat restoration components.
  - Post-construction monitoring as needed.
- Ensure that park staff or representatives from appropriate state or federal agencies who were experienced in managing or monitoring special status species are on site to monitor for special-status species during the construction activities to verify that special-status species are not in the active construction area.
- Complete an APP in accordance with the Bald Eagle Guidelines (USFWS 2007) and APLIC standards. Some of the proposed alternatives are not consistent with the Bald Eagle Guidelines, as discussed in the FEIS.
  - The APP would include elements that provide for training for all utility and contractor personnel on compliance with applicable regulations, procedures to be implemented for avoidance and minimization of disturbance, reporting bird mortality, required permits, accepted construction standards for reducing bird impacts, methodology for evaluation of risks to migratory birds, opportunities for enhancement of bird populations or habitat, public awareness and education, and identification of key resources.
  - The standards described in APLIC (1994) would be followed and would also comply with the APLIC *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006).
  - Proposed construction and maintenance activities would follow and adhere to the Bald Eagle Guidelines (USFWS 2007), which would minimize the potential for "take" on the bald eagle.
  - To reduce impacts on birds from collisions with the transmission line, the APP (PSE&G 2010) would be written in compliance with APLIC standards and would use the current best available technologies.
- Continue to identify and control invasive plant species through the applicant's invasive plant management plans. In addition, an aggressive invasive plant management plan developed and implemented by the applicant would include ongoing monitoring and treatment.
- Close access roads to the public to reduce the impacts of illegal collection. It has been demonstrated by Garber and Burger (1995, 1152 and 1158) that when formerly intact, undisturbed, forested areas are opened to human recreation, the extinction of special-status species can occur in that particular area. Rare species, especially plants and small reptiles and amphibians, are vulnerable to illegal collecting, and even small numbers collected annually for a number of years could jeopardize the local population.
- Law enforcement would monitor visitor activities in these areas, including the use of remote surveillance to assess the need for and effectiveness of area closures. There would be an increase in

patrols along the access roads and any new ROW. Existing and proposed new access roads, especially access roads, could act as an attractive nuisance and/or recreation opportunity, by inviting visitors to areas inhabited by rare species and increasing visitor encounters with these species.

- Law enforcement and resource staff would monitor closed areas for invasive species, vegetation, wildlife, and erosion, and the presence of park staff may dissuade visitors from entering these illegal areas.
- Implement road closures and/or patrols prior to and during construction activities at locations where it was deemed effective.
- Install barrier fencing along streams to keep wood turtles from entering construction sites.
- Implement seasonal restrictions to reduce impacts on special-status species. Seasonal restrictions would be site-specific, based on species present and their use of the site and include the following:
  - Seasonal restrictions on vegetation clearing from March 15 through July 31 would prevent the unauthorized take of nests and unfledged chicks of birds protected by the MBTA (USFWS 2010). This seasonal restriction would protect the majority of the special-status bird fledglings that may occur in the study areas for each alternative. Therefore, the permanent and seasonal resident nesting special-status bird species would not be forced to abandon nests or young, because vegetation clearing would not occur during the nesting season; no direct mortality of eggs, young, or adults would occur as a result.
  - Seasonal restrictions for disturbance of bald eagles would include a restriction within 1,000 feet of bald eagle nests between December 15 and August 31, the bald eagle nesting period. This restriction is recommended in the Bald Eagle Guidelines (USFWS 2007).
  - Seasonal restrictions for tree clearing and construction would be implemented from December 15 to March 31 in the vicinity of bald eagle roosts.
  - To prevent cutting of potential roost trees for the Indiana bat, a season restriction from April 1 through September 30, which includes the restriction of cutting trees with a DBH greater than 8.7 inches would be implemented.
  - A seasonal restriction from April 1 through October 31 preventing the cutting of all trees or snags with a DBH greater than 5 inches would be implemented to avoid potential impacts on northern myotis and other tree-roosting bats.
  - Seasonal restrictions on project activities would be implemented in venomous snake basking, birthing, and foraging habitat during the active season. Safe dates for project activities span from November 1 through March 31. Further timing restrictions for drilling and excavation activities would be required in the vicinity of overwintering dens.
  - Seasonal restrictions for Neotropical birds and bats would also benefit nesting and birthing reptile species in the spring and summer.
  - Seasonal restrictions would be implemented on project activities in wood turtle foraging habitat during the active season. Safe dates for project activities are November 15 through March 31.
  - Seasonal restrictions on project activities in bog turtle wetlands and 300-foot buffer during active season would be implemented. Safe dates for project activities are November 1 through March 31.

Various measures to specifically protect bog turtles would be undertaken in accordance with the *Bog Turtle (*Clemmys muhlenbergii*) Northern Population Recovery Plan* (USFWS 2001), and the bog turtle conservation zones presented in the "Special-status Species" section of chapter 3 of the FEIS. These actions would be undertaken where appropriate as mitigation measures. Future coordination with appropriate federal and state agencies would clarify the extent to which adverse effects to the bog turtle would be likely to occur and would determine whether a biological assessment (BA) would be required. The FEIS and the BA for this project would include more details concerning impacts and mitigation measures to the bog turtle as appropriate. Other conservation and/or mitigation measures to protect the bog turtle suggested by the Recovery Plan include the restoration of disrupted wetland hydrology, the control of invasive species, reconnection of fragmented habitat, population monitoring, and protection of nests from collection and predation (USFWS 2001).

CULTURAL RESOURCES

Mitigation measures will be identified through consultation with Section 106 consulting parties prior to signature of the Record of Decision, and finalized in the ROW permit to the applicant, but will include a combination of efforts and practices as described in the three resource categories below.

ARCHEOLOGY

Avoidance of effects to archeological sites will be the preferred method of mitigation. The applicant would be required to cordon off site areas and deliberately avoid them by construction activities, thereby preserving the sites' integrity and potential for scientific knowledge.

If avoidance is infeasible, the applicant would be required to undertake data recovery of the affected portion of the site, according to state and federal standards. In most situations, this would involve substantial excavation for the purpose of recovering a sample of the significant data contained in the site, as well as detailed analyses of the recovered data. However, DEWA maintains a 100% standard for data recovery, which exceeds both state and federal standards. Thus, in the event that data recovery excavations are required within NPS boundaries, the affected portion of the site would be fully excavated. The applicant must prepare excavation plans and submit to the DEWA cultural resources manager for approval before implementation. The applicant will be required to treat all artifacts excavated on NPS lands according to 36 CFR Part 79 standards.

Alternative mitigation measures may also be required such as the development of exhibits and other kinds of interpretive materials. While such measures are not an alternative to DEWA's excavation standard, alternative mitigation measures can be valuable, and would include input from all consulting parties in the project. Examples of alternative mitigation include interpretive materials for the public, such as building a display or exhibit (permanent or portable) showing artifacts, graphics, and text; or a public document, such as a book, booklet, or pamphlet about the site that can be made available to the public.

HISTORIC STRUCTURES

Effects are expected to be primarily adverse visual impacts. Avoidance and minimization efforts will be the first priority. These efforts may include strategic placement by the applicant of transmission towers to be as visually unobtrusive as possible, as well as selection of color and finish that blend in with the vegetation of the area. "Artificial-tree" designs, as used by some cell phone towers, are not suitable.

Some of the adverse visual impacts may be mitigated through placement of trees and other vegetation between the historic architectural resource and the transmission line. These measures are most effective in situations where the transmission line is sufficiently far removed from the historic structure so as to be

mostly or totally hidden from view by vegetative screening. In these cases, however, towers, lines, and ROW may still be visible five months of the year (November – March) when leaves are off the trees. Coniferous vegetation could also be used to increase screening potential where appropriate. Sites for which these method is appropriate will be identified on a case-by-case basis, and measures proposed by the applicant approved by the parks.

Mitigation measures identified in the permit may also require the applicant to prepare materials that interpret the history and architecture of the study area to the public at large. Possible work products include published histories, National Register nominations, websites, brochures, exhibits, wayside panels, and driving/walking tours. The parks will review and approve all applicant-prepared products before distribution.

Mitigation can also include requiring the applicant to fund or complete improvements to the physical condition of the adversely-impacted structures, or other structures agreed upon by the parks and Section 106 consulting parties.

The parks may also prepare planning documents for historic property management, such as preservation plans, leasing viability studies, etc.

CULTURAL LANDSCAPES

Similar to historic structures, design modifications will be considered first; these could include both strategic placement of the transmission towers to be as visually unobtrusive as possible and selections of color and finish of the towers that might blend them more into the surrounding landscape.

- When feasible, alignments should be at lower elevations or behind higher elevations to mitigate visual impacts of the corridor. Any design changes to the towers should be discussed and reviewed by the parks and Section 106 consulting parties before action is taken.
- Some of the current efforts to conceal cell towers by giving them the appearance of an artificial tree only call more attention to the tower, failing to mitigate the visual impact. Colors and finish that blend more with the landscape might be more desirable.

Some of the adverse visual impacts may be mitigated through placement of trees and other vegetation between the cultural landscape resources and the transmission line corridor. These measures are most effective in situations where the transmission line is sufficiently far removed from the resource so as to be mostly or totally hidden from view by vegetative screening. Sites for which this method is appropriate will be identified on a case-by-case basis, and measures proposed by the applicant approved by the parks.

Some of these adverse visual impacts may be mitigated through requiring the applicant to prepare materials that interpret the overall cultural landscapes of the study area as well as individual cultural landscapes in the study area to the public. Interpretation should explore cultural landscapes as evolving entities, responsive to the needs of their occupants. Possible work products include published histories, National Register nominations, websites, brochures, exhibits, wayside panels and driving/walking tours. The parks will review and approve all applicant-prepared products before distribution.

Mitigation can also include improving the physical condition of the adversely-impacted landscapes, or other cultural landscapes agreed upon by the parks and Section 106 consulting parties.

Planting plans for landscapes in and around the corridor alignment, and implementation of such plans, are potential mitigation measures for cultural landscapes. The parks may also prepare planning documents for historic property management, such as preservation plans, leasing viability studies, etc.

INFRASTRUCTURE, ACCESS AND CIRCULATION

Prior to construction activities

- Develop a construction staging plan with the NPS and other parklands.
- Develop a traffic control plan in conjunction with NPS, other parklands, and local jurisdictions.
- Work with NPS and affected agencies to develop a cooperative agreement for the control of unauthorized public access and use on NPS and other federal and state lands that could result from the proposed project. The agreement would address various provisions related to unauthorized access, such as the following:
  - Additional measures to be taken to discourage unauthorized use of the project corridor and associated access roads.
  - Periodic inspection for unauthorized access and any resulting damage.
  - Repair of any damage from unauthorized access.
- Develop a media strategy/notification plan as a means to notify local residents, businesses, and officials of closures and changes in traffic patterns.

During construction activities

- Design and construct new access roads to minimize runoff and soil erosion.
- Install gates at the entrances to access roads to reduce unauthorized use; coordinate gate locks with landowners.
- Restore public roadways to their pre-construction conditions or better upon completion of project construction activities.
- Reclaim any road-related disturbance areas after construction is completed.

VISUAL RESOURCES

During Project Design several mitigation measures would be undertaken. Measures under APLIC to decrease bird collisions and electrocutions would supersede visual resource mitigation measures that directly contradict those found under the APLIC guidelines in areas where both sets of mitigation measures would be applicable:

- Locate new access roads within previously disturbed areas.
- Route the alignment of new access roads to follow landform contours where practicable, providing that such alignment does not impact additional resource values, to minimize ground disturbance and/or reduce scarring (visual contrast) of the landscape.
- Place structures in designated areas so as to avoid sensitive features such as, but not limited to, riparian areas, water courses, and cultural sites, and/or to allow conductors to clearly span the

features, within limits of standard tower design. If the sensitive features cannot be completely avoided, towers would be placed so as to minimize the disturbance.

- Place tower structures at the maximum feasible distance from roadway and trail crossings, and where preservation of existing vista(s) is particularly important. Distances would be within the limits of standard tower structure design.
- Use non-reflective neutral colored paints and coatings approved by the NPS to reduce reflection, glare, and/or contrast on structures.
- Use non-reflective insulators (i.e., non-ceramic or porcelain).
- Use non-specular conductors to reduce reflectivity.
- Locate construction staging areas away from visually sensitive locations.
- Conceptual landscaping in the form of vegetation planted outside but along the utility ROW.

During construction and maintenance activities

- Restrict construction vehicle movement outside the ROW to NPS-approved routes. Should additional road access be required, permission would be granted by the NPS prior to disturbance, and appropriate remuneration fees would be assessed.
- Keep areas around the towers clean and free of debris.
- Maintain a clean construction site and remove all related equipment, materials, and litter following construction.
- Preserve vegetation within the 150-foot-wide right-of-way that would not interfere with maintenance access needs.
- Revegetate disturbed areas with approved species.
- Provide regular maintenance of access roads and fences within and leading to the corridor.
- Cut stumps close to ground.
- Implement “low-impact tree clearing” which involves directional tree-felling, both mechanically and by hand.
- Rehabilitate and/or restore disturbed areas.

SOUNDSCAPES

- Comply with county and city noise ordinances.
- Provide advanced notice of construction to affected residences, businesses, and public facilities.
- Install sound-control devices on all construction equipment.
- Install muffled exhaust on all construction equipment and vehicles except helicopters, if used.
- Limit construction activities to daytime hours.

VISITOR USE

- Develop an off-highway vehicle / all-terrain vehicle (OHV/ATV) deterrent plan prior to construction activities.
- Coordinate construction schedules with NPS and other managers of affected recreation areas to avoid peak visitor use periods and notify visitors of construction.
- Permanently close and revegetate spur roads to discourage OHV/ATV use. For roads still in use, restrict access by unauthorized users as identified in the OHV/ATV deterrent plan. (See Infrastructure, Access, and Circulation for similar mitigation measures).
- Prior to construction develop a media strategy/notification plan as a means to notify local residents and visitors of closures.

HEALTH AND SAFETY

- Develop safety and emergency plans for the project prior to construction activities.
- Fully train operators of the construction equipment and vehicles to reduce the chance of accidents.
- Inspect construction equipment for malfunctions or faulty parts to reduce the risk of leaking fluids that could harm the environment or humans from contact.
- Put in place safety devices such as traveling grounds, guard structures, and radio equipped public safety roving vehicles and lineman prior to the initiation of wire stringing activities.
- Install guard poles or guard structures at all transportation, flood control, and utility crossings, and may be installed at parks or near residences. Guard poles are temporary facilities designed to stop the travel of the conductor should it momentarily drop below a conventional stringing height.
- Restrict use of the immediate area in which construction would occur for safety reasons (PPL and PSE&G 2008, A10-6) to minimize impacts on park visitors during construction of the line within the parks.
- Fence off construction areas in areas outside of the park, but inside the study area, where the public could access the construction site.
- Station a safety representative at APPA crossings during any and all construction to maintain public safety.
- Station a safety watchman on the river during stringing operations to stop any boat traffic if an incident does occur or if conditions otherwise warrant (PPL and PSE&G 2008, 6).
- Implement road closures and traffic control to minimize the risk of accidents from occurring during the construction period.
- Regularly maintain and inspect helicopters and employ operators certified/licensed in helicopter aviation.
- Operators conducting aerial work in support of the utility may encounter hazards from the various types of flight profiles, terrain, infrastructure, weather, and operation at low levels and speeds.
  - To reduce the potential risk of a collision, the crew would identify potential collision hazards and make corrective actions prior to taking flight.

– While in flight, the crew would exercise concentration, maintain situational awareness, be knowledgeable of their area of operations, maintain effective communications, and establish clear roles and responsibilities.

REFERENCES

Avian Power Line Interaction Committee (APLIC)

1994 *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994*.

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RECEIVED
JUN 03 2011

Gregory J. Smith
Manager-Transmission Expansion

PPL Electric Utilities
Two North Ninth Street, GENN5
Allentown, PA 18101-1179

ppl™

June 1, 2011

Mr. John Donahue
Delaware Water Gap National Recreation Area
One River Road
Bushkill, PA 18324

Ms. Pamela Underhill
Appalachian National Scenic Trail
252 McDowell Street
Harper's Ferry, WV 25425

Re: Susquehanna Roseland Mitigation Concept

Dear John and Pam:

I have enclosed a draft of PPL's and PSEG's (collectively, the "Applicants") Mitigation Conceptual Plan. Although the mitigation planning is in its early stages, the Applicants want to clearly confirm to the National Park Service that the Applicants are committed to mitigation for any unavoidable impacts that result from the construction of the Applicant's planned Susquehanna to Roseland 500 kV transmission line. The Applicants are providing this to you as information that can be used as the NPS prepares the draft Environmental Impact Statement.

Additionally, when we last spoke, you mentioned that the Park Service would provide the Applicants with an acreage range that will likely be needed for mitigation based upon GIS modeling that the Park Service has had performed on the potential visual impacts. We would greatly appreciate your sharing that acreage range with us as to enable us to better understand the scope of the mitigation that might be necessary.

Please call me if you have any questions about this Mitigation Conceptual Plan.

Sincerely,

Gregory J. Smith

cc: Ron Reybitz
John Valeri
Andrew Tittler
Rob Pollock

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May 31, 2011

Applicants' Mitigation Concept for the Susquehanna – Roseland 500 kV Transmission Line Project

Public Service Electric and Gas Company (PSE&G) and PPL Electric Utilities Corporation (PPL), collectively known as the Applicants, would like to reiterate their intent, as initially set forth in their National Park Service (NPS) application, to properly mitigate for impacts to NPS lands from the Applicants' proposal to construct the Susquehanna – Roseland 500 kV Transmission Line Project (the "Project"). This statement outlines Applicants' conceptual plan to address potential adverse impacts. This conceptual plan was developed based upon impacts to NPS lands and is thus only applicable to NPS Alternatives 2 and 8. The NPS resources are the Delaware Water Gap National Recreation Area (DEWA), the Middle Delaware National Scenic River (Scenic River), and the Appalachian National Scenic Trail (APPA).

The Applicants have looked extensively at various possible routing alternatives to construct the line between Susquehanna and Roseland. The most suitable route was defined as the route minimizing the effect of the transmission line on all factors of the natural and human environment, while avoiding unreasonable routes, extreme costs, and non-standard design requirements to the extent possible.

The Applicants and their routing consultant teams, along with public outreach and other specialty consultants, undertook a 6-month program of identifying potential routes in their respective states. This program involved intensive analysis through reviewing maps, Geographic Information Systems (GIS) data sets, and aerial photography; conducting field analysis; and subsequently identifying three Alternative Routes for further evaluation.

Once the Alternative Routes were identified, the Applicants and their routing teams held public workshops throughout the project study area; consulted with various federal, state, and local regulatory and resource agencies and other stakeholders; and conducted additional analysis of the three routes comparing land use, rights-of-way, environmental, cost, public input, and other factors, in order to identify a preferred route.

As a result of the intensive routing study, the Applicants have determined that the best route for the new line resulting in the least overall impact on the natural and human environments is a route that traverses through approximately 4.18 miles of land held by the NPS in Pennsylvania and New Jersey along the path of an existing 230 kV transmission line owned and operated by the Applicants. The preferred route makes use of existing transmission line rights-of-way for the overwhelming majority of the route in both states (100 percent in New Jersey and more than 90 percent in Pennsylvania). The preferred route was submitted to, and subsequently approved by, the public utility regulatory agencies in both states. The preferred route is the same route being evaluated by the NPS in Alternatives 2 and 8 by the NPS as part of its Environmental Impact Statement.

The Applicants have put forth a proposal to either avoid or minimize impacts of the Project by using Best Management Practices that will become part of the NPS Special Use and Construction Permits for the construction of the Project. However, the Applicants recognize that there may be instances where impacts cannot be avoided or minimized. In such instances, the Applicants are prepared to mitigate unavoidable impacts by providing land preservation based, primarily, on the impact of the Project on viewsheds. The Applicants will work with the NPS to arrive at a reasonable methodology to determine the appropriate mitigation, including developing formulae or methodologies to determine the amount of land preservation and the types of property interests necessary to achieve the mitigation objectives. The land preservation can then be accomplished by direct property interest acquisitions or by working with (and funding) one or more third party conservation organizations that identify and acquire land as part of their organizational mission.

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

JUN 27 2011

Mr. Gregory Smith
Manager, Transmission Expansion
PPL Electric Utilities
Two North Street, GENPL3.
Allentown, Pennsylvania 18101-1179

Dear Mr. Smith:

Thank you for your correspondence of June 1, 2011, including your most recent iteration of the applicant's mitigation concept. We will make every effort to ensure that the EIS reflects your efforts to propose mitigation for the impacts caused by alternatives number two (#2) and number eight (#8) as you have requested. However, the mitigation is non-specific and has become less substantive with each new iteration.

Regarding your second request, we cannot agree that we reached an understanding that the National Park Service (NPS) would propose mitigation measures for the applicant. We were at an impasse on that issue in our meeting. It was suggested that the applicant propose their mitigation strategy and you, as the applicant's representative, requested that the NPS should define how impacts would be ameliorated in a quantitative fashion.

The EIS process will define the impacts; this activity is still in process. Any efforts to offset impacts proposed by the applicant will be included in the document such as your concept included in the June 1, 2011, correspondence. It is not the role of the NPS to negotiate mitigation at this stage of the process, before any decision is made. We remain open to including any commitments made by the applicant in the document so that the public has a complete understanding of the potential benefits along with the impacts from the proposal.

We look forward to continuing a fruitful dialogue on all aspects of the project.

Sincerely,

John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6279

APPENDIX F-2: AVIAN PROTECTION PLAN

As part of mitigation for the proposed plan, an APP would be developed and would be a condition of the applicant's permit. This example of an APP is a plan developed by PSE&G for the New Jersey Highlands Council. While this APP provides an example of what an APP might be similar to for the proposed S-R Line, the below plan has not been reviewed by NPS, and NPS was not a participant in the development of this plan. An APP for the proposed S-R Line would be developed and reviewed by NPS.

This APP was developed for the New Jersey Highland section of the proposed S-R Line, outside of NPS land. PSE&G has developed an APP (PSE&G 2010) in accordance with the *Avian Protection Plan Guidelines* (APP Guidelines), a joint guidance document prepared by APLIC and USFWS (2005). The APP Guidelines, along with related guidance documents, are considered the most current and comprehensive guidance tools to reduce the risks that result from bird interactions with electrical utility facilities, including electrocution by and collision with the proposed transmission line. Related documents that were used to develop the APP included *Suggested Practices for Raptor Protection on Power Lines* (Miller et al. 1975), *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006), and *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994* (APLIC 1994). The APP is also closely integrated with the CMP for the S-R Line through the New Jersey Highlands (PSE&G 2009), which has several components that relate to bird habitats, including the Transmission ROW Management Plan, Wetland and Transition Area Mitigation Plan, Stream and Riparian Habitat Restoration Plan, Critical Wildlife Habitat Endangered Species Mitigation Plan, and the Forest Management Plan. The APP describes the bird resources and issues in the project area, defines the methods that PSE&G would employ to avoid and minimize the direct and indirect impacts of the project on bird resources, and identifies bird enhancement opportunities that PSE&G would implement during operation of the project. This section summarizes some of the best available technologies incorporated in the APP to reduce potential bird collisions and electrocutions associated with the proposed transmission line.

Transmission lines are known to pose collision risks to birds. Collisions occur when birds fail to avoid the lines, either because they cannot detect the lines or cannot maneuver to avoid them once they have detected the lines (PSE&G 2010, 8). Bird collisions with power lines often occur when a transmission line runs perpendicular to a flight path used by birds that move back and forth from feeding and roosting sites on a daily basis or when migrant birds are traveling at reduced altitudes (usually in inclement weather) and encounter the structures. Therefore, the most successful strategies for mitigating collision-induced bird injury and mortality to date have focused on improving visibility of transmission lines, particularly the static wire (PSE&G 2010, 8). Additionally, transmission towers can pose an electrocution risk to birds because towers provide perching, loafing, and sometimes nesting opportunities for birds close to energized and/or grounded hardware (PSE&G 2010, 7). Electrocution can occur when a bird simultaneously contacts electrical equipment either phase to phase or phase to ground (APLIC 2006, ix). This normally occurs when a bird attempts to perch on a transmission tower/pole with insufficient clearance between these elements; other birds, such as raptors, may also use the poles for nesting and could be electrocuted while landing. Bird electrocutions typically occur on power lines with voltages less than 60 kV because there is inadequate separation between energized conductors and hardware or ground conductors and hardware (APLIC 2006, ix, 106). Therefore, transmission line structures that are considered safe for birds are lines that provide a minimum horizontal and vertical separation to accommodate both the wrist-to-wrist wing span and the height of a particular bird or group of birds (PSE&G 2010, 8), because the body size of birds is one of the most important characteristics that make certain species susceptible to electrocution (APLIC 2006, 24).

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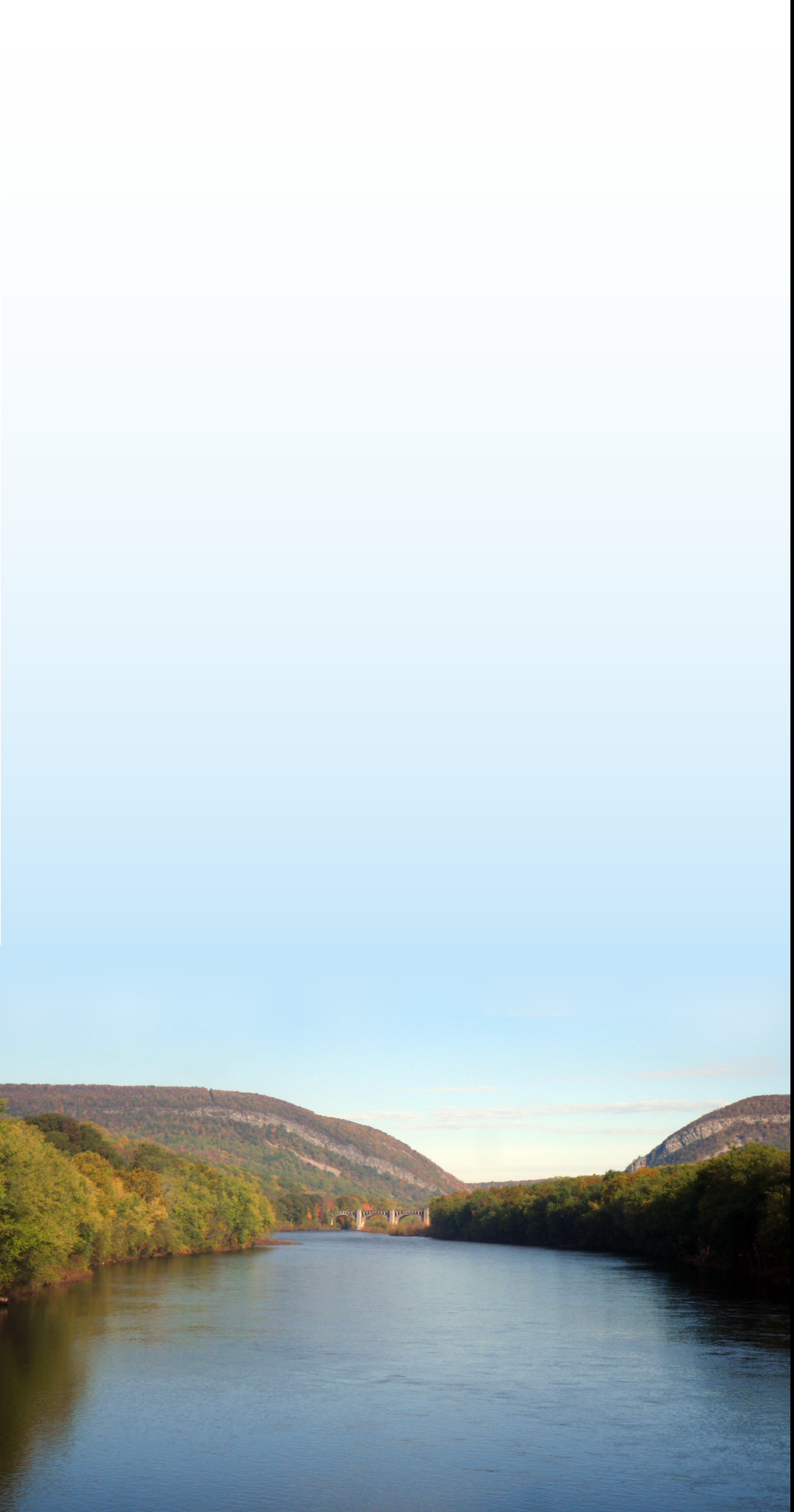
Public Service Electric and Gas Company (PSE&G)

2009 Amended Highlands Applicability Determination Highlands Preservation and Planning Area, Roseland to Susquehanna Overhead Electric Transmission Project. Submitted to: New Jersey Department of Environmental Protection Division of Watershed Management. May.

2010 Avian Protection Plan for PSE&G's Susquehanna-Roseland 500 kV Transmission Line. Draft Review Document.



Appendix G

Affected Environment Information

APPENDIX G:
AFFECTED ENVIRONMENT INFORMATION

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APPENDIX G-1: GENERALIZED STRATIGRAPHIC COLUMN

System	Series	Formation	Member	Description	Thickness (feet)
DEVONIAN	Upper	Trimmers Rock	Millrift	Dark-gray to medium-dark gray siltstone, shale, and very fine-grained sandstone, coarsening upwards. Fossiliferous (brachiopods).	720-1,825
			Sloat Brook		
	Middle	Mahantango		Medium-dark-gray siltstone and silty shale. Fossiliferous, biostromes (corals, brachiopods, pelecypods, bryozoans).	1,300-2,450
	Middle	Marcellus	Brodhead Creek	Dark-gray, laminated to poorly bedded silty shale; depauperate brachiopods. Medium-dark gray shaly limestone.	800-950
			Stony Hollow	Medium-dark-gray to medium-gray, laminated to thin-bedded, shaly limestone, fossiliferous (brachiopods).	150
			Union Springs	Medium-dark-gray to dark-gray laminated shale; sheared along detachment.	50
		Onondaga (Buttermilk Falls)	Seneca	Fossiliferous cherty limestone. Contains TIOGA ash bed.	15
			Moorehouse (Stroudsburg)	Medium-gray limestone and argillaceous limestone with beds, pods and lenses of dark-gray chert. Fossiliferous (brachiopods, ostracodes), burrowed.	135
			Nedrow (McMichal)	Medium-dark-gray calcareous argillite with lenses of light-medium gray fossiliferous limestone.	40
			Edgecliff (Foxtown)	Medium-dark-gray calcareous siltstone and argillaceous limestone containing lenses of dark-gray chert. Fossiliferous, one-inch diameter crinoid "columnals" in lower half.	80
DEVONIAN	Lower	Schoharie		Medium-to medium-dark gray argillaceous calcareous siltstone. Fossiliferous (brachiopods, *Taonurus* burrows in lower half, vertical burrows in upper half).	100-150
		Esopus		Medium- to dark-gray silty shale and shaly to finely arenaceous siltstone. Poorly fossiliferous. Burrowed (*Taonurus*).	180-300
		Oriskany Group: Ridgeley		Light- to medium-gray, fine- to coarse-grained calcareous sandstone and quartz-pebble conglomerate with minor siltstone, arenaceous limestone, and dark-gray chert. Fossiliferous (brachiopods).	0-16
		Oriskany Group: Shriver Chert		Medium-dark-gray siliceous calcareous shale and siltstone and beds, lenses, and pods of dark-gray chert and minor calcareous sandstone. Fossiliferous (brachiopods), burrowed.	50-85
		Helderberg Group: Port Ewen Shale		Medium-dark-gray poorly fossiliferous, irregularly laminated calcareous shale and siltstone grading up to fossiliferous, burrowed, irregularly bedded calcareous siltstone and shale.	150
		Helderberg Group: Minisink Limestone		Dark- to medium-gray argillaceous fossiliferous limestone.	11-14
		Helderberg Group: New Scotland	Maskenozha	Dark-gray silty calcareous laminated fossiliferous shale with lenticular argillaceous fossiliferous limestone.	45
			Flatbrookville	Medium-dark-gray silty and calcareous fossiliferous shale with lenticular medium-gray argillaceous, very fossiliferous limestone.	20-33
		Helderberg Group: Coeymans	Stormville	Medium-gray, fine- to coarse-grained, biogenic limestone, fine-to medium-grained arenaceous limestone, fine- to coarse-grained, crossbedded and planarbedded calcareous sandstone and quartz-pebble conglomerate, with some dark-gray chert. Fossiliferous (brachiopods, crinoids).	0-20
			Shawnee Island / Thacher Mbr of Manlius Fm	Shawnee Island: Medium-gray, argillaceous and arenaceous irregularly bedded fossiliferous and burrowed limestone with chert at top. Contains bioherms of medium-light-gray very coarse grained crudely bedded biogenic limestone with corals, stromatoporoids, and shelly fauna (*Gypidula*). Thacher: Dark-gray, unevenly bedded limestone with yellowish-gray shale partings.	0-60 / 0-35
			Kalkberg Limestone	Medium-dark gray argillaceous massive fossiliferous limestone (diversified fauna) with nodules and lenses of dark-gray chert.	0-60
			Peters Valley	Medium-gray arenaceous limestone to light-medium-gray fine- to coarse-grained pebbly calcareous sandstone. Cross bedded, fossiliferous.	0-9
			Depue Limestone	Medium- to dark-gray arenaceous and argillaceous fossiliferous Limestone.	13-29

			Ravena	Medium-dark-gray slightly argillaceous, fossiliferous limestone.	0-30
SILURIAN AND DEVONIAN	Up. Silurian & Low. Devonian	Rondout	Mashipacong	Medium-dark- to light-gray shale, calcareous shale, and very fine- to medium-grained argillaceous limestone. Mudcracks, cut and fill.	8-15
			Whiteport Dolomite	Dark- to medium-gray mud-cracked laminated dolomite.	5-10
			Duttonville	Dark- to medium-gray calcareous shale and argillaceous limestone. Mud-cracked intervals and biostromal limestone beds.	10-20
SILURIAN	Upper	Decker	Wallpack Center / Clove Brook	Wallpack Center: Lenticular and evenly bedded quartz-pebble conglomerate, calcareous sandstone and siltstone, argillaceous and arenaceous limestone and dolomite. Cross bedded, planar bedded, flaser bedded, fossiliferous. Clove Brook: Medium-gray to medium-dark gray fossiliferous (crinoidal) limestone with light-olive-gray shale partings near top.	0-85 / 0-50
		Bossardville Limestone		Dark- to medium-gray, laminated argillaceous limestone locally containing deep mud cracks (as much as 20 feet deep) grading up to dark-gray laminated limestone. Poorly fossiliferous (ostracodes).	12-110
		Poxono Island		Light-olive-gray to green, calcareous and dolomitic, laminated, fissile to nonfissile shale, olive-green dolomite, sandstone, and siltstone.	500-800
	Middle & Upper	Bloomsburg Red Beds		Red, green, and gray siltstone, shale, sandstone, and conglomeratic sandstone in upward-fining sequences. Cross-bedded and laminated, mud cracks, cut and fill, scattered ferroan dolomite concretions. Partly burrowed. Fish scales locally.	1,500
	Lower and Middle	Shawangunk (Members loose their identity several miles northeast of Delaware Water Gap)	Tammany	Gray, fine- to coarse-grained, partly crossbedded, pyritic conglomerate, evenly bedded quartzite, and about 2% dark-gray argillite.	800
			Lizard Creek	Gray to olive-gray, fine- to coarse-grained, partly crossbedded, pyritic, thin- to thick-bedded quartzite interbedded with thin-to thick bedded, gray argillite.	275
			Minsi	Gray to olive-gray, fine- to coarse-grained, partly crossbedded, pyritic and feldspathic, thin- to thick-bedded quartzite, conglomeratic quartzite, and conglomerate. Locally contains mud-cracked argillite.	300
ORDOVICIAN	Middle and Upper Middle and Upper	Martinsburg	Pen Argyl	Dark-gray to grayish black, thick- to thin-bedded (some beds more than 20 feet thick), evenly bedded claystone slate, rhythmically interbedded with quartzose slate, subgraywacke, and carbonaceous slate. Taconic unconformity at top. Disappears under Shawangunk about one mile west of Delaware Water Gap.	3,000-6,000
			Ramseyburg	Medium- to dark-gray claystone slate alternating with light- to medium-gray, thin- to thick-bedded graywacke and graywacke siltstone.	2,800
			Bushkill	Dark- to medium-gray thin-bedded (beds do not exceed six Inches thick), claystone slate with thin interbedded quazrtzose slate and graywacke siltstone and carbonaceous slate. Not exposed in Delaware Water Gap National Recreation Area.	4,000

APPENDIX G-2: MAJOR GEOLOGIC FORMATIONS THAT THE ALTERNATIVES WOULD CROSS WITHIN THE STUDY AREA

Period	Geologic Unit	Alternative						Description	Drainage	Ease of Excavation	Foundation Stability	Paleontology
		1	2	2b	3	4	5					
Devonian	Mahantango Formation	X	X	X	X	X		Medium-gray, olive-weathering, fine- to coarse-grained sandstone and numerous dark-gray to brown shale interbeds; includes “Centerfield coral reef” in eastern Pennsylvania	Good surface drainage	Moderately easy to moderately difficult; locally difficult; fast to moderate drilling rate	Good; need for excavation to sound material; need for under drainage	Formation well known for fossils; includes fossil findings of many species and specimens
	Marcellus Shale	X	X	X	X	X		Black, carbonaceous shale; limestone (Purcell member) is present locally; may contain abundant pyrite and siderite concretions and nodules; Tioga bentonite is included at base in eastern Pennsylvania	Good surface drainage	Moderately easy; fast drilling rate	Good; should be excavated to sound material	Sparse with fossils; those found indicate an oxygen-poor deep marine environment
	Buttermilk Falls Limestone	X	X	X	X	X		Medium-gray, fine to coarsely crystalline, fossiliferous, partly argillaceous limestone; gray, calcareous, silty shale; and dark-gray chert; deeply leached in western part of outcrop belt	Good surface drainage	Moderately difficult in east to easy in the west; drilling rate is moderate to fast	Generally good, but only fair where bedrock is deeply weathered; should be excavated to sound material	Includes fossiliferous grey limestone; many specimens found in this formation
	Esopus Formation	X	X	X	X	X		Very fine- to coarse-grained, gray to olive-gray, hard siltstone and medium- to dark-gray, silty shale	Good surface drainage	Moderately difficult; weathered zones in western part of the outcrop belt are easy; very closely spaced, blocky fracture pattern in siltstone facilitates excavation in some areas; drilling rate is moderate to fast	Good when excavated to sound bedrock	Somewhat fossiliferous; an important specimen used to justify a taxonomic revision was collected in this formation
	Ridgeley Sandstone	X	X	X	X			In eastern Pennsylvania, white to very light-gray quartz sandstone and fine-grained pebble conglomerate; fossiliferous	Good surface drainage	Difficult; degree and depth of weathering are a major factor; the greater the amount of weathered, friable rock, the easier to excavate; drilling rate is slow	Good when excavated to sound, fresh bedrock; deep weathering may be a special problem	Relatively fossil rich; trace fossils collected indicate a barrier beach
	Coeymans Formation	X	X	X	X			Gray, sandy and clayey limestone and gray, fine- to coarse-grained calcareous sandstone and quartz-pebble conglomerate; amount of limestone decreases westward	Good surface drainage, except in deeply leached, porous areas to the west, where surface drainage is moderate	Moderately difficult, except easy where deeply weathered and leached; drilling rate is moderate; in weathered zones, drilling rate is fast	Excellent in unweathered bedrock; fair to poor where deeply weathered, requiring special foundation design	Very abundant in fossils; contains trace fossils and fossil-rich patch reefs
Silurian	Decker Formation	X	X	X	X			Variable lithology; lenses and beds of medium- to light-gray, calcareous sandstone and siltstone, quartz-pebble conglomerate, and arenaceous fine- to coarse-grained limestone near the Delaware River, grading westward to silty, finely arenaceous limestone, calcareous siltstone, fine-grained calcareous sandstone, and shale	Good surface drainage	Easy where deeply weathered and leached; moderately difficult in unweathered bedrock; drilling rate is moderate to fast	Fair; should be excavated to sound material; may require special foundation support design in some areas	Abundantly fossiliferous with trace fossils present; many abundant marine fauna
	Poxono Island Formation	X	X	X	X			Limy, light-olive-gray to green, silty and sandy shale, olive-green dolomite, and minor thin interbeds of fine-grained limy sandstone	Good surface drainage	Moderately easy, should be rippable where steeply dipping; fast drilling rate	Good; should be excavated to sound bedrock	Not a commonly fossil-rich formation
	Bloomsburg Red Beds	X	X	X	X	X	X	Predominantly red shale and siltstone; some sandstone, thin impure limestone, and green shale	Good surface drainage	Moderately easy; relatively fast drilling rate	Good; should be excavated to sound material	Significant specimen findings in DEWA of a rare ancestral horseshoe crab; fish scales and vertebrate fossils have been found in this formation

Period	Geologic Unit	Alternative						Description	Drainage	Ease of Excavation	Foundation Stability	Paleontology
		1	2	2b	3	4	5					
	Shawangunk Formation	X	X	X	X	X	X	Light- to dark-gray, fine- to very coarse-grained sandstone and conglomerate containing thin shale interbeds; crossbedded; tightly cemented	Good surface drainage	Difficult; boulder fields on lower slopes beneath outcrop areas are a special problem; drilling rate is very slow	Good; excavate to sound bedrock	Sparsely fossiliferous; contains some fossils, including rare jellyfish-like fauna
Ordovician	Martinsburg Formation (including the Ramseyburg Member)	X	X	X	X	X	X	Buff-weathering, dark-gray shale and thin interbeds of siltstone, metabentonite, and fine-grained sandstone; brown-weathering, medium-grained sandstone containing shale and siltstone interbeds is present in the middle of the formation; basal part grades into limy shale and platy-weathering silty limestone Ramseyburg Member is interbedded medium- to dark-gray to brownish-gray, fine- to medium-grained, thin- to thick-bedded graywacke sandstone and siltstone and medium- to dark-gray, laminated to thin-bedded shale and slate	Good surface drainage	Moderately easy in shale; moderately difficult in limestone; difficult in sandstone; fast drilling rate	Good; should be excavated to sound rock; limestone should be investigated for solution openings	Oldest fossiliferous unit in DEWA; many specimens of certain groups have been identified from this formation

Source: USGS 2005, 1; 2006, 1; Geyer and Wilshusen 1982; NPS 2004.

APPENDIX G-3: MAJOR GEOLOGIC FORMATIONS/ROCK TYPES THAT THE ALTERNATIVES COULD CROSS OUTSIDE THE STUDY AREA

Period	Geologic Unit	Description	Alternative					
			1	2	2b	3	4	5
Jurassic	Boonton Formation	Reddish-brown to brownish-purple, fine-grained sandstone, siltstone, and mudstone	X	X	X	X	X	X
	Towaco Formation	Reddish-brown to brownish-purple, fine- to medium-grained micaceous sandstone, siltstone, and silty mudstone	X	X	X	X	X	X
Pennsylvanian	Llewellyn Formation	Gray, fine- to coarse-grained sandstone, siltstone, shale, conglomerate, and numerous anthracite coals in repetitive sequences	X	X	X	X	X	X
	Pottsville Formation	Predominantly gray sandstone and conglomerate; also contains thin beds of shale, claystone, limestone, and coal	X	X	X	X	X	X
Mississippian	Mauch Chunk Formation	Grayish-red shale, siltstone, sandstone, and some conglomerate; some local non-red zones	X	X	X	X	X	X
	Pocono Formation	Light-gray to buff or light-olive-gray, medium-grained crossbedded sandstone and minor siltstone; commonly conglomeratic at base and in middle	X	X	X	X	X	X
Mississippian into Devonian	Spechty Kopf Formation	Light- to olive-gray, fine- to medium-grained crossbedded sandstone, siltstone, and local polymictic diamictite, pebbly mudstone, and laminate						X
Devonian	Catskill Formation	Grayish-red sandstone, siltstone, shale, and mudstone; locally conglomeratic; contains gray sandstone in upper part	X	X	X	X	X	X
	Trimmers Rock Formation	Olive-gray siltstone and shale, characterized by graded bedding; marine fossils; some very fine-grained sandstone in northeast	X	X	X	X	X	X
	Mahantango Formation	Medium-gray, olive-weathering, fine- to coarse-grained sandstone and numerous dark-gray to brown shale interbeds; includes “Centerfield coral reef” in eastern Pennsylvania; also includes the following members, in descending order: Tully Limestone, Sherman Ridge Sandstone, Montebello Sandstone, Fisher Ridge Sandstone, Dalmatia Shale, and Turkey Ridge Sandstone	X	X	X	X	X	X
	Marcellus Shale	Black carbonaceous shale; limestone (Purcell Member) is present locally; may contain abundant pyrite and siderite concretions and nodules; Tioga bentonite is included at base in eastern Pennsylvania	X	X	X	X	X	X
Silurian	Bloomsburg Red Beds	Grayish-red, thin- to thick-bedded, poorly to moderately well sorted massive siltstone, sandstone, and local quartz-pebble conglomerate containing local planar to trough crossbedded laminations	X	X	X	X	X	X

Period	Geologic Unit	Description	Alternative					
			1	2	2b	3	4	5
Ordovician	Martinsburg Formation	Buff-weathering, dark-gray shale and thin interbeds of siltstone, metabentonite, and fine-grained sandstone; brown-weathering, medium-grained sandstone containing shale and siltstone interbeds is present in the middle of the formation; basal part grades into limy shale and platy-weathering, silty limestone						X
	Ramseyburg Member	Interbedded medium- to dark-gray to brownish-gray, fine- to medium-grained, thin- to thick-bedded graywacke sandstone and siltstone and medium- to dark-gray, laminated to thin-bedded shale and slate	X	X	X	X	X	X
	Bushkill Member	Interbedded medium- to dark gray, thinly laminated to thick-bedded shale and slate and less abundant medium-gray to brownish-gray, laminated to thin-bedded siltstone	X	X	X	X	X	X
	Lower Part of Beekmantown Group	Very thin- to thick-bedded, interbedded dolomite and minor limestone; upper beds are light olive-gray to dark-gray, fine- to medium-grained, thin- to thick-bedded dolomite	X	X	X	X	X	X
	Epler Formation	Very finely crystalline, light-gray limestone interbedded with gray dolomite; coarsely crystalline limestone lenses present						X
	Graywacke and Shale of Martinsburg Formation	Shale containing conspicuous graywacke; includes autochthonous sandstone and shale of Shochary Ridge						X
	Jacksonburg Formation	Dark-gray, shaly limestone (cement rock) having slaty cleavage; basal medium- to thick-bedded limestone (cement limestone) increases in thickness eastward						X
Cambrian	Allentown Dolomite	Very thin- to very thick-bedded dolomite containing minor orthoquartzite and shale; upper part is medium-light- to medium-dark-gray, fine- to medium-grained, locally coarse-grained, medium- to very thick-bedded dolomite	X	X	X	X	X	
	Leithsville Formation	Light- to dark-gray and light-olive-gray, fine- to medium-grained, thin- to medium-bedded dolomite	X	X	X	X	X	X
	Allentown Formation	Medium- to medium-dark-gray, thick-bedded dolomite and impure limestone; dark-gray chert stringers and nodules; laminated; oolitic and stromatolitic; some orange-brown-weathering calcareous siltstone at base						X

Period	Geologic Unit	Description	Alternative					
			1	2	2b	3	4	5
Proterozoic	Biotite-Quartz-Feldspar Gneiss	Gray-weathering, locally rusty, gray to tan or greenish-gray, fine- to medium-coarse-grained, moderately layered and foliated gneiss that is variable in texture and composition; composed of oligoclase, microcline microperthite, quartz, and biotite; locally contains garnet, graphite, sillimanite, and opaque minerals	X	X	X	X	X	X
	Hornblende Granite	Pinkish-gray- to medium-buff-weathering, pinkish-white or light-pinkish-gray, medium- to coarse-grained, gneissoid to indistinctly foliated granite and sparse granite gneiss composed principally of microcline microperthite, quartz, oligoclase, and hornblende	X	X	X	X	X	X
	Potassic Feldspar Gneiss	Light-gray- to pinkish-buff-weathering, pinkish-white to light-pinkish-gray, fine- to medium-grained, moderately foliated gneiss				X	X	X
	Pyroxene Granite	Gray- to buff- or white-weathering, greenish-gray, medium- to coarse-grained, massive, gneissoid to indistinctly foliated granite containing mesoperthite to microantiperthite, quartz, oligoclase, and clinopyroxene	X	X	X	X	X	X
	Quartz-Oligoclase Gneiss	White-weathering, light-greenish-gray, medium- to coarse-grained, moderately layered to indistinctly foliated gneiss	X	X	X	X	X	X
	Felsic to Mafic Gneiss	Light, medium-grained, predominantly quartz and feldspar of igneous origin						X
Unknown	Diorite	Made largely of white to light-gray plagioclase and black hornblende; may also contain biotite	X	X	X	X	X	X
	Miscellaneous formations/rock types <5%	NA	X	X	X	X	X	X

APPENDIX G-4: PERCENTAGE OF GEOLOGIC FORMATIONS CONTAINING LIMESTONE OUTSIDE THE STUDY AREA

	Pennsylvania Counties							New Jersey Counties		
	Carbon	Lackawanna	Luzerne	Monroe	Northampton	Pike	Wayne	Morris	Sussex	Warren
Alternatives	5	1,2,2b,3,4	All	All	4,5	1,2,2b,3,4	1,2,2b,3,4	All	All	All
Formation									0.89%	
Allentown Formation					11.11%					
Berkshire Valley and Poxono Island Formations, undivided								0.34%		
Bossardville Limestone									0.36%	
Buttermilk Falls Limestone				0.01%						
Buttermilk Falls Limestone through Esopus Formation, undivided	0.50%			4.20%						
Decker Formation through Poxono Island Formation, undivided	0.75%			1.69%						
Epler Formation					10.01%					
Jacksonburg Formation					5.75%					
Jacksonburg Limestone									0.69%	2.27%
Jacksonburg Limestone and Sequence at Wantage, undivided										0.29%
Kalkberg Limestone, Coeymans Limestone, Manlius Limestone									0.35%	
Leithsville Formation					4.25%					
Limestone of Martinsburg Formation					0.12%					
Minisink Limestone and New Scotland Formation									0.35%	
Ontelaunee Formation					0.62%					
Port Ewen Shale									0.34%	
Poxono Island Formation									1.16%	
Rickenbach Formation					3.54%					

	Pennsylvania Counties							New Jersey Counties		
	Carbon	Lackawanna	Luzerne	Monroe	Northampton	Pike	Wayne	Morris	Sussex	Warren
Ridgeley Formation through Coeymans Formation, undivided	0.50%			2.01%						
Rondout Formation and Decker Formation									0.30%	
Schoharie Formation				0.01%					0.50%	

Source: USGS 2005, 1, 2006, 1.

APPENDIX G-5: OTHER PUBLIC AND CONSERVATION LANDS THAT COULD BE CROSSED OUTSIDE THE STUDY AREA

County	State Game Lands/Wildlife Management Areas	State Parks	State Forests	Important Bird Areas/Important Mammal Areas	Federal Lands	National Wildlife Refuges	TNC Preserves
Carbon County, Pennsylvania	State Game Lands 40, 91, 129, 141, 149, and 168	Beltzville State Park, Hickory Run State Park, Lehigh Gorge State Park	Delaware State Forest, Weiser Forest	Hickory Run State Park IBA, Lehigh Valley/Lehigh Gorge State Park IMA, State Game Land 129/Hickory Run State Park/Holiday Pocono IMA	Beltzville Lake, Delaware and Lehigh National Heritage Corridor		
Lackawanna County, Pennsylvania	State Game Lands 91, 135, 300, 307, and 312	Archbald Pothole State Park Lackawanna State Park	Lackawanna State Forest		Lackawanna National Heritage Valley		Dick and Nancy Eales Preserve at Moosic Mountain
Luzerne County, Pennsylvania	State Game Lands 57, 91, 119, 149, 187, 206, 207, 224, 260, and 292	Frances Slocum State Park, Lehigh Gorge State Park, Nescopeck State Park, Ricketts Glen State Park	Lackawanna State Forest	Dutch Mountain Wetlands Complex–State Game Land 57 IBA, Lehigh Valley/Lehigh Gorge State Park IMA, Ricketts Glen State Park, Crevling Lake Area IBA, State Game Land 129/Hickory Run State Park/Holiday Pocono IMA, Susquehanna Riverlands IBA	Delaware and Lehigh National Heritage Corridor, Lackawanna National Heritage Valley		
Monroe County, Pennsylvania	State Game Lands 38, 127, 129, 168, 186, 221, 312, and 318	Big Pocono State Park, Gouldsboro State Park, Tobyhanna State Park	Delaware State Forest	Cherry Valley Watershed IMA, Delaware State Forest/ Bushkill Creek Area IMA, Delaware Water Gap IMA, Long Pond Preserve IBA, Long Pond Preserve IMA, Pocono Lake Preserve IBA, Pocono Lake/Adams Swamp/Two-Mile Run IMA, State Game Land 129/Hickory Run State Park/Holiday Pocono IMA, Tobyhanna and Gouldsboro State Parks/State Game Land 127 IMA	Delaware River Water Trail	Cherry Valley NWR	Cherry Valley, Fern Ridge Bog, Long Pond, Tannersville Cranberry Bog, Thomas Darling Preserve at Two-mile Run

County	State Game Lands/Wildlife Management Areas	State Parks	State Forests	Important Bird Areas/Important Mammal Areas	Federal Lands	National Wildlife Refuges	TNC Preserves
Morris County, New Jersey	Berkshire Valley, Black River, Budd Lake, Musconetcong River, Rockaway River, South Branch, Splitrock Reservoir Access, Wildcat Ridge	Farny State Park, Hacklebarney State Park, Hopatcong State Park		Allamuchy Mountain State Park IBA, Great Swamp National Wildlife Refuge IBA, Hatfield Swamp IBA, Northern Musconetcong Mountain Region IBA, Pequannock Watershed IBA, Picatinny Arsenal North/Denmark Lake IBA, Wildcat Ridge Wildlife Management Area and Splitrock Reservoir IBA	Morristown National Historical Park, Picatinny Arsenal, Crossroads of the American Revolution National Heritage Area	Great Swamp NWR	
Northampton County, Pennsylvania	State Game Land 168	Jacobsburg Environmental Education Center	Delaware State Forest		Delaware and Lehigh National Heritage Corridor, Delaware River Water Trail	Cherry Valley NWR	Minsi Lake/Totts Gap Corridor, Mount Bethel Fens
Pike County, Pennsylvania	State Game Lands 116, 180, 183, 209, and 316	Promised Land State Park	Delaware State Forest	Delaware State Forest/Bushkill Creek Area IMA, Delaware Water Gap IMA, Promised Land State Park, Bruce Lake Natural Area IBA, Shohola Waterfowl Management Area IBA, Upper Delaware Scenic River IBA	Delaware River Water Trail		

County	State Game Lands/Wildlife Management Areas	State Parks	State Forests	Important Bird Areas/Important Mammal Areas	Federal Lands	National Wildlife Refuges	TNC Preserves
Sussex County, New Jersey	Bear Swamp, Culvers Brook Access, Flatbrook-Roy, Hainesville, Hamburg Mountain, Little Flatbrook Access, Paulinskill River, Sparta Mountain, Trout Brook, Walpack, Weldon Brook, Whittingham	Allamuchy Mountain State Park, High Point State Park, Hopatcong State Park, Kittatinny Valley State Park, Stephens State Park, Swartswood State Park	Stokes State Forest	Allamuchy Mountain State Park IBA, Appalachian Mountains IBA, Bear Swamp Wildlife Management Area - Sussex IBA, Cedar Swamp/Farber Tract IBA, Clove Brook Road Corridor IBA, Delaware Water Gap and Valley IBA, Giant Fen Area IBA, Hamburg Mountain IBA, Hyper Humus Marshes IBA, Kittatinny Camp/Van Ness Road IBA, Kittatinny Mountain Eastern Slope IBA, Moe Mountain IBA, Pequannock Watershed IBA, Rockport Marsh IBA, Sparta Mountain Wildlife Management Area IBA, Stokes State Forest and High Point State Park IBA, Vernon Valley Grasslands/Pochuck Marsh IBA, Wallkill River National Wildlife Refuge IBA, Walpack Valley IBA, Wantage Grasslands IBA, Wawayanda Mountain IBA, Whittingham Wildlife Management Area IBA		Wallkill River National Wildlife Refuge	Arctic Meadows, Blair Creek, Johnsonburg Swamp, Kittatinny Ridge Preserves, Mashipacong Bogs, Minisink Valley, Muckshaw Ponds, Sussex Swamp Preserves
Warren County, New Jersey	Alpha Grasslands Preserve, Beaver Brook, Belvidere Access, Buckhorn Creek, Columbia, Hackettstown Hatchery, Harmony Access, Honey Run, Hummers Beach Access, Knowlton Access, Musconetcong River, Pequest, Pohatcong, Ratzman Access, Rockport, White Lake	Allamuchy Mountain State Park, Hopatcong State Park, Kittatinny Valley State Park, Stephens State Park	Jenny Jump State Forest, Worthington State Forest	Allamuchy Mountain State Park IBA, Alpha (Pohatcong) Grasslands IBA, Delaware Water Gap and Valley IBA, Jenny Jump State Forest IBA, Kittatinny Mountain Eastern Slope IBA, Merrill Creek Reservoir IBA, Mount Tammany Cliffs IBA, Old Mine Road IBA			Blair Creek, Johnsonburg Swamp, Kittatinny Ridge Preserves

County	State Game Lands/Wildlife Management Areas	State Parks	State Forests	Important Bird Areas/Important Mammal Areas	Federal Lands	National Wildlife Refuges	TNC Preserves
Wayne County, Pennsylvania	State Game Lands 70, 159, 299, 300, 310, and 312	Gouldsboro State Park, Prompton State Park, Tobyhanna State Park, Varden Conservation Area		Tobyhanna and Gouldsboro State Parks/State Game Land 127 IMA, Upper Delaware Scenic River IBA	Prompton Lake, Lackawanna National Heritage Valley, Delaware River Water Trail		Lacawac Sanctuary, Lehigh Pond, Long Eddy River Edges Preserve

Source: PGC 2010; NJDEP 2003, 2011; PADCNR 2011a, 2011b, 2011c; USFWS 2011a; National Atlas 2003a, 2003b; TNC 2010, 2011; Audubon PA 2010; NJ Audubon 2010; Lackawanna Heritage Valley Authority n.d.; Crossroads of the American Revolution Association 2010; Delaware & Lehigh National Heritage Area 2009; NPS 2011b.

APPENDIX G-6: SPECIES DOCUMENTED IN DEWA

SPECIES LIST FOR DEWA AND SPECIES OBSERVED DURING FIELD SURVEYS

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Birds					
Gavia stellata	Red-throated Loon*				
Gavia immer	Common Loon*	x			
Podiceps grisegena	Red-necked Grebe*				
Podiceps auritus	Horned Grebe*				
Podilymbus podiceps	**Pied-billed Grebe***				
Phalacrocorax carbo	Great Cormorant*				
Phalacrocorax auritus	Double-crested Cormorant*				
Botaurus lentiginosus	**American Bittern***	x			
Ixobrychus exilis	**Least Bittern***				
Ardea herodias	**Great Blue Heron***	x	x		
Casmerodius albus	**Great Egret***				
Egretta thula	**Snowy Egret***				
Egretta tricolor	**Tricolored Heron***				
Egretta caerulea	**Little Blue Heron***				
Butorides striatus	Green Heron*	x			
Nycticorax nycticorax	**Black-crowned Night-heron***				
Cygnus olor	Mute Swan				
Cygnus columbianus	Tundra Swan*				
Branta canadensis	Canada Goose*	x			
Branta bernicla	Brant*				
Chen caerulescens	Snow Goose*				
Aix sponsa	Wood Duck*	x			
Anas platyrhynchos	Mallard*	x			
Anas rubripes	American Black Duck*				
Anas strepera	Gadwall*				
Anas acuta	Northern Pintail*				
Anas americana	American Wigeon*				
Anas clypeata	Northern Shoveler*				
Anas discors	Blue-winged Teal*				
Anas crecca	**Green-winged Teal***				
Aythya valisineria	Canvasback*				
Aythya americana	Redhead*				
Aythya collaris	Ring-necked Duck*				
Aythya marila	Greater Scaup*				

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Aythya affinis	Lesser Scaup*				
Clangula hyemalis	Long-tailed Duck*				
Melanitta nigra	Black Scoter*				
Melanitta fusca	White-winged Scoter*				
Bucephala clangula	Common Goldeneye*				
Bucephala albeola	Bufflehead*				
Lophodytes cucullatus	Hooded Merganser*				
Mergus merganser	Common Merganser*	x			
Oxyura jamaicensis	Ruddy Duck*				
Cathartes aura	Turkey Vulture*	x		x	x
Coragyps atratus	Black Vulture*	x			
Circus cyaneus	**Northern Harrier***				
Accipiter striatus	**Sharp-shinned Hawk***	x			
Accipiter cooperii	**Cooper's Hawk***	x	x		
Accipiter gentilis	**Northern Goshawk***	x			
Buteo lineatus	**Red-shouldered Hawk***	x		x	x
Buteo platypterus	**Broad-winged Hawk***	x			
Buteo jamaicensis	Red-tailed Hawk*	x			
Buteo lagopus	Rough-legged Hawk*				
Aquila chrysaetos	Golden Eagle*				
Haliaeetus leucocephalus	**Bald Eagle***	x			
Pandion haliaetus	**Osprey***	x			
Falco columbarius	Merlin*				
Falco sparverius	**American Kestrel***				
Falco peregrinus	**Peregrine Falcon***				
Phasianus colchicus	Ring-necked Pheasant				
Bonasa umbellus	Ruffed Grouse				
Meleagris gallopavo	Wild Turkey	x			
Fulica americana	**American Coot***				
Rallus limicola	**Virginia Rail***				
Porzana carolina	**Sora***				
Pluvialis squatarola	Black-bellied Plover*				
Charadrius semipalmatus	Semipalmated Plover*				
Charadrius vociferus	Killdeer*				
Tringa melanoleuca	Greater Yellowlegs*				
Tringa flavipes	Lesser Yellowlegs*				
Tringa solitaria	Solitary Sandpiper*	x			
Actitis macularia	**Spotted Sandpiper***				

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Calidris melanotos	Pectoral Sandpiper*				
Calidris minutilla	Least Sandpiper*				
Scolopax minor	American Woodcock*				
Gallinago gallinago	**Wilson's Snipe***				
Larus philadelphia	Bonaparte's Gull*				
Larus atricilla	Laughing Gull*				
Larus delawarensis	Ring-billed Gull*				
Larus argentatus	Herring Gull*				
Larus glaucoides	Iceland Gull*				
Larus hyperboreus	Glaucous Gull*				
Larus fuscus	Lesser Black-backed Gull*				
Larus marinus	Great Black-backed Gull*				
Sterna caspia	**Caspian Tern***				
Sterna hirundo	**Common Tern***				
Zenaida macroura	Mourning Dove*	x			
Columba livia	Rock Dove				
Coccyzus americanus	Yellow-billed Cuckoo*				
Coccyzus erythropthalmus	**Black-billed Cuckoo***				
Tyto alba	**Barn Owl***				
Asio otus	**Long-eared Owl***				
Asio flammeus	**Short-eared Owl***				
Bubo virginianus	Great Horned Owl*				
Nyctea scandiaca	Snowy Owl*				
Strix varia	**Barred Owl***	x			
Aegolius acadicus	Northern Saw-whet Owl*				
Otus asio	Eastern Screech-owl*				
Caprimulgus vociferus	**Whip-poor-will***	x			
Chordeiles minor	**Common Nighthawk***				
Chaetura pelagica	Chimney Swift*				
Archilochus colubris	Ruby-throated Hummingbird*	x		x	x
Megaceryle alcyon	Belted Kingfisher*	x			
Melanerpes erythrocephalus	**Red-headed Woodpecker***				
Melanerpes carolinus	Red-bellied Woodpecker*	x		x	x
Sphyrapicus varius	Yellow-bellied Sapsucker*				
Picoides pubescens	Downy Woodpecker*	x	x	x	x
Picoides villosus	Hairy Woodpecker*	x		x	
Picoides arcticus	Black-backed Woodpecker*				
Colaptes auratus	Northern Flicker*	x			

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Dryocopus pileatus	Pileated Woodpecker*	x	x	x	x
Contopus borealis	Olive-sided Flycatcher*	x			
Contopus virens	Eastern Wood-pewee*	x	x	x	x
Empidonax virescens	Acadian Flycatcher*	x			
Empidonax flaviventris	**Yellow-bellied Flycatcher***				
Empidonax traillii	Willow Flycatcher*				
Empidonax alnorum	Alder Flycatcher*				
Empidonax minimus	**Least Flycatcher***	x			
Sayornis phoebe	Eastern Phoebe*	x			
Myiarchus crinitus	Great Crested Flycatcher*	x			
Tyrannus tyrannus	Eastern Kingbird*	x	x		
Lanius excubitor	Northern Shrike*				
Vireo olivaceus	Red-eyed Vireo*	x	x		
Vireo gilvus	Warbling Vireo*	x			
Vireo philadelphicus	Philadelphia Vireo*				
Vireo griseus	White-eyed Vireo*				
Vireo flavifrons	Yellow-throated Vireo*	x			
Vireo solitarius	**Blue-headed Vireo***	x			
Cyanocitta cristata	Blue Jay*	x	x	x	x
Corvus corax	Common Raven*	x		x	x
Corvus brachyrhynchos	American Crow*	x			
Corvus ossifragus	Fish Crow*				
Eremophila alpestris	**Horned Lark***				
Progne subis	Purple Martin*				
Stelgidopteryx serripennis	Northern Rough-winged Swallow*	x			
Riparia riparia	Bank Swallow*				
Tachycineta bicolor	Tree Swallow*	x			
Hirundo pyrrhonota	**Cliff Swallow***				
Hirundo rustica	Barn Swallow*	x			
Parus bicolor	Tufted Titmouse*	x	x	x	x
Parus atricapillus	Black-capped Chickadee*	x		x	x
Parus carolinensis	Carolina Chickadee*				
Sitta canadensis	Red-breasted Nuthatch*	x		x	x
Sitta carolinensis	White-breasted Nuthatch*	x	x	x	x
Certhia americana	Brown Creeper*	x			
Thryothorus ludovicianus	Carolina Wren*	x			
Troglodytes aedon	House Wren*	x			
Troglodytes troglodytes	**Winter Wren***				

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Cistothorus palustris	**Marsh Wren***				
Regulus satrapa	Golden-crowned Kinglet*	x		x	x
Regulus calendula	Ruby-crowned Kinglet*	x			
Polioptila caerulea	Blue-gray Gnatcatcher*	x	x	x	x
Sialia sialis	Eastern Bluebird*	x			
Turdus migratorius	American Robin*	x	x	x	x
Hylocichla mustelina	**Wood Thrush***	x	x		
Catharus fuscescens	**Veery***	x			
Catharus ustulatus	**Swainson's Thrush***				
Catharus minimus	**Gray-cheeked Thrush***				
Catharus guttatus	Hermit Thrush*	x			
Dumetella carolinensis	Gray Catbird*	x	x	x	x
Mimus polyglottos	Northern Mockingbird*				
Toxostoma rufum	**Brown Thrasher***	x			
Sturnus vulgaris	European Starling	x			
Anthus rubescens	American Pipit*				
Bombycilla cedrorum	Cedar Waxwing*	x			
Parula americana	**Northern Parula***	x			
Vermivora celata	Orange-crowned Warbler*				
Vermivora peregrina	Tennessee Warbler*				
Vermivora chrysoptera X pinus	Brewster's Warbler*	x			
Vermivora pinus	Blue-winged Warbler*	x			
Vermivora chrysoptera	**Golden-winged Warbler***				
Vermivora ruficapilla	Nashville Warbler*				
Dendroica petechia	Yellow Warbler*	x			
Dendroica pensylvanica	Chestnut-sided Warbler*				
Dendroica magnolia	Magnolia Warbler*	x			
Dendroica tigrina	Cape May Warbler*				
Dendroica caerulescens	**Black-throated Blue Warbler***				
Dendroica cerulea	**Cerulean Warbler***	x			
Dendroica fusca	**Blackburnian Warbler***	x			
Dendroica coronata	Yellow-rumped Warbler*	x		x	x
Dendroica virens	**Black-throated Green Warbler***	x			
Dendroica discolor	Prairie Warbler*	x			
Dendroica palmarum	Palm Warbler*				
Dendroica pinus	Pine Warbler*	x			
Dendroica castanea	Bay-breasted Warbler*				
Dendroica striata	**Blackpoll Warbler***	x			

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Dendroica dominica	Yellow-throated Warbler*				
Helmitheros vermivorus	**Worm-eating Warbler***	x			
Protonotaria citrea	**Prothonotary Warbler***				
Mniotilta varia	Black-and-white Warbler*	x			
Setophaga ruticilla	American Redstart*	x			
Seiurus aurocapillus	Ovenbird*	x			
Seiurus noveboracensis	Northern Waterthrush*	x			
Seiurus motacilla	Louisiana Waterthrush*	x			
Oporornis formosus	**Kentucky Warbler***				
Oporornis agilis	Connecticut Warbler*				
Oporornis philadelphia	Mourning Warbler*				
Geothlypis trichas	Common Yellowthroat*	x		x	x
Wilsonia pusilla	Wilson's Warbler*	x			
Wilsonia canadensis	**Canada Warbler***	x			
Wilsonia citrina	**Hooded Warbler***	x	x		
Icteria virens	**Yellow-breasted Chat***				
Piranga rubra	**Summer Tanager***	x			
Piranga olivacea	Scarlet Tanager*	x	x		
Cardinalis cardinalis	Northern Cardinal*	x	x	x	x
Pheucticus ludovicianus	Rose-breasted Grosbeak*	x			
Guiraca caerulea	Blue Grosbeak*				
Passerina cyanea	Indigo Bunting*	x		x	x
Pipilo erythrophthalmus	Eastern Towhee*	x	x	x	x
Spizella arborea	American Tree Sparrow*				
Spizella pusilla	Field Sparrow*	x			
Spizella passerina	Chipping Sparrow*	x			
Ammodramus savannarum	**Grasshopper Sparrow***				
Passerculus sandwichensis	**Savannah Sparrow***				
Pooecetes gramineus	**Vesper Sparrow***				
Zonotrichia albicollis	White-throated Sparrow*	x		x	x
Zonotrichia leucophrys	White-crowned Sparrow*				
Passerella iliaca	Fox Sparrow*				
Melospiza melodia	Song Sparrow*	x			
Melospiza lincolnii	Lincoln's Sparrow*				
Melospiza georgiana	Swamp Sparrow*	x			
Junco hyemalis	Dark-eyed Junco*	x		x	x
Calcarius lapponicus	Lapland Longspur*				
Plectrophenax nivalis	Snow Bunting*				

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Sturnella magna	**Eastern Meadowlark***				
Dolichonyx oryzivorus	**Bobolink***				
Molothrus ater	Brown-headed Cowbird*	x			
Agelaius phoeniceus	Red-winged Blackbird*	x			
Euphagus carolinus	Rusty Blackbird*				
Quiscalus quiscula	Common Grackle*	x			
Icterus galbula	Baltimore Oriole*	x			
Icterus spurius	Orchard Oriole*	x			
Coccothraustes vespertinus	Evening Grosbeak*				
Pinicola enucleator	Pine Grosbeak*				
Carpodacus purpureus	Purple Finch*			x	x
Carpodacus mexicanus	House Finch*				
Loxia curvirostra	Red Crossbill*				
Loxia leucoptera	White-winged Crossbill*				
Carduelis flammea	Common Redpoll*				
Carduelis pinus	Pine Siskin*				
Carduelis tristis	American Goldfinch*	x		x	x
Passer domesticus	House Sparrow				
Mammals					
Didelphis virginiana	Virginia Opossum				
Blarina brevicauda	Northern Short-Tailed Shrew				
Cryptotis parva	**Least Shrew**				
Sorex hoyi	Pygmy Shrew				
Sorex cinereus	Masked Shrew				
Sorex fumeus	Smokey Shrew				
Sorex palustris	Water Shrew				
Condylura cristata	Star-Nosed Mole	x			
Scalopus aquaticus	Eastern Mole				
Pipistrellus subflavus	Eastern Pipistrelle				
Eptesicus fuscus	Big Brown Bat				
Lasiurus borealis	Eastern Red Bat				
Lasiurus cinereus	Hoary Bat				
Myotis leibii	Eastern Small-Footed Myotis	x			
Myotis lucifugus	**Little Brown Bat**				
Myotis septentrionalis	**Northern Myotis**				
Ursus americanus	Black Bear	x	x	x	x
Procyon lotor	Common Raccoon	x			
Mustela frenata	Long-Tailed Weasel	x			

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Mustela vison	Mink				
Lutra canadensis	River Otter				
Mephitis mephitis	Striped Skunk				
Canis latrans	Coyote		x		
Vulpes vulpes	Red Fox				
Urocyon cinereoargenteus	Gray Fox				
Lynx rufus	**Bobcat**	x			
Marmota monax	Woodchuck	x			
Sciurus carolinensis	Gray Squirrel	x		x	x
Tamiasciurus hudsonicus	Red Squirrel	x			
Glaucomys volans	Southern Flying Squirrel				
Tamias striatus	Eastern Chipmunk	x		x	x
Castor canadensis	American Beaver	x			
Napaeozapus insignis	Woodland Jumping Mouse				
Zapus hudsonius	Meadow Jumping Mouse				
Peromyscus maniculatus	Deer Mouse		x		
Peromyscus leucopus	White-Footed Mouse				
Synaptomys cooperi	Southern Bog Lemming				
Clethrionomys gapperi	Southern Red-Backed Vole	x			
Microtus pennsylvanicus	Meadow Vole				
Microtus pinetorum	Woodland Vole				
Ondatra zibethicus	Common Muskrat	x			
Rattus norvegicus	Norway Rat				
Mus musculus	House Mouse				
Erethizon dorsatum	Porcupine	x	x		
Lepus americanus	Snowshoe Hare				
Sylvilagus floridanus	Eastern Cottontail	x			
Odocoileus virginianus	White-Tailed Deer	x	x	x	x
Amphibians					
Notophthalmus viridescens viridescens	Red-Spotted Newt	x	x	x	x
Ambystoma jeffersonianum	**Jefferson Salamander**				
Ambystoma maculatum	Spotted Salamander	x			
Ambystoma opacum	**Marbled Salamander**	x			
Ambystoma platineum	Silvery Salamander				
Desmognathus fuscus fuscus	Northern Dusky Salamander	x	x		
Desmognathus ochrophaeus	Mountain Dusky Salamander				
Eurycea bislineata	Northern Two-Lined Salamander		x		
Eurycea longicauda longicauda	**Long-Tailed Salamander**				

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Gyrinophilus porphyriticus porphyriticus	**Northern Spring Salamander**				
Hemidactylium scutatum	**Four-Toed Salamander**				
Plethodon glutinosus	Northern Slimy Salamander	x	x		
Plethodon cinereus	Red-back Salamander	x	x	x	x
Pseudotriton ruber ruber	Northern Red Salamander				
Rana catesbeiana	American Bullfrog	x		x	x
Rana clamitans melanota	Green Frog	x	x	x	x
Rana palustris	Pickerel Frog	x		x	x
Rana pipiens	Leopard Frog	x	x		
Rana sylvatica	Wood Frog	x		x	x
Bufo americanus americanus	Eastern American Toad	x	x	x	x
Bufo woodhousii fowleri	**Fowler's Toad**	x			
Acris crepitans crepitans	**Northern Cricket Frog**				
Hyla versicolor	Gray Treefrog	x			
Pseudacris crucifer crucifer	Northern Spring Peeper	x	x		
Reptiles					
Chelydra serpentina serpentina	Common Snapping Turtle	x			
Sternotherus odoratus	Common Musk Turtle				
Chrysemys picta	Painted Turtle	x			
Pseudemys rubriventris	Redbelly Turtle				
Clemmys guttata	**Spotted Turtle**				
Clemmys insculpta	**Wood Turtle**	x			
Glyptemys muhlenbergii	**Bog Turtle**				
Graptemys geographica	**Common Map Turtle**				
Trachemys scripta elegans	Red-Eared Slider				
Terrapene carolina carolina	**Eastern Box Turtle**	x			
Eumeces fasciatus	Five-Lined Skink	x			
Sceloporus undulatus hyacinthinus	Northern Fence Lizard	x		x	x
Carphophis amoenus amoenus	**Eastern Worm Snake**				
Coluber constrictor constrictor	Northern Black Racer	x			
Diadophis punctatus edwardsii	Northern Ringneck Snake	x		x	x
Elaphe obsoleta obsoleta	Black Rat Snake	x			
Heterodon platirhinos	**Eastern Hognose Snake**	x			
Lampropeltis triangulum triangulum	Eastern Milk Snake	x			
Nerodia sipedon sipedon	Northern Water Snake	x			
Opheodrys vernalis	**Smooth Green Snake**	x			
Storeria dekayi dekayi	Northern Brown Snake				

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Storeria occipitomaculata occipitomaculata	Northern Redbelly Snake				
Thamnophis sirtalis sirtalis	Eastern Garter Snake	x	x		
Thamnophis sauritus sauritus	**Eastern Ribbon Snake**	x			
Crotalus horridus	**Timber Rattlesnake**	x	x		
Agkistrodon contortrix mokasen	**Northern Copperhead**	x			
Fish					
Petromyzon marinus	Sea Lamprey				
Amia calva	**Bowfin**				
Anguilla rostrata	American Eel	x			
Oncorhynchus mykiss	Rainbow Trout				
Salmo trutta	Brown Trout				
Salvelinus fontinalis	Brook Trout				
Alosa aestivalis	Blueback Herring				
Alosa pseudoharengus	Alewife				
Alosa sapidissima	American Shad				
Dorosoma cepedianum	Gizzard Shad				
Carpiodes cyprinus	Quillback				
Esox americanus	Redfin Pickerel				
Esox masquinongy	Muskellunge				
Esox niger	Chain Pickerel				
Cyprinus carpio	Common Carp				
Exoglossum maxillingua	Cutlips Minnow				
Cyprinella analostana	Satinfin Shiner				
Catostomus commersoni	White Sucker				
Ameiurus catus	White Catfish				
Ameiurus natalis	Yellow Bullhead				
Ameiurus nebulosus	Brown Bullhead				
Ictalurus punctatus	Channel Catfish				
Noturus gyrinus	**Tadpole Madtom**				
Noturus insignis	Margined Madtom				
Campostoma anomalum	Central Stoneroller				
Notemigonus crysoleucas	Golden Shiner				
Notropis amoenus	Comely Shiner				
Luxilus cornutus	Common Shiner				
Notropis hudsonius	Spottail Shiner				
Notropis procne	Swallowtail Shiner				
Rhinichthys atratulus	Blacknose Dace				

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Rhinichthys cataractae	Longnose Dace				
Semotilus atromaculatus	Creek Chub				
Semotilus corporalis	Fallfish				
Fundulus diaphanus	Banded Killifish				
Morone americana	White Perch				
Morone saxatilis	Striped Bass				
Ambloplites rupestris	Rock Bass				
Enneacanthus gloriosus	Bluespotted Sunfish				
Lepomis auritus	Redbreast Sunfish				
Lepomis cyanellus	Green Sunfish				
Lepomis gibbosus	Pumpkinseed				
Lepomis macrochirus	Bluegill				
Micropterus dolomieu	Smallmouth Bass				
Micropterus salmoides	Largemouth Bass				
Pomoxis annularis	White Crappie				
Pomoxis nigromaculatus	Black Crappie				
Etheostoma olmstedi	Tessellated Darter				
Perca flavescens	Yellow Perch				
Percina peltata	Shield Darter				
Stizostedion vitreum	Walleye				
Cottus cognatus	Slimy Sculpin				
Invertebrates					
Alasmidonta heterodon	**Dwarf Wedgemussel**				
Alasmidonta undulata	**Triangle Floater**				
Alasmidonta varicosa	**Brook Floater**				
Anodonta implicata	**Alewife Floater**				
Elliptio complanata	Eastern Elliptio				
Lampsilis cariosa	**Yellow Lampmussel**				
Cambarus bartonii	Appalachian Brook Crayfish				
Orconectes limosus	Spinycheek Crayfish				
Trichoptera	Caddisfly Sp.				
Ephemeroptera	Mayfly Sp.				
Plecoptera	Stonefly Sp.				
Calopteryx maculata	Ebony Jewelwing	x			
Lestes vigilax	Swamp Spreadwing	x			
Argia fumipennis	Variable Dancer	x			
Ischnura posita	Fragile Forktail	x			
Ischnura verticalis	Eastern Forktail	x			

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Aeshna tuberculifera	**Black Tipped Darner**	x			
Aeshna verticalis	**Green Striped Darner**	x			
Anax junius	Common Green Darner	x			
Boyeria vinosa	Fawn Darner	x			
Epiaeschna heros	Swamp Darner	x			
Gomphus borealis	Beaverpond Clubtail	x			
Epitheca (Tetragoneuria) cynosura	Common Baskettail	x			
Celithemis elisa	Calico Pennant	x			
Celithemis eponina	**Halloween Pennant**	x			
Erythemis simplicicollis	Eastern Pondhawk	x			
Ladona julia	Chalk Fronted Corporal	x			
Leucorrhinia frigida	Frosted Whiteface	x			
Leucorrhinia intacta	Dot-Tailed Whiteface	x			
Libellula luctuosa	Widow Skimmer	x			
Plathemis lydia	Common Whitetail	x			
Libellula pulchella	Twelve Spotted Skimmer	x		x	x
Libellula vibrans	Great Blue Skimmer	x			
Pachydiplax longipennis	Blue Dasher	x			
Perithemis tenera	Eastern Amberwing	x			
Sympetrum semicinctum	**Band Winged Meadowhawk**	x			
Sympetrum vicinum	Autumn Meadowhawk	x			
Tramea lacerata	Black Saddlebags	x			
Cordulegaster spp.	Unid. Spiketail	x			
Somatochlora spp.	Unid. Emerald	x			
Epargyreus clarus	Silver Spotted Skipper	x			
Erynnis baptisiae	Wild Indigo Duskywing	x			
Thymelicus lineola	European Skipper	x			
Hesperia leonardus	**Leonard's Skipper**	x			
Polites peckius	Peck's Skipper	x			
Pompeius verna	Little Glassywing	x			
Poanes massasoit	**Mulberry Wing**	x			
Euphyes conspicua	Black Dash	x			
Papilio glaucus	Tiger Swallowtail	x		x	x
Papilio troilus	Spicebush Swallowtail	x			
Pieris rapae	Cabbage White	x			
Colias philodice	Clouded Sulphur	x			
Colias eurytheme	Orange Sulphur	x			
Phoebis sennae	Cloudless Sulphur	x			

Scientific Name	Common Name	Alternatives			
		1, 2, 2b	3	4	5
Lycaena phlaeas	American Copper	x			
Cupido comyntas	Eastern-Tailed Blue	x			
Celastrina ladon	Spring Azure	x			
Celastrina neglecta	Summer Azure	x			
Danaus plexippus	Monarch	x			
Speyeria cybele	Great Spangled Fritillary	x			
Phyciodes tharos	Pearl Crescent	x			
Euphydryas phaeton	**Baltimore Checkerspot**	x			
Polygonia interrogationis	Question Mark	x			
Polygonia comma	Eastern Comma	x			
Vanessa atalanta	Red Admiral	x			
Vanessa cardui	Painted Lady	x			
Vanessa virginiensis	American Lady	x			
Limenitis Archippus	Viceroy	x			
Enodia anthedon	Northern Pearly Eye	x			
Satyrodes appalachia	Appalachian Brown	x			
Megisto cymela	Little Wood Satyr	x			
Coenonympha tullia	Common Ringlet	x			

* Indicates migratory species

Bold text indicates special-status species, identified as such by Pennsylvania, New Jersey, or both

All species listed were documented by NPS, those with checkmarks in the alternatives boxes were observed during 2010 & 2011 field surveys.

APPENDIX G-7: LIFE HISTORY REQUISITES FOR SPECIAL STATUS SPECIES NOT OBSERVED OR OTHERWISE DOCUMENTED

AQUATIC WILDLIFE SPECIES

Eastern Pearlshell (*Margaritifera margaritifera*): The eastern pearlshell is found in small streams and rivers that support host fish species: brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*) or Atlantic salmon (*S. salar*) and uses a variety of substrates (CT DEP 2010). They generally live buried in clean, mixed stable substrates. The eastern pearlshell is considered critically imperiled in Pennsylvania and has been known from several sites in the Delaware River in Pennsylvania; however, it appears to be extirpated from Monroe County and is now known from only one population in Schuykill County (NatureServe 2009). Its status is undetermined in New Jersey (NatureServe 2009).

Ironcolor Shiner (*Notropis chalybaeus*): The ironcolor shiner prefers pools and slow runs of low gradient, small acidic creeks and small rivers with sandy substrate (Nature Serve 2009). The ironcolor shiner may be extirpated from Pennsylvania though it was once known from the Delaware River; however, it has not been documented in DEWA waters since 1978 (Nature Serve 2009; NPS 2010). It is considered critically imperiled in both Pennsylvania and New Jersey (Nature Serve 2009).

Banded Sunfish (*Enneacanthus obseus*): This species is considered critically imperiled in Pennsylvania and appears to be extirpated from its historic range in the Middle Delaware River (Pike County). It is currently known only from the lower Delaware River near Philadelphia, Pennsylvania (NatureServe 2009). The banded sunfish prefers small ponds, and backwaters of creeks as well as small and large rivers and boggy brooks over sand or mud in sluggish, acidic, heavily vegetated waters (NatureServe 2009).

TERRESTRIAL WILDLIFE SPECIES

Cobblestone Tiger Beetle (*Cicindela marginipennis*): Cobblestone tiger beetles are a federal species of concern. They are found on gravel and cobblestone bars that have small patches of sand, on the upstream ends of treed islands in small to large river systems associated with islands or bends in large rivers. These gravel bars are sparsely vegetated (TNC 2004, 2; Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2008, 8–9). The historic range of the cobblestone tiger beetle was believed to stretch from West Virginia to Indiana and Pennsylvania, but it is now only found in isolated areas in several states in the northeastern United States, including within the Delaware River in New Jersey (COSEWIC 2008; New Hampshire Fish and Wildlife Service [NHFWS] 2005, 1–2). Dam construction, river channelization, water pollution, and the use of ATVs may have contributed to the decline of this species (COSEWIC 2008, 12). The cobblestone tiger beetle has historically occurred on a few islands within DEWA and MDSR. However, the current status of these occurrences is unknown. An invertebrate survey of the corridors for alternatives 1, 2, and 2b did not observe cobblestone tiger beetles (EcolSciences 2009). Because the type of habitat required by the cobblestone tiger beetle is not found within areas that will be disturbed in the study area (all gravel or cobblestone bars would be spanned by the transmission line), this invertebrate species was dismissed from further analysis.

Superb jewelwing (*Calopteryx amata*): Superb jewelwing dragonflies are a New Jersey State threatened species. This species of dragonfly is found near fast-moving streams with areas of dense canopy and abundant stream vegetation. The superb jewelwing has a range along the east coast from Maine to North Carolina. In New Jersey their habitat is limited to northwestern Sussex County along fast-moving streams. The superb jewelwing is threatened in New Jersey due to limited range and habitat vulnerability (CWFNJ 2012). An invertebrate survey of the DEWA corridors for alternatives 1, 2, and 2b resulted in no

spottings of the superb jewelwing within areas that will be disturbed in the study area (EcolSciences 2009). This invertebrate species was dismissed from further analysis.

Harpoon clubtail (*Gomphus descriptus*): The harpoon clubtail dragonfly is considered threatened in New Jersey due to rarity and limited suitable habitat. Harpoon clubtail dragonflies inhabit rivers and streams near gravel bars. Much of their time is spent burrowing. Within New Jersey these dragonflies are limited to the ridges and valleys of Sussex County (CWFNJ 2012). The harpoon clubtail dragonfly was not observed during an invertebrate survey of the corridors for alternatives 1, 2, and 2b (EcolSciences 2009). This invertebrate species was dismissed from further discussion since suitable habitat will not be disturbed in the study area.

Kennedy's emerald (*Somatochlora kennedyi*): The Kennedy's emerald dragonfly is threatened in New Jersey. These dragonflies are known to habitat streams flowing through open habitats, like marshes and bogs. The Kennedy's emerald distribution ranges from Massachusetts west to Minnesota within the United States (Massachusetts Division of Fisheries and Wildlife n.d). New Jersey is the southern limit of the Kennedy's emerald has a limited distribution. Sussex County contains the only known population in New Jersey. The rarity and the sensitivity of habitat threaten the Kennedy's emerald in New Jersey (CWFNJ 2012). An invertebrate survey of the corridors for alternatives 1, 2, and 2b did not observe any Kennedy's emerald dragonflies (EcolSciences 2009). This species was dismissed from further analysis because suitable habitat for this species will not be disturbed in the study area.

Gray petaltail (*Tachopteryx thoreyi*): The gray petaltail dragonfly is listed as endangered in New Jersey. This dragonfly is a woodland species that inhabits small seepages with skunk cabbage and ferns. The gray petaltail range is thought the eastern United States and limited to Bergen, Morris, Passaic, and Sussex Counties in New Jersey. This species is endangered in New Jersey since the largest know colony was destroyed during a residential development (CWFNJ 2012). This dragonfly species was not located in the corridors for alternatives 1, 2, and 2b during an invertebrate survey (EcolScience 2009). The gray petaltail was dismissed from further analysis since disturbance to suitable habitat will not occur within the study area.

Brook snaketail (*Ohpiogomphus asperses*): Brook snaketail dragonflies are threatened in New Jersey. This species inhabits clear sand bottomed fast-moving streams, often flowing through dense woodlands. The brook snaketail occurs from Nova Scotia west to Quebec and south to North Carolina (Massachusetts Division of Fisheries and Wildlife 2008). In New Jersey the brook snaketail is limited to the northwest Ridge and Valley areas. This species is threatened in New Jersey due to its rarity and lack of suitable breeding habitat (CWFNJ 2012). Brook snaketail dragonflies were not observed during an invertebrate survey of the corridors for alternatives 1, 2, and 2b (EcolScience 2009). Suitable habitats will not be disturbed within the study area therefore the brook snaketail dragonfly has been dismissed from further analysis.

Blue-spotted Salamander (*Ambystoma laterale*): The blue-spotted salamander inhabits hardwood forests that contain soil types of sandy and silt loams, gravelly, loamy sand, or muck soil types. Ground cover usually consists of rotting logs, rocks, and leaf litter where blue-spotted salamanders can remain in moist depressions. Areas of temporary standing water typically serve as breeding areas. The blue-spotted salamander was listed as endangered in New Jersey in 1974 based on the declining population numbers, believed to be associated with habitat loss and pesticide use (NJ ENSP 2001). The blue-spotted salamander presently remains state-listed as endangered by Pennsylvania and New Jersey. No potential habitat for the blue-spotted salamander has been identified within the study area and will therefore be dismissed from further discussion.

PLANTS

Northern Arrowhead (*Sagittaria cuneata*): Northern arrowhead is state-listed by New Jersey as endangered. It is an aquatic plant that is found in swampy areas or standing water in ponds, lakes, stream edges, and ditches and is considered an obligate-wetland plant. This species is found in marshes and wetlands throughout temperate North America, extending from north-central Alaska to Labrador and south to California and northern Texas (NRCS 2010). Because Northern arrowhead was not observed in New Jersey, where it is listed, along the alignment for any of the alternatives, this plant species was dismissed from further analysis.

Yellow sedge (*Carex flava*): Yellow sedge is state-listed by Pennsylvania as a threatened species. The yellow sedge is a wetland-obligate species that occurs mostly in the northern United States and in Canada. This species is perennial sedge that grows to a maximum of 2.5 feet. Fruiting occurs from June to August (NRCS 2010). Yellow sedge was not observed during any of the vegetation surveys (NPS 2011a; Mellon 2010); therefore, this species was dismissed from further analysis.

Long's sedge (*Carex longii*): Long's sedge is a wetland species that can be found from Texas to Wisconsin and east to the Atlantic Coast of the United States. It can be found on sandy lakeshores and in bogs. Blooming occurs in June, with fruiting following from July to September (NRCS 2010). Long's sedge is state-listed by Pennsylvania as tentatively undetermined, but is proposed as a threatened species. Long's sedge was not observed during any of the field surveys (NPS 2011a; Mellon 2010) and there are no records of this species occurring within the study area for this project; therefore, this species was dismissed from further analysis.

Matted-spikerush (*Eleocharis intermedia*): Matted-spikerush is an annual, grass-like, wetland plant that inhabits the eastern United States from Minnesota south to Tennessee and Mississippi and northeast to Maine and Canada (NRCS 2010). Matted-spikerush is state-listed by Pennsylvania as a threatened species and is protected by the Highlands Protection and Planning Act. Matted-spikerush was not observed during any of the field surveys (NPS 2011a; Mellon 2010) and there are no records of this species occurring within the study area for this project; therefore, this species was dismissed from further analysis.

Northeastern Bulrush (*Scirpus ancistrochaetus*): The northeastern bulrush is a member of the sedge family (Cyperaceae) and is found in ponds, wet depressions, or shallow sinkholes within small wetland complexes. Northeastern bulrush is highly tolerant of seasonally variable water levels. Not all botanists consider the northeastern bulrush to be a distinct species; however, based on morphological and genetic evidence as well as botanical expertise of an expert in the genus *Scirpus*, the USFWS recognizes the northeastern bulrush as a distinct species (USFWS 1993, 1, 2). Threats to the species include habitat loss and degradation caused by wetland draining, dredging, and filling for residential and agricultural development (USFWS 1993, 1). Northeastern bulrush is federally listed as an endangered species. It is also state-listed by Pennsylvania as an endangered species, although it is proposed to be changed to a (Pennsylvania) state-listed threatened species. Northeastern bulrush was not observed during any of the field surveys (NPS 2011a; Mellon 2010) and there are no records of this species occurring within the study area for this project. Because northeastern bulrush 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.

Small-whorled Pogonia (*Isotria medeoloides*): The small-whorled pogonia is a member of the orchid family (Orchidaceae) and is listed as federally threatened, as well as state-listed by Pennsylvania as endangered. This species 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 2011a; Mellon 2010) 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, sphagnous 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).

Canadian Serviceberry (*Amelanchier canadensis*): Canadian serviceberry is currently not state-listed by Pennsylvania; however, it is proposed to be listed as endangered. This deciduous species usually found as a small shrub or tree in wet sites. It blooms in late March and the resulting fruits provide food for wildlife (University of Connecticut 2010). Canadian serviceberry was not observed during any field surveys (NPS 2011a; Mellon 2010) and there are no records of this species occurring within the study area for this project. Because Canadian serviceberry 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.

APPENDIX G-8: RARE AND UNIQUE COMMUNITIES PRESENT WITHIN THE COUNTIES OF PENNSYLVANIA AND NEW JERSEY THAT COULD BE TRAVERSED BY THE S-R LINE

Common Name	State Rank	Pennsylvania Counties							New Jersey Counties		
		Carbon	Lackawanna	Luzerne	Monroe	Northampton	Pike	Wayne	Morris	Sussex	Warren
Acidic broadleaf swamp	Vulnerable				X	X					
Acidic glacial lake	Imperiled to vulnerable	X	X				X	X			
Acidic glacial peatland complex	Not ranked						X	X			
Acidic shrub swamp	Vulnerable	X			X			X			
Aster-like boltonia/small-headed aster/field mint herbaceous vegetation	Critically imperiled to imperiled									X	X
Atlantic white-cedar/great rhododendron swamp	Critically imperiled									X	
Basin graminoid-forb fen	Critically imperiled					X					
Big bluestem/Indian grass river grassland	Vulnerable					X		X			
Birch (black-gum) rocky slope woodland	Imperiled					X					
Black spruce swamp	Critically imperiled								X	X	X
Black spruce/tamarack palustrine woodland	Imperiled						X	X			
Black spruce/tamarack peatland forest	Vulnerable						X				
Black spruce woodland bog	Critically imperiled								X	X	
Boreal conifer swamp	Vulnerable		X		X		X				
Broadleaf/conifer swamp	Vulnerable to apparently secure				X						

Common Name	State Rank	Pennsylvania Counties							New Jersey Counties		
		Carbon	Lackawanna	Luzerne	Monroe	Northampton	Pike	Wayne	Morris	Sussex	Warren
Calcareous glacial lake	Critically imperiled							X			
Calcareous riverside outcrop community	Critically imperiled (PA) Critically imperiled to imperiled (NJ)					X				X	
Calcareous riverside seep community	Critically imperiled								X		
Calcareous seepage swamp	Critically imperiled					X					
Cave aquatic community	Imperiled									X	X
Cave terrestrial community	Imperiled									X	
Circumneutral broadleaf swamp	Imperiled to vulnerable					X					
Dry-mesic calcareous forest	Imperiled (unknown)									X	X
Dry oak/heath woodland	Vulnerable	X	X		X	X	X				
Ephemeral/fluctuating natural pool	Vulnerable	X		X	X	X					
Glacial bog	Vulnerable		X	X	X			X			
Hemlock/hardwood swamp	Imperiled								X	X	
Hemlock/mixed hardwood palustrine forest	Vulnerable to apparently secure		X	X	X		X	X			
Hemlock palustrine forest	Vulnerable	X									
Herbaceous vernal pond	Vulnerable to apparently secure					X					
Highbush blueberry/sphagnum wetland	Secure						X				
High-gradient clearwater creek	Vulnerable	X			X		X				

Common Name	State Rank	Pennsylvania Counties							New Jersey Counties		
		Carbon	Lackawanna	Luzerne	Monroe	Northampton	Pike	Wayne	Morris	Sussex	Warren
Inland acidic seep community	Critically imperiled									X	
Leatherleaf/bog rosemary peatland	Imperiled to vulnerable		X	X	X		X	X			
Leatherleaf/cranberry peatland	Imperiled to vulnerable						X				
Leatherleaf/sphagnum boreal dwarf scrub shrub	Critically imperiled									X	
Little bluestem/Pennsylvania sedge opening	Vulnerable to apparently secure						X				
Limestone fen	Critically imperiled									X	X
Limestone glade	Critically imperiled									X	
Low heath scrub shrub	Critically imperiled	X	X	X	X			X			
Marl fen plant association	Critically imperiled									X	
Mesic central forest	Imperiled				X						
Mesic scrub oak/heath/pitch pine barrens	Critically imperiled	X		X	X						
Natural pond	Imperiled to vulnerable		X								
Northern Appalachian acidic cliff community	Secure	X	X	X				X			
Northern Appalachian acidic rocky summit community	Imperiled	X	X	X	X						
Northern Appalachian boulder field	Secure	X									
Northern Appalachian calcareous cliff community	Imperiled			X		X					
Northern Appalachian calcareous rocky summit community	Critically imperiled			X							

Common Name	State Rank	Pennsylvania Counties							New Jersey Counties		
		Carbon	Lackawanna	Luzerne	Monroe	Northampton	Pike	Wayne	Morris	Sussex	Warren
Northern Appalachian shale barren	Imperiled						X				
Northern Appalachian shale cliff community	Imperiled					X	X				
Northern conifer forest	Imperiled to vulnerable	X			X						
Northern hardwood forest	Imperiled to vulnerable				X		X				
Northern hardwood/conifer forest	Vulnerable							X			
Pitch pine/mixed hardwood woodland	Imperiled to vulnerable	X									
Pitch pine/scrub oak woodland	Imperiled to vulnerable						X				
Poor fen	Critically imperiled							X			
Prairie fen	Critically imperiled									X	
Prairie sedge/spotted joe/pye-weed marsh	Critically imperiled to imperiled					X					
Red spruce/mixed hardwood palustrine forest	Vulnerable			X	X		X	X			
Red spruce palustrine forest	Vulnerable	X	X	X	X		X	X			
Red spruce palustrine woodland	Imperiled to vulnerable	X					X				
Red-cedar/prickly-pear shale scrub shrub	Imperiled						X				
Rice cut-grass/green-fruited bur-reed/water smartweed seasonally flooded herbaceous vegetation	Vulnerable									X	
Rich red maple/black ash swamp	Critically imperiled to vulnerable									X	X

Common Name	State Rank	Pennsylvania Counties							New Jersey Counties		
		Carbon	Lackawanna	Luzerne	Monroe	Northampton	Pike	Wayne	Morris	Sussex	Warren
Ridgetop dwarf-tree forest	Vulnerable	X		X	X		X				
Riverside ice scour community	Critically imperiled to imperiled							X			
Scrub oak scrub shrub	Vulnerable	X	X	X	X		X				
Shale cliff/rock outcrop community	Imperiled (unknown)										X
Shrub fen	Critically imperiled				X						
Skunk cabbage/golden saxifrage forest seep	Apparently secure to secure					X					
Sphagnum/beaked rush peatland	Vulnerable						X				
Sycamore/green ash/American elm/ red-osier dogwood forest	Critically imperiled to imperiled									X	X
Talus cave community	Imperiled to apparently secure			X							
Talus slope community	Imperiled to vulnerable									X	X
Waterfall and plungepool	Vulnerable to apparently secure				X		X				
Water-willow (*Decodon verticillatus*) shrub wetland	Vulnerable						X				
Xeric central conifer forest	Vulnerable to apparently secure						X				
Yellow water-crowfoot/clearweed/water smartweed herbaceous vegetation	Vulnerable									X	X

Common Name	State Rank	Pennsylvania Counties							New Jersey Counties		
		Carbon	Lackawanna	Luzerne	Monroe	Northampton	Pike	Wayne	Morris	Sussex	Warren

Source: PNHP 2010; NJDEP 2008a, 2008b, 2008c.

Note: Communities in italics are found in New Jersey only; communities in bold are found in Pennsylvania only.

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.

APPENDIX G-9: NATURAL HERITAGE SITES/OUTSTANDING NATURAL FEATURES

OUTSTANDING NATURAL FEATURES IDENTIFIED IN PENNSYLVANIA BY THE NATURE CONSERVANCY

County	Natural Heritage Sites
Carbon County, PA	Aquashicola Creek Wetlands, Bake Oven Knob, Bear Creek Lake, Bears Rocks, Beltzville Lake Vernals, Berry Run Barrens, Black Creek Gorge, Black Shanty Run, Broad Mountain West, Carpsrocus Creek Thickets, Christmans Ponds, Christmans Wetland, Cross Run Vernals, Devil's Potato Patch/Little Gap, East Side Wetland, Fawn Run Wetlands, Fourth Run Wetlands, Francis E. Walter Reservoir Site, Glen Onoko, Golf Course Wetland, Hell Creek Barrens, Hickory Run Boulder Field, Hickory Run Campground, Hickory Run Headwaters, Hickory Run Wetland, Hughes Swamp, Indian Mountain Barren, Irishtown Run, Keipers Run, Kidder Wetlands, Lake Harmony/Big Boulder Lake, Lehigh Gap, Lehigh Gorge at Sandy Run, Lehigh Gorge at Tank Hollow, Leonardsville Swamps, Mahoning Creek Wetlands, Mauch Chunk Ridge Barrens, Mosey Wood Wetlands, Mud Run Natural Area, Mud Swamp, Owl Creek Wetlands, Penn Forest/Wild Creek Reservoirs, Penn Haven Oak Barren, Penrose Swamp Barrens, Pine Run Woods, Pocono Mountain Barren, Pocono Mountain Wetlands, Quakake Creek Wetland, Roundhead Mountain Barren, Schoch Barrens Complex, Schoch Thicket, Scrub Mountain, Spring Mountain, Stone Mountain Woods, Stony Ridge, Swamp Run, and Yellow Run Barren
Lackawanna County, PA	AD 431 Mine – Riverdrift, America Swamp, Archbald Pothole, Atherton Pond, Bald Mountain, Balsam Swamp-Lackawanna, Bassett Pond, Bear Lakeigrassy Pond, Bear Swamp-Moscow, Behler Swamp, Bell Mountain Outcrops, Blue Shutter Road Swamp, Brzostek Swamp, Carpenter Swamp, Chapman Lake, Corby Swamp, County Line Island, Daleville Swamp, Dunmore Bald, Dunmore Swamps, Eagle Lake, Elmhurst Mud Pond, English Swamp, Fallbrook Swamp, Horseshoe Swamp, Johnson Pond-Westend Pond Complex, Kizer Pond, Lake Kewanee Bog, Long Swamp, Mash Creek Marsh, Montage Mountain Foothills, Montage Rocky Summit, Moosic Bend Lackawanna River, Moosic Lake, Moosic Mountain Barrens, Mountain Mud Pond, Nay Aug Gorge, Newton Lake/Mud Pond, Nines Pond, Painter Creek Bog, Panther Gorge, Panther Hill Site, Pittston Road Bog, Potter Creek Bog, Sadler Avenue AMLF #2 Site, Salem Hill Barren, Sand Springs Woods, Sickler Pond, Stafford Bald, Swartz Road Swamp, Tannery Road Swamp, Tunkhannock Creek, West Mountain Summit, and Wyoanna Cliffs

County	Natural Heritage Sites
Luzerne County, PA	Abrahams Creek Wetlands, Andy Pond, Arbutus Peak, Bald Mountain Road Swamp, Bear Creek At Shades Creek, Bear Creek Railroad Site, Bear Hollow, Bear Swamp, Beaver Run Wetlands, Behren Pond, Benton Station Fields, Black Creek Flats, Blue Nob Ridgetop Dwarf-Tree Forest, Boulder Run Swamp, Briggsville Vernal Pools, Campbell's Ledge, Canada Bog, Central Mountain, Choke Creek Shrub Swamp, Council Cup Cliffs, County Line Islands, County Line Swamp, Cranberry Pond, Dogtown Mines, Dorrance Bog, Dreck Creek Watershed, Dry Land Hill Pools, East Fork Harveys Creek (North), East Fork Harveys Creek (South), Edgewood Vernal Pools, Five Points Swamp, Folstown Mud Pond, Frances E. Walter Reservoir, Gardner Creek Reservoir, Glen Lyon Anthracite Mine, Grand View, Haas Route 115, Hanover Crossing Wetland, Harris Pond, Harveys Lake, Haystack Mountain, Hell's Kitchen, Hell's Kitchen AMLF # 3 Site, Hell's Kitchen, Anthracite Mine, Hobbie Meadow, Humboldt Barren, Huntington Creek, Ice Caves, Indefatigable Swamp, Indian Lake Swamp, Kendall Creek Wetland, Kirby Park, Kitchen Creek Falls, Kitchen Creek Ravines, Lake Jean, Lake Leigh, Lee Swamp, Lehigh Gorge, Lehigh River - Route 115 Bridge Site, Lehigh River at Choke Creek, Lilly Lake, Mill Creek at Suscon, Mountain Springs Lakes, Mud Pond, Mud Pond Woods, Mylet's Corners, Nanticoke Marsh, Nescopeck Creek Valley, Nescopeck Mountain Barrens, Nevel Swamp, Nuangola Lake, Nuangola Railroad Tunnel, Nuangola Station Swamp, Old Beaver Dam Swamp, Old Boston Mine, Opossum Swamp, Opperman Pass, Orloski’s Bog, Penobscot Mountain Ridgetop, Perrins Marsh, Pine Creek, Pipeline Swamp, Pipeline Swamp North, Pittston Rookery, Plains Flats, Popples Quarry Pond, Red Bear Swamp, Ricketts Glen Swamp, Roaring Brook Swamp, Route 11 Boat Launch, Scotch Run, Shades Glen Headwaters, Shickshinny Mountain Ridgetop, Shickshinny Mountain, Shingle Run, Slocum Marsh, Sorber Run Lake, State Game Lands #14, State Game Lands #573, Stockton Mountain Barrens, Summer Hill Bog, Suscon Railroad Grade Site, Susquehanna River at Duryea, Susquehanna River at Exeter, Susquehanna River at Hanover Green, Susquehanna River at Mocanaqua, Susquehanna River at Nanticoke, Susquehanna River in Columbia County (North), Susquehanna Riverlands, Sylvan Lake, Tannery Road Site/Behler Swamp, The Meadows/ Beech Lake, The Tubs, Tillbury Knob, Valmont Industrial Park, Wapwallopen Gorge, Wilkes-Barre Mountain, Wolf Run Headwater Swamp, Wright Creek Watershed (A), Wright Creek Watershed (B), Wright Creek Watershed (C), and Wyoming Mountain Barrens
Monroe County, PA	Adams Swamp, Appalachian Trail, Arnott Fen, Bender Swamp, Big Marsh, Big Offset Barren, Big Spring, Bloomer Swamp, Bond Hill Falls, Boulder Field, Bradys Swamp, Camelback Mountain, Cherry Creek Fen, Circle Bog, Cresco Heights, Delaware River, Dutch Hill, Eschenbaugh Swamp, Fern Ridge Bog, Goose Pond Run Falls, Goose Pond Swamp, Green Ridge Marsh, H. Bender Falls, Halfmoon Lake, Huckleberry Marsh, Intake Dam Woods, Kintz Swamp, Lake Mineola Marsh, Lake Naomi Shrub Swamps, Lake Naomi, Laurel Drive Bog, Leavitt Falls, Little Pond Swamp, Lon Price Marsh, Long Pond Macrosite Preserve, Longpatch Swamp, Lost Lakes, Mount Wisner, Mud and Sipos Swamp Area, Pinemere Camp Swamp, Pocono Creek Floodplain Forest, Pocono Lake Preserve, Pocono Plateau Lake Wetlands, Pond Swamp, Ramaque Lake Swamp, Ramot Bog, Sand Spring, Schoch Barren, Selfice Swamp, Seven Pines Mountain, Spruce Cabin Pond, Spruce Cabin Run, Spruce Mountain Run Falls, Spruce Mountain, Stillwater Lake Swamps, Stoney Run Pond, Stony Run, Tannersville Bog, The Mash, Tims Swamp, Twomile Run Swamp, Underwood Swamp, Upper Buck Hill Creek, Vogt Farm Wetland, Wagner Way Swamp, Wagners Bog, Wallpack Bend Cliff, Wild Creek Reservoir Watershed, and Zimmer Wildlife Sanctuary
Northampton County, PA	Angle Swamp, Arrow Island, Bear Swamp, Bertsch Creek Seep, Big Offset Barren, Binney And Smith Woods, Blue Mountain, Bull Run, Bushkill Creek Watershed, Delaware River Water Gap, Delaware Shore Near Keifer Island, East Bangor Wetland Complex, East Johnsonville Swamp, Eastern Industries Quarry, Easton Bluff, Five Points Wetland, Foul Rift, Fox Gap Pond, Frost Hollow Overlook, Getters Island, Getz Swamp, Granite Hill, Grand Central Woods, Hellertown Marsh, Hellertown Reservoir Area Vernals, Frya Run Watershed, Island Park, Jacobsburg Environmental Education Center, Lake Poco, Lehigh Gap, Lehigh Slopes, Little Gap, Little Offset Swamp, Lohman Swamp, Lohman Wetlands, Mariton Uplands, Martins Creek Watershed, Minsi Lake Vernal Ponds, Morgan Hill, Mount Jack Limestone Outcrop, Mount Bethel Fens, Neffs Pond, Old Sow Island, Oughoughton Creek Power, Polly Acres Swamp, Portland Powerplant Site, Raesly Wood, Raubs Island, Raubsville Lock 22-23 Delaware River, Redington Cave, Rismiller Woods, School Road Swamp, Springtown Marsh, Steel City Slopes, Totts Gap, Totts Gap Swamp, Weaversville Ponds, and Whippoorwill Island

County	Natural Heritage Sites
Pike County, PA	Bald Hill Swamp, Bald Hill, Balsam Swamp, Beaver Lake, Ben Bush Swamp, Big Bear Swamp, Big Dam Ridge Swamp, Big Swamp, Blooming Grove Long Pond Swamp, Bruce Lake, Buck Bar, Buckhorn Oak Barre, Bushkill Falls, Bushkill Shale Cliff, Bushkill Swamp, Conservation Island, Corilla Lake, Crooked Swamp, Crossroads Tavern Woods, Deep Brook, Delaware River, Dingmans Falls, Dry Brook Shale Barren, East Mountain Thicket, Edgemere Road Woods, Elbow Swamp, Eschbach Heights Shale Barren, Fairview Lake, Forest Lake, Fulmer Falls, Gates Run, Germantown Swamp, Glenside Shale Barren, Hemlock Farms Barren, High Knob, Holsey Meadow Swamp, Little York Swamp, Lackawaxen River, Lake Belle, Lake Giles, Lake Laura, Lake Maskenozha, Lake Paupack, Lake Scott, Ledgedale Swamp, Lehman Township Woods, Little Bushkill Swamp, Little Mud Pond Swamp, Little Mud Pond, Little Teedyuskung Lake Bog, Long Swamp, Low Knob, Lower Shapnack Island, Mainses Pond, Maple Swamp, Mashipacong Shale Cliff, Matamoras Cliffs, Milford Cliffs, Millrift Cliffs, Millrift Pine Flats, Mud Pond Region, Old Port Jervis Road Shale Cliff, Painter Swamp, Paupack Falls, Pecks Pond Bog, Pinchot Falls, Pine Lake, Pocono Environmental Education Center, Point Peter, Poison Brook Swamp, Raymondskill Falls, Rock Hill Pond, Sagamore Swamp, Sawkill Mud Pond, Shapnack Island, Shoemakers Barren, Shohola Falls Swamp, Silver Lake, Smiths Swamp, Spruce & Rowland Swamps, Sunrise Swamp, Sunset Creek Ravine, Taylortown Swamp, Tinkwig Creek, Toms Creek, Twelvemile Pond, Twin Lakes, Well Road Swamp, Wallenpaupack Creek, White Birch Swamp, and Wolf Lake
Wayne County, PA	Abrahamsville Cliffs, Aldenville Mud Pond, B'nai B'rith Bog, Barkley Lake, Bear Swamp, Beaver Pond, Belmont Lake, Bender Swamp, Bethel Swamp, Beyea Pond, Bigelow Lake, Buckingham Boat Access, Butternut Creek, Carley Brook Bog, Carr Pond, Chestnut Lake, Clemo Pond, Conkling Hill, Crockenburg Pond, Crooked Mud Pond, Damascus Cliffs, Delaware River, Delaware River, Dripping Cliffs, Dyberry Creek Rookery, East/West Branches Dyberry Creek, Elk Lake, Farrell Corners Fen, Finnegan Corners, Flat Rock Bog, Forest City Station Bald, Freytown Swamp, Gas Hollow, Girdland Bog, Hancock River Ledges, Hardwood Ridge, Harvey Cleveland Bog, Hawks Nest, Hawley Bog, Hiawatha Lake, Hoadley Pond, Holberts Pond, Howell Pond, Island Lake, Lackawaxen River, Lake Ariel, Lake Henry, Lake Lacawac, Lakewood Bog, Lehigh Pond, Little Bigelo, Little Hickory Lake, Lookout Bog, Lovelace Pond, Lower Woods, Maple Grove Church Bald, Maple Grove Wildflower Site, Maple Grove, Marsh Pond, Milanville Riverwash South, Milanville Riverwash, Milanville Woods, Miller Pond, Moosic Mountains, Mount Ararat, Narrowsburg Bend, Orson Glade, Pennsylvania Gas & Water Co. Lands, Peterson Lake, Pine Swamp, Pipeline Bog, Poyntelle Lake Orson, Prompton Bog,Rock Lake, Rocky Run, Salem Hill Barren, Schoolhouse Creek, Shehawken Lake, Silkmans Swamp, Sly Lake, Snag Pond, Spruce Lake, Spruce Pond, Star Pond, Starrucca Creek Tributary, Stockport Woods, Sugarloaf Mountain, Thousand-acre Swamp, Topps Bog, Upper Woods Pond, Wallsnpaupack Creek, Wangum Creek, West Damascus Rookery, and White Oak Pond

Sources: PA TNC 1990; PA TNC 1991; PA TNC 1998; PA TNC 1999; PA TNC 2005a; PA TNC 2005b; PA TNC 2006.

NATURAL HERITAGE PRIORITY SITES IDENTIFIED IN NEW JERSEY BY NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

County	Natural Heritage Sites
Morris County, NJ	Bartley Ravine, Black River Meadow, Budd Lake Bog, Budd Lake Outlet, Chester Railroad Site, Green Pond Mountain, Green Pond Mountain North, Ironia, Isabels Site, Lake Denmark, Lincoln Park Gravel Pits, Mount Freedom, Mount Hope Bog, New Russia Gravel Pit Site, Picatinny Lake, Splitrock Reservoir Site, Valhalla Hemlock Glen, Great Piece Meadows, Pequannock River, Bridge to Nowhere, Pompton River Gravel Bar Site, and Sparta Pine Swamp
Sussex County, NJ	Andover Junction Site, Andover Ridge, Arctic Meadows, Branchville, Breakneck Mountain, Bridge to Nowhere, Brighton Meadow, Buckmire Pond, Buttermilk Falls, Cherry Ridge Ravine, Colesville, Crater Lake, Dingmans Ferry Bridge Site, Edison Bog, Emmens Station Site, First Time Fen, Flatbrook Valley Roadbank Site, Flatbrookville Rivershore, Franklin Mine, Franklin Quarry, Franklin Yard, Greendell Marsh, Greendell Powerline Site, Hainesville Woods, Hampton Ridge, Hardistonville, Heaters Pond Ridge, Hemlock Pond, High Point, Hopkins Corner Site, Hyper Humus, Johnsonburg, Kittatinny Cliffs and Talus, Kuser Cedar Swamp, Lake Grinnell Bog, Lubbers Run, Mashipacong Bogs, McAfee Quarry, Millville Ravine, Montague Rivershore-Bridge, Montague Rivershore-West, Montague Rivershore-White Brook, Montague Woods, Morris Lake Woods, Muckshaw Ponds, Ogdensburg Glades, Ogdensburg Meadow, Old Mine Road Site, Perona Lake, Rosencrans Ferry Site, Rudeville, Sawmill Pond Swamp, Second Chance, Shermans Glen, Shuster Pond, Site 564, Smith Ferry Site, Sparta Avenue, Sparta Pine Swamp, Sparta Station Site, Springdale, Steam Mill Site, Sterling Hill, Sterling Mine, Stillwater Ridge, Stockholm Slope, Sussex Mills, Swartswood Lake, Swartswood Sinkhole Ponds, Vernon Valley, Wallpack Center Road Site, Wallpack Ravine, Wallpack Ridge, Waterloo, Wawayanda Lake, Wawayanda Swamp, Wildcat Ravine and Bog, Wolf Lake, Woodruffs Gap, and Wrights Pond Bluffs
Warren County, NJ	Belvidere Riverside, Blairstown White Lake, Buttermilk Bridge Site, Columbia Floodplain, Dancing Leaves Site, Delaware, Depew Island, Dildine Island, Flatbrookville Rivershore, Foul Rift, Ghost Lake, Glovers Pond, Greendell Marsh, Greendell Ridge, Hardwick Meadow, Harmony Shore, High Rock Mountain, Hutchinson, Johnsonburg, Limestone Ridge Marsh, Luck Low Site, Luse Pond, Manunka Chunk Bluffs, Millbrook Gap, Mountain Lake Bog, Mt. Tammany, Pequest, Phillipsburg Bluffs, Pohatcong Mountain, Poxono Island, Poxono Shore, Riegelsville Bluffs, Shuster Pond, Southtown Sinkhole, Squires Corner Site, Swayze, Three Nest Cliff, Tocks Swamp, and Van Campen Glen

Source: NJDEP 2007

APPENDIX G-10: GENERAL CONFORMITY APPLICABILITY ANALYSIS

The preferred alternative for the proposed project (alternative 2) would be constructed within the U.S. Environmental Protection Agency (USEPA) designated northeastern ozone (O_3) transport region, a multi-state ozone nonattainment area. The project is thereby potentially subject to the federal General Conformity Rule established at 40 CFR Part 93 Subpart B. A general conformity applicability analysis was conducted to determine if increases in air pollution from the construction of the preferred alternative (alternative 2) would cause or contribute to new violations of the National Ambient Air Quality Standards (NAAQS).

1. Regulatory Background: General Conformity Applicability Analysis

The General Conformity Rule was established to ensure that federal activities do not interfere with efforts to return nonattainment areas back into compliance with the NAAQS. In particular, Section 176(c) of the Clean Air Act prohibits federal agencies, departments, or instrumentalities from engaging in, supporting, licensing, or approving any action, in an area that is in nonattainment of the NAAQS, which does not conform to a USEPA approved state implementation plan. Therefore, the NPS must determine whether or not the project would interfere with the goals in the affected state implementation plans.

Pursuant to Clean Air Act Section 176(c) requirements, the USEPA promulgated 40 CFR Part 51, Subpart W and Part 93, Subpart B, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans." These regulations, commonly referred to as the General Conformity Rule, apply to all federal actions except for those federal actions related to transportation plans, programs, and projects under Title 23 U.S. Code or the Federal Transit Act, which are subject to Transportation Conformity (40 CFR Part 93 Subpart A).

Alternative 2 would be constructed in areas of both Pennsylvania and New Jersey. In Pennsylvania, counties associated with the S-R line, including Pike, Monroe, Wayne, Northampton, Lackawanna, Luzerne, and Carbon Counties, are considered to be in attainment with the NAAQS. In New Jersey, counties associated with the S-R line, including Warren, Sussex, and Morris Counties, are considered to be in attainment for all criteria air pollutants except ozone. Morris County is also in nonattainment for $PM_{2.5}$. The general conformity applicability analysis has been based on the assumption that the proposed project is within the ozone transport region and a $PM_{2.5}$ nonattainment area.

To regulate the emission levels resulting from a project, federal actions located in nonattainment areas are required to demonstrate compliance with the General Conformity Rule. The project area is located within a nonattainment area; therefore, a General Conformity Rule applicability analysis was conducted.

Section 93.153 of the General Conformity Rule sets applicability requirements for projects through establishment of *de minimis* levels for annual criteria pollutant emissions. These *de minimis* levels are set according to criteria pollutant nonattainment area designations. Projects with total emissions below the *de minimis* levels are exempt from the requirements of the rule. Those at or above the levels are required to perform a conformity determination as established in the rule. The *de minimis* levels apply to the largest single-year total of direct and indirect project emissions, from stationary and mobile sources, that can occur during the construction and operation phases of the action.

The NPS has completed a General Conformity Rule applicability analysis in order to determine if air quality impacts from the preferred alternative 2 are significant. For ozone, emissions have been estimated for the ozone precursor pollutants NO_X and volatile organic compounds (VOCs). Annual emissions for these compounds were estimated for each of the project actions (construction and maintenance) to determine if they would be below or above the *de minimis* levels established in the rule. The *de minimis* threshold for moderate ozone nonattainment areas in an ozone transport region is 100 tons per year (TPY) for NO_X and 50 TPY for VOCs. The *de minimis* levels for $PM_{2.5}$ established in the rule are 100 TPY for directly emitted $PM_{2.5}$ and each of the precursors SO_2 and NO_X.

Sources of NO_X, VOCs, $PM_{2.5}$, and SO_2 associated with the proposed project would include emissions from land clearing and logging equipment, construction equipment, vehicles including workers' vehicles, trucks hauling and delivering construction materials, and off-gassing from resurfacing of paved roads. It also includes emissions from maintenance operations including worker's vehicles and landscaping equipment.

2. General Conformity Applicability Analysis

For this project, construction-related and maintenance operations-related general conformity analysis was performed for the preferred alternative (alternative 2). This conformity analysis and air emissions evaluation will follow the criteria specified in 40 CFR Part 51, and 93, Determining Conformity of General Federal Actions to State or Federal Implementation Plans: Final Rule (April 5, 2010). The emissions evaluation will also follow all NEPA-related criteria provided in 40 CFR Part 6.

The analysis of construction and maintenance operations emissions was based on estimates of the type and quantity of construction equipment likely to be involved in the project. Air emissions have been evaluated by use of the National Mobile Inventory Model (NMIM) software package, which incorporates data from the USEPA NONROAD 2005 and MOBILE 6.02 programs.

2.1 Construction Phase Emissions

Construction emission would result from the operation of heavy land clearing and logging equipment, delivery trucks and construction equipment, worker commuter vehicles, and asphalt paving.

The annual construction related emissions are provided in table G-1.

TABLE G-1: CONSTRUCTION EMISSIONS

Year	Pollutants (tons/year)					
	VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$
2013	1.41	13.85	10.33	0.03	0.27	0.26

2.2 Maintenance Operations Phase Emissions

The source of maintenance operations emissions are the sawing equipment and the operational (motor vehicle) sources. Table G-2 provides operations related emissions.

TABLE G-2: OPERATIONS EMISSIONS

Year	Pollutants (tons/year)					
	VOC	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$
2014	3.15E-03	3.00E-02	1.54E-02	2.74E-05	1.99E-03	1.93E-03

3. Summary of Construction and Operations Emissions

The emissions from construction and maintenance operations occur in different years and do not combine on an annual basis. Table G-3 shows that emissions associated with constructing and maintenance operating the preferred alternative 2, when compared to the *de minimis* values for an area that is in moderate nonattainment for ozone; nonattainment for $PM_{2.5}$ established in 40 CFR § 93.153 (b) for NO_X, $PM_{2.5}$, and SO_2 for 100 tons per year; and for VOCs of 50 tons per year, fall below the *de minimis* values.

TABLE G-3: ANNUAL EMISSIONS

Activity	Pollutants (tons/year)			
	VOC	NO_x	SO_2	$PM_{2.5}$
de minimis levels	50	100	100	100
Construction (2013)	1.41	13.85	0.03	0.26
Maintenance Operations (2014)	0.003	0.03	2.74E-05	0.002

4. Conclusion

The total direct and indirect emissions from stationary and mobile sources associated with the proposed project in any given year are less than the *de minimis* levels established under the General Conformity Rule. Hence, a full conformity determination is not required and the proposed project is not subject to the Rule.

5. Additional Considerations – Carbon Sequestration

The park is considered as a carbon sink. The contribution of preferred alternative (alternative 2) to climate change through greenhouse gas emissions was further analyzed.

TABLE G-4: DEFORESTATION DATA FOR ALTERNATIVE 2

Dominant Species	Acres - ROW Expansion	Acres - Roads outside of ROW
Autumn-olive, Gray Dogwood, Eastern Red Cedar	1.5	0
Black Cherry, Tulip Poplar, Red Maple, White Ash	8.4	0
Chestnut Oak, Northern Red Oak, Black Oak	7.3	0
Chestnut Oak, Sweet Birch	4	0
Eastern Hemlock, Chestnut Oak, White Oak, Northern Red Oak, Scarlet Oak, Sweet Birch	0.9	0
Eastern Hemlock, Yellow Birch, Sugar Maple	15.7	0.31
Eastern Red Cedar	3.2	0
Eastern White Pine	0	0.15
Eastern White Pine, Eastern Hemlock	2	0
Eastern White Pine, Northern Red Oak, Black Oak, American Beech	2.1	0.03
Northern Red Oak, Black Oak, White Oak, Sweet Birch, Eastern White Pine	5.4	0.04
Northern Red Oak, Sugar Maple, Tulip Poplar	1.7	0
Pine species Planted Forest	0.4	0
Silver Maple, American Elm	1.2	0
Smooth Alder	1	0
Sugar Maple, Yellow Birch, American Beech	27.6	0.18
Sweet Birch, Red Maple	8	0
Sycamore, Green Ash	0.5	0
White Oak, Northern Red Oak, Black Oak, Flowering Dogwood	17.6	0.49
Total	**108.5**	**1.2**

Carbon sequestration rates for avoided deforestation have been estimated to be up to 172.1 tons of carbon per acre per year. Based on the total acres of mature forest removed for the expansion of the right-of-way and creation of access roads, the amount of carbon sequestration potential lost from deforestation could be as much as 18,879 metric tons of carbon per year. However, the forest in the right-of-way will be replaced by grassland. The Chicago Climate Exchange had credited carbon sequestration due to grass plantings at 1 metric ton of CO_2 per acre per year, or around 0.273 metric tons of carbon per acre per year. The uptake of carbon for the right-of-way area if converted to grass would be around 30 metric tons of carbon per year.

TABLE G-5: CARBON SEQUESTRATION ESTIMATES

Activity	Sequestration Rate (metric tons C/acre/yr)	Applied Area	Sequestration Rate for S-R (metric tons C/yr)
Deforestation (ROW and access roads)	-172.1	109.7	-18879.37
Grass plantings (ROW)	0.273	108.5	29.6205

Source: USDOT 2010; Center for Integrated Natural Resources & Agricultural Management n.d.

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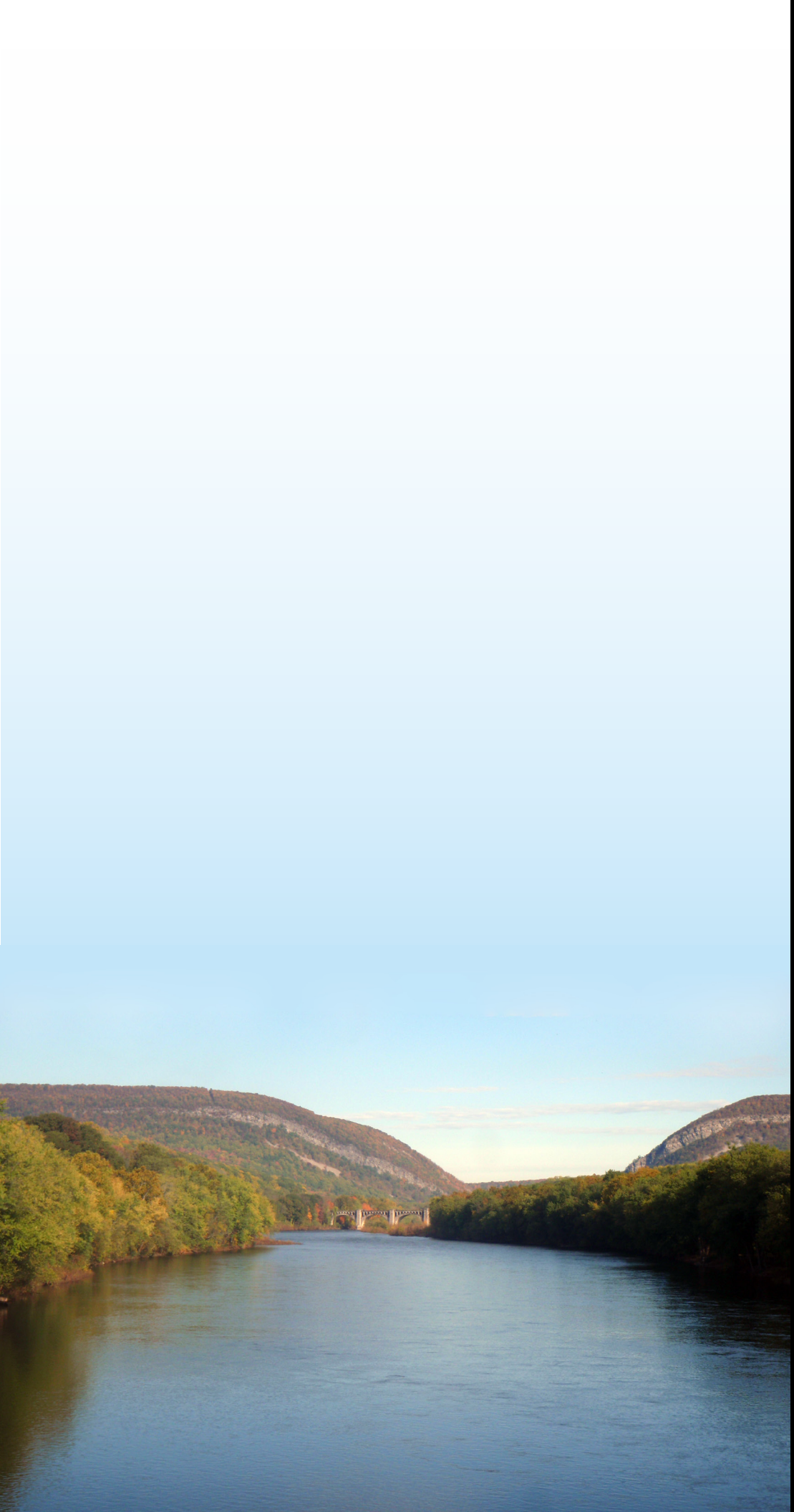


Appendix H

Projects Assessed for Cumulative Impacts

APPENDIX H:
PROJECTS ASSESSED FOR CUMULATIVE IMPACTS
AS OF AUGUST 31, 2011

Action Project	Project Description	Date	Location	Impact Type
Infrastructure - Roads (includes Road Repair / Line Painting / Sign Upgrades / Regrade)				
Smooth Ride Initiatives: Road Surface Rehabilitation throughout DEWA (all park road paving projects)	Work included roadway pavement overlay, milling at all roadway transitions and road connections, pavement of aprons on connecting roads and driveways to allow smooth transition, repainting of pavement markings on all overlaid and sealed sections, grading and grubbing to re-establish roadway shoulders and drainage, guardrail reinforcement or replacement, crack and slurry seal of roadways and parking areas, installation of reflective roadway markers, traffic marking and lane stripe painting, and associated traffic control, signage, flaggers, construction surveying, and testing.	2006/ 2007; ongoing	DEWA- NJ, PA Inside the study area	Adverse: Temporary impacts to visitors during work (construction zones, noise, extra signage) Beneficial: Longer-term (several years), beneficial visitor use (no potholes, smooth driving surface), NPS Ops (less patching, issues with flat tires, etc.).
US Route 209 Roadway Surface and Health and Safety Improvements (in design, may be subject to change).	Purpose is to reduce crashes along the US 209 corridor while protecting park resources and preserving and improving the visitor experience along the corridor. Planned work will consist of milling and paving the roadway to improve the overall traction and surface condition of the roadway and implementation of selected traffic health and safety improvements. Includes left turn lane from NB US 209 onto Bushkill Falls Road and full traffic signal. Replacement of roadway signage throughout corridor. Electronic info boards at North & South Contact Stations. Safety improvements include signing, etc. to warn motorists of highly active wildlife crossings areas along US 209 near Tom's Creek and Zimmerman Flats.	In process 2011	DEWA – PA	Adverse: Bushkill Falls Road intersection will be larger and more "urban." More signs (sign pollution) and potential for noise pollution (rumble strips). Beneficial: Health and safety. Safer intersection through turn lane and signals. Signs in good condition and meeting MUTCD standards for retro-reflectivity. Signage to warn motorists of highly active wildlife crossing areas.

Action Project	Project Description	Date	Location	Impact Type
PennDOT SR 2001 Road Project	Correction of substandard horizontal and vertical roadway curvature and replacement of the existing bridge and culvert crossings of Randalls Creek, Bar Road Run, Toms Creek, Briscoe Creek (Alicia's Creek), Hornbecks Creek, and Dingmans Creek. Also included are resurfacing, shoulder improvements, signing, guiderail adjustments, and a curve straightening. Following is information directly from PennDOT Cat Ex Evaluation & Programmatic Section 4(f) Eval (Aug 2004): Existing roadway is 9 ft lanes with no shoulders. New will be 11 ft lanes with 8 ft shoulders. Horizontal and vertical curvature fixes require realignment of the roadway substantially in some areas. Entire project (3 sections, one currently under construction) require up to 23 property takes and 27 residential relocations. Utility pole relocation throughout project and one underground water line relocated. Total length of streams impacted by project = 8,257 ft. Wetland impacts = 3.61 total; 1.57 EV. Wetland impacts mitigated on NPS lands through 5.01 acre constructed wetland. Increased pavement and bridges may have adverse impact on flood elevations. Vegetation impacts (forested lands, etc.) and mitigated through reseeding. Impacts to NPS lands = 37.8 acres (mitigated through land exchanges). Cultural resources present but having no adverse effect. Tax base reductions from takings. No impacts on economic activity. Temporary construction impacts to air quality, noise levels, water quality, soil erosion & sedimentation.	Present. 2009-2011	DEWA – PA Reconstruct SR 2001 (Milford Road) from its intersection with SR 739 in Delaware Township south to intersection with US Route 209 in Bushkill, PA for approx. 21.7 kilometers (13.5 miles).	Beneficial: gateway communities, safety and socioeconomics. Adverse: Geology, air quality, soundscapes, water quality, floodplains and wetlands, visitor experience, socioeconomics, gateway communities. Contributes to fragmentation of ecological landscapes and residential encroachment.
Old Mine Road South Rehabilitation Same as other Road Paving projects (proposed, may be subject to change).	South Old Mine road (1.1 mi.) will be reconstructed to repair pavement failures occurring since last reconstruction in 2001. In process.	Future. Proposed 2011	DEWA – NJ Inside the study area	Adverse: Threatened and endangered plant and animal species concerns. Beneficial: Health and safety, operations, visitor experience (repairs potholes, etc.).

Action Project	Project Description	Date	Location	Impact Type
Rehabilitate River Road	River Road requires complete reconstruction using proper road base material and modern construction techniques including reflectors, signage, guardrails, 80 culverts. *Environmental assessment completed but not finalized; no Decision Document Project is tabled for now.*	Proposed 2015; currently tabled but could be completed at a later date.	DEWA – PA	Adverse: Cultural resources (increasing "modernization/ urbanization" to roadway. Natural resources (migrations). Potential one-way impacts to gateway community commuters. Visitor experience (both adverse and beneficial) by making roadway safety improvement (change experience of small rural roadway). Beneficial: Health and safety traffic would become more "park" traffic, and not commuters.
DEWA 14(7) Rehab Remainder of US 209	Reconstruct remaining sections of US 209 mile 5.3 to 16.1. Includes health and safety improvements at the intersection of US 209 and PA SR 739, Eshback Launch (milepost 6.5), and Chestnut Ridge Road (milepost 11). Recommendations listed in the FHWA's 1986 draft Engineering Study, 1995 Design Scoping Report, and 1992 Traffic Health and Safety Study include pavement milling, reconstruction and widening of the road base, asphalt pavement and sign replacement.	Proposed 2015	DEWA – PA	Change to "look and feel" of US 209 into major roadway (not park road). Short-term impacts to visitors (detours, construction zones, etc.).
Alternative Transportation Program	DEWA has identified alternative transportation systems (ATS) as a means to enhance mobility options for visitors while conserving the natural, cultural, and scenic resources of the park. ATS options include transit, pedestrian, bicycle, or water resources-based transportation options to give visitors an alternative means of travel to and within national parks. An alternative transportation feasibility study was conducted at DEWA to evaluate the effectiveness of various ATS options.	Proposed/ future	DEWA - NJ, PA Inside the study area	POTENTIAL: REVIEW UNDER NEPA NOT COMPLETED YET. By providing alternative forms of transportation, ATS can reduce the impacts of personal vehicle use on park resources, while improving the visitor experience. Long-term impacts include infrastructure needs (stop shelters, larger/improved pull-outs for destinations, bus traffic on park roads). Dispersed use throughout the US 209 corridor. Long-term needs may include building accessory structures (shelters, etc.). More signage. Reduces # of car trips on 209 for recreational users of trail & river.

Action Project	Project Description	Date	Location	Impact Type
US 209 Commercial Use Expiration 2015	Commercial vehicles are currently permitted on US 209 with fee payment. Commercial traffic will be prohibited on US 209 after 2015.	Future - 2015	DEWA – PA	Beneficial & adverse to gateway communities, socioeconomics, NPS operations. Beneficial: visitor use and experience, soundscapes
Marshalls Creek Traffic Relief project	PennDOT project. Phase 3 of the traffic relief project is a bypass route proposed around the Village of Marshalls Creek to alleviate traffic issues at US 209/Milford Rd/Seven Bridges Road. Marshalls Creek is gateway community.	Proposed	Monroe County, PA	Adverse: Some may include vegetation, habitat loss, water quality. Benefits: Socioeconomics. Improvement of traffic through Marshalls Creek may reduce traffic on River Rd.
I-80 weigh station	Upgrade of weigh station facility on Interstate 80 east of Kittatinny Point. Project in-progress by NJDOT. On DEWA boundary, in the Water Gap - Columbia, NJ right under some of the proposed alternatives. Includes lighting upgrades along I-80 within DEWA. Weigh station would have septic system (none currently existing).	Proposed	DEWA-NJ Inside study area	Adverse: Archeological resources. Water quality. Visual resources. Lighting upgrades may cause more “urban” feel; NPS asked that lighting is night-sky friendly. Unclear on what design they are using. Beneficial: Socioeconomics, Public Health & Safety.
NJ to PA Lackawanna Passenger Rail Cutoff (Highspeed Passenger Train from NE PA to NYC)	New Jersey Transit proposal for high speed passenger train from Northeastern Pennsylvania to New York City. This project would restore rail service along an abandoned railroad ROW to restore service from Scranton, Pennsylvania to Hoboken, New Jersey. *An EA was completed in 2008, and a FONSI for the project was received in 2009. There are funding issues for this project.*	Proposed	NJ, PA	Adverse: Soundscapes, viewshed. Beneficial: Socioeconomics, infrastructure

Action Project	Project Description	Date	Location	Impact Type
Infrastructure - Bridges/Dams/Culverts (includes Repair/Replacement)				
DEWA 14(10) US 209-Rehabilitation MP 4.3 TO 5.3 and replace Toms Creek Bridge	Rehabilitation of US Route 209 and replacement of the Toms Creek Bridge along US Route 209. Rehab will consist of milling off the asphalt pavement surface, rubblizing the original concrete slabs, widening the pavement structure to a uniform width, and installing underdrains to facilitate subsurface drainage. Ditches will be reshaped to obtain improved drainage. Includes shoulder repairs and asphalt overlay of the Township road being utilized as a detour. Repair of Toms Creek Road Bridge and roadway approaches to be used as a detour of US 209 when Toms Creek Bridge is replaced. Repairs include rehabilitation and stabilization of bridge abutment and foundation, and surrounding stream bank. Bridge, roadway, and stream bank were severely undermined during the flooding events of September 2004 and April 2005, and continue to erode endangering the bridge. Sediment removal within the channel will also be performed to help direct the stream flow away from the bridge and eroding stream bank.	2005 - ongoing	DEWA - PA	Adverse: Water quality, Species of Concern. Visitor Experience, Invasive species. Beneficial: Infrastructure, safety.
DEWA 14(10) US 209-Rehabilitation MP 4.3 TO 5.3 and replace Toms Creek Bridge	Rehabilitation of US Route 209 and replacement of the Toms Creek Bridge along US Route 209. Rehab will consist of milling off the asphalt pavement surface, rubblizing the original concrete slabs, widening the pavement structure to a uniform width, and installing underdrains to facilitate subsurface drainage. Ditches will be reshaped to obtain improved drainage. Includes shoulder repairs and asphalt overlay of the Township road being utilized as a detour. Repair of Toms Creek Road Bridge and roadway approaches to be used as a detour of US 209 when Toms Creek Bridge is replaced. Repairs include rehabilitation and stabilization of bridge abutment and foundation, and surrounding stream bank. Bridge, roadway, and stream bank were severely undermined during the flooding events of September 2004 and April 2005, and continue to erode endangering the bridge. Sediment removal within the channel will also be performed to help direct the stream flow away from the bridge and eroding stream bank.	2005 - ongoing	DEWA - PA	Adverse: Water quality, Species of Concern. Visitor Experience, Invasive species. Beneficial: Infrastructure, safety.

Action Project	Project Description	Date	Location	Impact Type
Repair Failing Watergate Dam #10 (may be subject to change).	This dam is listed on the NPS Dams Inventory as NPS Number: 15 with a National ID number of NJ00831. This earthen embankment structure has a height of 16 feet and has a storage capacity of 60 acre/feet. This is the largest dam in the Watergate Recreation site. This project would rehabilitate this dam by replacing the low level water resources outlet, repair the sluffed off area on the face of the dam, remove woody vegetation from the dam, rebuild the spillway and spillway bridge, and protect the toe of the dam with rip rap.	2011 in design	DEWA – NJ Inside the study area	Adverse: Water quality, wetlands, Species of special concern Visitor Experience, Cultural Landscapes.
DEWA 14(13) US Route 209 - Raymondskill Creek Bridge Rehabilitation	FHWA Project 14(13): Rt. 209 Raymondskill Bridge 014P Rehabilitation. Includes replacement of existing super-structure over Raymondskill Creek, repair existing bridge abutments, and scour issues. Also includes replacement of the existing guardrail and asphalt pavement approaches.	2011	DEWA - PA	Adverse: Negligible affects on geology, air quality, soundscapes, water quality, floodplains, fish/fish habitat, visitor use and experience, socioeconomics. Cultural and Archeological resources at the mouth of the creek.
Repair historic stone culverts on Mountain Road	Project includes masonry repairs including some dismantling and repointing. The structures included are the Walpack/Mountain Road Culvert, Buttermilk Falls Culvert, and Mountain Road/Shaffer House Culvert. Culverts are very similar in design and construction detailing and are experiencing similar failures, though they each present some differing "root causes" of deterioration and challenges. According to HPTC, Buttermilk Falls is an excellent example of the stone culverts in the area and should be a priority to repair and preserve. *The Park intends to seek funding to repair these resources.*	Proposed	DEWA - NJ	Beneficial: Infrastructure, cultural resources
Delaware River Bridge projects- DRJTBC	The Delaware Water Gap Toll Bridge is a dual roadway, multi-span, steel plate structure that measures 2465 feet in length. The bridge carries Interstate 80 across the Delaware River providing a gateway from eastern metropolitan areas to Pocono tourist and recreational destinations. The bridge carried an average of 53900 vehicles (both directions) per day in 2009. Ongoing improvements include bridge maintenance; scour repair is proposed.	Ongoing and proposed work	DEWA-NJ Inside the study area	Adverse: There are staging and construction related impacts to APPA related to this project. Some visitor use issues (confusion with road closures, construction signage, etc.). Scour repair is proposed at this time; may impact river users by diverting to one side of river. Water quality and protected aquatic species would be protected by cofferdams around each pier. May need some staging on park land.

Action Project	Project Description	Date	Location	Impact Type
Infrastructure - Structures (includes Interior and Exterior Repair and Rehabilitation / Facility Improvements)				
DEWA Regrade 6 Historic Building Sites Phase II	Project will regrade 6 historic building sites for drainage and accessibility. Replacement and/or repair of existing storm water resources drainage systems are necessary in some cases and the installation of new storm water resources drainage where it does not currently exist. Buildings include: Peters House, Slateford Farmhouse, and the Depue House.	Proposed	DEWA - NJ, PA Parkwide Inside the study area	Beneficial: Grading corrects site drainage problems that cause recurring damage to buildings, driveways and parking areas. Where possible, the grading will provide for accessibility to buildings. Maintenance of historic/significant structures.
Pocono Environmental Education Center (PEEC) Cabin Replacement	Project rehabilitated/replaced the visitor cabins at PEEC. Before there were over 300 beds available in 53 three season cabins on the PEEC campus; project provided 250 beds in substantially fewer buildings for three season use. Value analysis looked at cost effective ways to provide the number of beds desired and determined its more cost effective to replace the cabins versus rehabilitate them.	01/24/2005	DEWA - PA	Adverse: Soil, surface water. Beneficial: visitor use and experience, health and safety, operations and management.
Sustainable Comfort Stations	Project replaced existing failing, substandard, and temporary chemical toilets at various locations with permanent odor-free vault toilets incorporating the US Forest Service Sweet Smelling Toilet (SST) design features in accordance with Directors Orders #83, Public Health.	2005-2008	DEWA - NJ, PA These replacements occurred throughout the park with many in the south end. Inside the study area	Beneficial: These locations are heavily visited sites used for fishing, picnicking, camping, hiking, recreation, and boat access. Units consist of single or double vault toilet buildings, vandal resistant construction, meeting the latest ADA requirements, and aesthetically pleasing design to conform to park design guide. Vegetation from spilled portable toilets was restored, and landscaping was done in the areas to complement the natural sites. Wayside exhibits were installed at the highest visitor locations to provide education and interpretation of the resource.

Action Project	Project Description	Date	Location	Impact Type
Hazardous Structure Demolition / Deconstruction (Phases I-3)	The park has identified structures (including small outbuildings, animal pens, etc.) that are in danger of collapse or have already collapsed, and could pose a hazard to park personnel and visitors. Phases I-3 include include structures which can be deconstructed (and materials salvaged) or demolished with minor effects or less on park resources. Phases 1-2 were funded in FY10, and 68 structures were removed. Phase 3 has been funded for FY12, covering up to 39 additional structures.	2005 - 2012	DEWA - NJ, PA Parkwide Inside the study area	Beneficial: The work includes removal of primary structures, such as residences and barns; removal of outbuildings, such as garages and sheds; and removal of hazardous materials, such as asbestos and lead paint. Sites will be restored to a natural condition, which includes final grading and seeding with native vegetation. Changes to overall landscape from removal of structures. Reduces hazards to park visitors and wildlife. Reduces park infrastructure. Reduces law enforcement needs for break-ins, re-securing, vandalisms, arsons.
Hazardous Structure Demolition / Deconstruction (Phase 4)	Approximately 114 structures or sites which have an unknown or more than minor effect on park resources were held for Phase 4 (as funding permits), when all data, consultation, and mitigations necessary and required can be accomplished and those structures can then be removed. This phase of the project will require an EA, and removals are planned, as funding permits, in the next 5 to 7 years.	Proposed	DEWA - NJ, PA Parkwide Inside the study area	Beneficial: The work includes removal of primary structures, such as residences and barns; removal of outbuildings, such as garages and sheds; and removal of hazardous materials, such as asbestos and lead paint. Sites will be restored to a natural condition, which includes final grading and seeding with native vegetation. Changes to overall landscape from removal of structures. Reduces hazards to park visitors and wildlife. Reduces park infrastructure. Reduces law enforcement needs for break-ins, resecuring, vandalisms, arsons. Adverse: Numerous National Register-eligible properties will be demolished, having an adverse impact on the cultural landscape of the park as a whole.

Action Project	Project Description	Date	Location	Impact Type
Kittatinny Point Visitor Center - Storm Recovery	The existing Kittatinny Point Visitor Center was flooded during the April 2006 and June 2006 flooding of the Delaware River. Project demolished the existing visitor center (60' × 60') leaving the visitor bathrooms and employee office area (25' × 60') in place. Project also included demolition of all septic piping, and wiring for employee bathroom and office area. The existing foundation was used to construct 60' × 60' open-air picnic pavilion. Project extended walls of remaining visitor structure to the ceiling of the new pavilion. The siding and walls of the remaining structure were finished in a log cabin or faux log cabin motif to complement the new building. Roof style, line and color were done to match new VC building highest number of visitors	2006	DEWA – PA Inside the study area	Beneficial: Visitor use and experience, operations and facilities. Built on piers to be above flood elevation. Old building area made into pavilion.
Infrastructure - Utilities (includes Water/Gas/Electric transmission, distribution, upgrades and maintenance)				
Appalachian Trail Relocation near the Columbia Gas Pipeline Crossing	The Appalachian Trail Conservancy and the Wilmington Trail Club has relocated approximately 1,100 feet of the footpath of the Appalachian National Scenic Trail. The relocation was constructed to mitigate the impacts of the proposed Columbia Gas pipeline upgrade on the Appalachian Trail. Relocation moved the footpath of the Trail away from views of an existing communications tower and a direct line of sight down the pipeline right-of-way to the west. The Trail treadway now crosses the pipeline right-of-way on a flat bench just below the ridgeline.	2007/ 2008	APPA (at crossing of Columbia Gas Pipeline in NJ) Inside the study area	Adverse: Visitor use and experience. Vegetation. Beneficial: Improvements to visitor use and experience, scenic resources.
Met-Ed removal of unused power poles and transformers	There are currently 61 poles and 4 transformers. None are utilized or would be in the future. Concern exists that transformers could begin leaking if not removed, and cross-braces on some poles have fallen already. The project would consist of removing transformers, dropping the poles by chainsaws (where feasible) and winding up all wire and removing hardware. *Project was proposed but was never undertaken due to a lack of funding and interest from the utility. Only transformers were removed (2010).*	Proposed 2007/ 2008, never completed	DEWA - PA Smithfield Beach and Hialeah area. Along Freeman Tract Road in Bushkill. Inside the study area	Beneficial: Restore area back to natural conditions. Improved visitor use and experience, scenic resources. Some poles may be used to help block off old driveways which are being accessed by illegal ATV riders, removed transformers, not poles; close to alternative 2 (potential mitigation).

Action Project	Project Description	Date	Location	Impact Type
Met-Ed Enhanced Vegetation Management Program	Met-Ed has multiple miles of electrical ROWs within the park. Line is 34-kV transmission line and if disabled a regional area would be affected. *Projects were proposed but were never undertaken due to a lack of funding and interest from the utility.*	Proposed 2008, never completed	DEWA - PA Throughout the park US 209 from Bushkill to Raymondskill Rd, Raymondskill Rd to Milford Road, Johnny Bee Rd to the Dingmans Visitor Center, Bushkill Falls Rd, Milford Rd, and Mountain Rd. Inside the study area	Adverse: Under their Enhanced Vegetation Management Program most trimming or removal would be from within the ROW but some problem trees might need to be removed. Problem tree is described as a tree or limb with high probability of falling across the line and taking out the line.
Tennessee Gas Line Proposal	Gas line expansion proposal. FERC has begun an EA, with public meetings. Project includes installation of 30 in diameter pipe in 22 miles of Pike and Wayne Counties, PA, and Sussex County, NJ. *In process.*	Current proposal	DEWA, APPA, PA, NJ The proposed line crosses the northern boundary of DEWA in Pike County and then APPA in Sussex County NJ.	Adverse: Potential impacts to archeology, vegetation, visitor experience, water quality. Residents, threatened and endangered species, Wetlands, water bodies and groundwater, fish and other wildlife, cultural resources, geology, Soils, Land use, Air and noise quality.
Columbia Gas Transmission Corporation pipeline increase	Columbia Gas is planning to remove and replace an existing natural gas pipeline to meet current demands. The gas pipeline traverses both within and outside of DEWA. DEWA Natural Gas Pipeline Enlargement Act (Dec 2005). ROW traverses 3.5 mi of DEWA. Act granted NPS the authority to change the ROW for the two land parcels to be consistent with the remainder of the ROW this allowing Columbia Gas to expand the size of the pipeline to meet current demands*. An EA is in process for the section in northern Pike County to New York State.*	2005 – 2008 for DEWA; future for removal and expansion	APPA in Northampton County, PA and in and outside of DEWA in Monroe, and Pike Counties, PA. Inside and Outside the study area	Adverse: Visitor use and experience, riparian and wetland habitat, invasive species, vegetation, water quality.

Action Project	Project Description	Date	Location	Impact Type
Northeast Supply Link Expansion – Palmerton Loop	Williams is developing a pipeline project to transport growing domestic natural gas supply to Pennsylvania, New York and New Jersey markets. The Northeast Supply Link Project is designed to deliver approximately 250,000 dekatherms of natural gas per day to the region by November 2013. It would involve the construction of 13 miles of additional pipe segments, called loops, in Pennsylvania and New Jersey, in addition to additional compression and existing facility modifications. This requires additional pipeline facilities in PA and NJ. Palmerton Loop is 3.7 miles of 42-inch pipe.	2012	Appalachian Trail crossing in PA. Inside the study area. Other expansion in NE PA and NW NJ.	Adverse: Residents, threatened and endangered species, Wetlands, water bodies and groundwater, Fish, vegetation and other wildlife, Cultural resources, geology, soils Land use, Air and noise quality.
Dominion/Allegheny Power 500-kV Transmission Line Project	The National Park Service (NPS) is preparing an Environmental Assessment (EA) to evaluate options to approve or deny an application for a special use permit for construction submitted by Dominion Virginia Power (DVP). The special use permit, if approved, would allow for the reconfiguration of an existing transmission line. The current right of way contains one 500 kilovolt (kV) transmission line. DVP proposes to replace the existing transmission line with twin parallel 500-kV transmission lines; all within the existing 150 foot transmission line right-of-way.	Ongoing	APPA This line crosses the Appalachian National Scenic Trail about six miles southeast of Front Royal, Virginia.	Adverse: No new land would be cleared for the removal and installation of the reconfigured transmission lines. To ensure that the full range of issues related to this proposed action are addressed in the EA, the park is soliciting public comments and concerns from all interested parties.

Action Project	Project Description	Date	Location	Impact Type
Potomac-Appalachian Transmission Highline (PATH) ROW EIS	The PATH Allegheny Transmission Company, LLC, PATH Allegheny Virginia Transmission Corporation (PATH-VA), and the Potomac Edison Company (Potomac Edison),have proposed construction of a new 765-kV electric transmission line the proposed project would follow existing rights-of-way on NPS and would require new ROW on USFS land. Proposal would require constructing, operating and maintaining new towers to accommodate an 765-kV transmission lines. *The application for this project has been withdrawn from the State Utility Commissions.*	Project on hold pending a re-evaluation after forecast modeling has been completed	On Federal lands in MD, VA and WV managed by the National Park Service, Harpers Ferry National Historical Park (HAFE), the Appalachian National Scenic Trail (APPA), Potomac Heritage National Scenic Trail (POHE) and the Chesapeake and Ohio Canal National Historical Park (CHOH). Also, Monongahela National Forest (MNF).	
PJM Interconnection proposal	The PJM Board authorized an additional $1.8 billion in transmission upgrades and improvements to keep the electrical grid reliable for the 51 million people living within its region. The upgrades were identified through PJM's Regional Transmission Expansion Plan, which forecasted reliability needs through 2025. It approved removing from the regional plan a proposed 500-kilovolt (kV) line connecting the Branchburg, Roseland and Hudson substations in northern New Jersey. Instead, existing lines will be upgraded and two new underground 230-kV cables will be installed to address projected overloads. In addition, the board reaffirmed its previous decision supporting the continued need for the Mid-Atlantic Power Pathway project by 2015.	Current, proposed	Northern NJ	Unknown

Action Project	Project Description	Date	Location	Impact Type
PPL Electric Utilities Northeast/Pocono Reliability Project	PPL Electric Utilities will be building three new electrical substations to serve customers in the region. To supply these substations they will need to build about 60 miles of new 230-kilovolt power line, with 150-foot ROW, and, on average, 145-foot steel monopoles. To connect these new substations to the existing 69-kilovolt lines they will need to build short segments of 69-kilovolt line – about 6 to 8 miles in total for the three facilities and add a second set of wires to the poles of an existing 10-mile, 69-kilovolt power line that runs from Lakeville to Cherry Ridge. Also as part of this project, PPL will be rebuilding an existing 69-kilovolt line that runs from the Peckville area in Lackawanna County to Honesdale, Wayne County. The line is about 20 miles long, and the project entails replacing the existing 70-foot wood poles with 95-foot steel monopoles.	Ongoing	PA Lackawanna, Monroe, Wayne, Pike and Luzerne counties	Unknown
PPL proposal for 138-12-kV substation	Proposal for 138-12-kV Substation in Moore Township, PA. Located at the base of the Kittatinny Ridge this proposal opens up additional areas to electric transmission.	9/2010	Moore Twp, PA Outside the study area	Adverse: Potential for affecting the viewshed in the immediate vicinity of the Appalachian National Scenic Trail.
Infrastructure - Communications (includes telephone, cell tower, cable/fiber optics, emergency towers and networks)				
Existing towers within approximately 5 miles of DEWA boundary	Existing tower locations within approximately 5 miles of DEWA boundary: • Fire Towers 1 • Cell Towers 22 • Minarets 12 • Transfer Stations 4 • Total Transmission Towers 509 - small (178) - medium (185) - large (107) - undefined (39)	Proposed, ongoing	NJ, PA	Adverse: Land use, Scenic resources and visitor experience, cultural resources including landscapes, socioeconomics, gateway communities, aerial hazards for rescue and fire operations.

Action Project	Project Description	Date	Location	Impact Type
Infrastructure - Visitor Access (includes rehabilitation or upgrades to boat launches, comfort stations, visitor center, beaches, picnic areas, camping, fishing)				
Rehabilitate Childs Park	This project has two major components, to remove dead and dying hemlock trees and reforest the site, and to rehabilitate and restore the cultural features and the public use facilities. The hemlock forest has been infected by wooly adelgid, which is killing the forest. The decline of the forest has created serious human health and safety concerns, and will have significant adverse impacts on the high-quality trout stream that that runs through the site.	ongoing	DEWA - PA	Beneficial: To address the health and safety concerns, all of the dead and dying trees must be removed. To address the health of the ecosystem, a restoration of the area must follow, which includes maintaining healthy hemlock trees, mitigating the effects of hemlock disease and mortality, and restoring/ replanting native vegetation to impacted sites. To address the cultural features and to rehab the public use facilities, the following work must be done: Pave existing parking area and provide parking for 80 cars and 2 buses; Restore impacted areas used for informal parking; Obliterate 3 existing failed vault toilets and construct a 10-stall toilet facility; Recondition 2 existing CCC Era picnic shelters and rehabilitate 50 picnic sites; Rehabilitate and repair trail and trail bridges within the site; Rehabilitate existing and install new bilingual wayside exhibits and signs; Restore picnic site
NJ Swim Beach (Turtle Beach)	The swim beach is located on the Delaware River at the Coppermine Inn site on Old Mine Road in Warren Co., NJ. The purpose is to provide an accessible opportunity for protected swimming that will meet visitor demand on the NJ side of the Delaware River, as recommended in the General Management Plan (GMP) (NPS 1987).	2006-2010	DEWA – NJ Inside the study area	Adverse: Soils, vegetation, RTE species, water quality. Beneficial: The project is needed to meet the park's legislative mandate to provide safe, cost effective, and harmonious outdoor recreation opportunities for visitors while conserving the natural, cultural, and scenic resources of the recreation area. Closure of the existing informal New Jersey swim beach that has evolved at the Depew Recreation Site is needed to eliminate exposure of park visitors to potentially hazardous river swimming and to eliminate adverse impacts to the state-designated threatened turtle.

Action Project	Project Description	Date	Location	Impact Type
Kittatinny Boat Launch Replacement	The concrete boat launch site at Kittatinny Point (API 78) was destroyed by the flooding and has been closed since April 2005. Launch needs to be completely reconstructed. The plan reviewed and approved is to rebuild the boat launch in-kind by removing remaining asphalt and replacing to the high water resources line. Below the high water resources line, Articulating Concrete Block (ACB) would be used instead of asphalt. The launch would be keyed in at the bottom of the ramp in the river bed. *Project currently does not have funding.*	Planned permit but no funding currently	DEWA – PA Inside the study area	Beneficial: Improved visitor use and experience, improved safety and health, improvements to operations and management.
River Campsite Restoration of Flood Damaged Sites	During the floods in 2004, 2005, and 2006, the Delaware River rose to levels at or near a 100-year (1% annual chance) flood. Prior to the floods, DEWA was operating 94 campsites within the river corridor. Approximately 30 sites were too heavily damaged or sites were unsafe or no longer extant to be returned to the same locations. Project assesses locations for 30 campsites to be restored in the river corridor, while avoiding impacts to natural and cultural resources, and providing campsites in locations and configurations appropriate for the visiting river users. DEWA has partnered with the US Forest Service and is developing and Environmental Assessment.	Planned	DEWA - NJ, PA Inside the study area	Beneficial: Improved visitor use and experience, prevention of soil erosion and compaction, improved safety and health, improvements to operations and management, habitat restoration.
Trail Development and Restoration (includes erosion prevention, road protection, habitat restoration)				
Joseph M McDade Recreational Trail Realignment	Re-align approximately 20 miles of the Joseph M. McDade Recreational Trail (McDade Trail). This previously approved and partially constructed 32-mile trail parallels the Delaware River in PA. The trail would stretch almost the full length of the park, providing access to the two largest communities bordering DEWA – Shawnee-on-Delaware to the south and the borough of Milford to the north.	1998-2010	DEWA – PA Inside the study area	Beneficial: Re-alignment reduced impact to habitats on the Hogback from hikers and bikers. The newly aligned portions of the trail are similar to the original alignment in following historic road traces, connecting historic properties, existing facilities and a variety of natural environments, thus providing an intimate glimpse of the natural and cultural history of the area.

Action Project	Project Description	Date	Location	Impact Type
Park-wide Invasive Species Control Programs	The management goal is to find occurrences of invasive wetland plant species and use integrated pest management techniques to suppress or eliminate patches within the park. The goal of the park's control program is to suppress invasive species populations and allow native species to return.	Ongoing	DEWA Inside the study area	Beneficial: Habitat is put at risk when invasive species are left unmanaged; altering ecological processes, degrading wildlife habitat, and decreasing biological diversity. Threatened open-canopy wetlands support rare plant communities along with marsh birds, small mammals; special concern reptiles, and a rare butterfly.
Illegal Activities				
Illegal off-road vehicle use	Illegal access on roads, trails, right-of-ways. Cutting of park locks and destruction of gates.	Past/ present/ future	Parkwide DEWA -NJ, PA Inside the study area	Adverse: Impacts park operations. Soil compaction and disturbance, habitat loss, invasive species introduction.
Illegal collection – flora and fauna	Illegal collection of flora and fauna, especially rare, threatened and endangered species for personal collection or sales.	Past/ present/ future	Parkwide DEWA - NJ, PA Inside the study area	Adverse: Loss of local species diversity.
Illegal collection – artifacts	Illegal collection of artifacts for personal collection or sales.	Past/ present/ future	Parkwide DEWA - NJ, PA Inside the study area	Adverse: Impacts park operations, Property damage. Loss of historic, cultural and recreational resources.
Illegal hunting / poaching	Illegal hunting or killing for personal use or sales.	Past/ present/ future	Parkwide DEWA - NJ, PA Inside the study area	Adverse: Impacts park operations. Loss of local species diversity.
Trespassing / vandalism	Illegal access, stealing signs, vandalism, destruction, graffiti of park property.	Past/ present/ future	Parkwide DEWA - NJ, PA Inside the study area	Adverse: Impacts park operations, Property damage. Loss of historic, cultural and recreational resources.
Arson	Intentional setting of fires resulting in destruction of park property	Past/ present/ future	Parkwide DEWA - NJ, PA Inside the study area	Adverse: Impacts park operations, Property damage. Loss of historic, cultural and recreational resources.

Action Project	Project Description	Date	Location	Impact Type
Encroachment	Illegal building, development or use of park property	Past/ present/ future	Parkwide DEWA - NJ, PA Inside the study area	Adverse: Impacts park operations, Property damage
Illegal woodcutting	Cutting of firewood for personal use or sale.	Past/ present/ future	Parkwide DEWA - NJ, PA Inside the study area	Adverse: Habitat loss.
Energy Generation Related				
FERC relicensing of Yards Creek Generating Station	This is a 400 MW pumped storage project The project is located on Yards Creek, a tributary to the Paulinskill River, which is a tributary to the Delaware River. The Project is owned and operated by FirstEnergy and Public Service Electric & Gas (PSEG) and consists of an upper and lower reservoir, a powerhouse with three reversible pump turbines, and associated electrical and water resources conveyance features. The Project is currently licensed with the Federal Energy Regulatory Commission (FERC) as FERC Project No. 2309; this license expires in February, 2013.	License expires 2013, 2011 application is due	Warren County, NJ (in the townships of Blairstown and Hardwick). Outside the study area	Beneficial: Potential for trail improvements and additional recreational opportunities. There is a project visitor center and a Boy Scout Camp located within the Project Boundary and the Appalachian trail runs near the upper reservoir. Adverse: Local hydrology and fish habitat impacted.
Marcellus Shale Natural Gas	Much of the new drilling interest taking place in northeastern Pennsylvania and southern New York is targeted at reaching the natural gas found in the Marcellus Shale formation, which underlies about 36 percent of the Delaware River Basin. Because Marcellus Shale is considered a tight geologic formation, natural gas deposits were not previously thought to be practically and economically mineable using traditional techniques. New horizontal drilling and extraction methods, coupled with higher energy costs, have given energy companies reason to take a new interest in mining the natural gas deposits within the Marcellus Shale.	Proposed	Delaware River Watershed (NY, NJ, PA)	Adverse: New extraction methods require large amounts of fresh water resources to fracture the formation to release the natural gas. A significant amount of water resources used in the extraction process is recovered, but this "frac water resources" includes natural gas and chemicals added to facilitate the extraction process, as well as brine and other contaminants released from the formation. Many affects to geology, water quality, and habitat are still unknown.

Action Project	Project Description	Date	Location	Impact Type
Martins Creek Power Plant, Coal Burning Facility	NJ Department of Environmental Protection petitioned the federal government to mandate a reduction in air pollution spewing from the RRI Energy's power plant in Portland, Pa., across the across the Delaware River from Knowlton in Warren County. DEP Commissioner Bob Martin announced he signed a petition under the federal Clean Air Act to ask the U.S. Environmental Protection Agency to force the plant to cut down on its emissions.	5/2010, ongoing	Portland, PA Plant is in Lower Mount Bethel Township, Northampton County. Outside the study area	Beneficial: If enforced this would improve air quality in the area.
Martins Creek Power Plant, Coal Burning Facility	On Aug. 23, 2005 there was a spill of more than 100 million gallons of contaminated water resources and fly ash into the Delaware River from PPL Generation LLC and PPL Martins Creek LLC's Martins Creek power plant PA Department of Environmental Protection filed suit against PPL Generation LLC and PPL Martins Creek LLC.	2005	Portland, PA In Lower Mount Bethel Township, Northampton County. Outside the study area	Adverse: Water quality and fish habitat.
Susquehanna Nuclear Reactor Upgrades	The operators of the Susquehanna Nuclear Power Plant near Berwick shut down one of the facility's two reactors March 2010 for refueling and maintenance upgrades as part of four-year plan to generate more electricity. PPL Corp., which owns the plant in southern Luzerne County, will replace roughly 40 percent of uranium fuel used to power the Unit 1 reactor, install a digital control system and replace turbines that run pumps to feed water resources used in cooling the reactor. In November 2009, the Nuclear Regulatory Commission also granted 20-year extensions of the operating licenses for each unit at the Susquehanna plant.	Ongoing	Berwick, PA	Unknown
Wind turbines in Northeastern PA	Northeastern Pennsylvania has the right kind of wind -- at the right elevation and the right speed -- to turn the 100-foot blades of wind turbines. Pennsylvania produces more megawatts by windmill than any state east of the Mississippi. And more than half of the working wind turbines in the state are in the region, with two in the Hazleton area and 43 in Waymart.	Ongoing	Northeastern PA. Outside the study area	Potential adverse impacts on migratory birds and bats. Visual impacts.

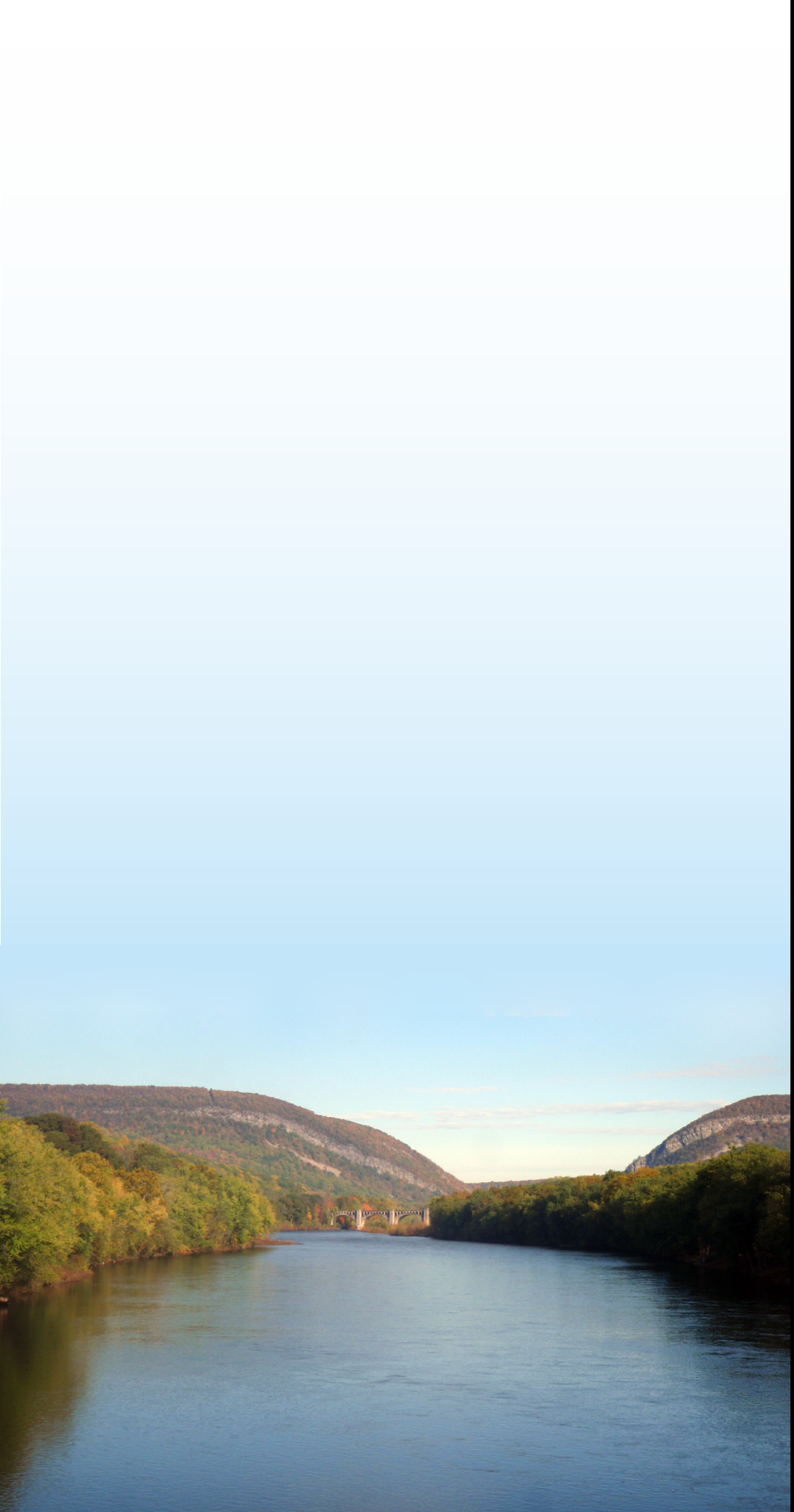
Action Project	Project Description	Date	Location	Impact Type
PA Fish and Boat Commission, Natural Gas Leasing and Water Access Programs	Projects may be approved on lands or waters when the projects are designed and implemented in such a way that they have little or no negative impact on the resource or property use. The Commission will not enter into natural gas leasing projects which are developmental in nature, meaning it will not permit the installation or use of production wells or any other type of natural gas production equipment on its properties. Under the Water Access Program, the Commission will consider requests to use its property to access, acquire or transport water resources.	Ongoing	PA PA Fish and Boat controls over 43,000 acres in the state	Adverse: New extraction methods require large amounts of fresh water resources to fracture the formation to release the natural gas. A significant amount of water resources used in the extraction process is recovered, but this "frac water resources" includes natural gas and chemicals added to facilitate the extraction process, as well as brine and other contaminants released from the formation. Many affects to geology, water quality, and habitat are still unknown.
Commercial / Industrial				
Airport improvements	Overflights and gliding from airports located in Mount Pocono, PA; Orange County, NY (Stewart); Blairstown, NJ; Stroudsburg, PA; Newton, NJ Add: Newark Flight Patterns -	Ongoing	Sussex and Warren Counties, NJ, Monroe County, PA Outside the study area	Adverse: Visitor Use and experience. Impacts to natural soundscapes from noise.
Fernwood Casino	Fernwood Resort has the necessary zoning permits to open a gaming facility within 6-12 months (9/2010). Could open with 500 slots and 26 table games drawing up to 1 million people. *State permit was not granted but could be in the future.*	Proposed	Monroe County, PA Outside the study area	Beneficial: stimulate local economy. Adverse: potential for impacts to infrastructure
Alpine Rose Auto Racetrack	The racetrack will be constructed in Eldred Township, Monroe County, Pennsylvania and would result in the clearing of forest along the north face of the Kittatinny Ridge to create approximately 4 miles of driving courses.	Proposed	Monroe County, PA APPA viewshed. Outside the study area	Adverse: Visitor use and experience, scenic resources. Impacts to soundscapes.

Action Project	Project Description	Date	Location	Impact Type
Leases and Permits				
Issuance of Special Use Permits related to Visitor Use	DEWA routinely issues special use permits related to such visitor uses including but not limited to weddings, baptisms, canoe races, reunions/reserved picnic sites, and 1st Amendment expressions. All applications for permits are catalogued. Permits are authorized by the Superintendent or Chief Ranger (as his designee). Any proposals that may fall outside the typical permitted activities will require discussion with the Superintendent and a separate NEPA review.	Ongoing	DEWA - NJ, PA Inside the study area	Adverse: These uses are for short-term use and will have no environmental disturbance or minimal disturbance that is easily and readily remediable. Most activities are at certain developed locations within the park, and have use criteria within the permit, such as "only on grassy picnic area."
Incidental Business Permits / Commercial Visitor Services	Project is for the reissuance/continuance of Incidental Business Permits for Commercial Visitor Services within the park. Permits are reissued every two years and require review. There are currently 37 Incidental Business Permits (Commercial Use Authorizations (CUA) operating within the recreation area providing services to park visitors including: canoe livery; guided fishing trips; rock climbing instruction; SCUBA diving instruction; and emergency tow truck operation. Majority of these have been operating in the park for more than 25 years.	Ongoing	DEWA - NJ, PA Inside the study area	Adverse: Any new requests for IBP/CUA will be reviewed case-by-case and after approval, may be added to the list for reissuance.
Agricultural leases	No-till practices employed in leased agricultural fields.	Ongoing	DEWA - NJ, PA Inside the study area	Beneficial: Areas preserve cultural and open space aesthetics. Also provide wildlife habitat.
Pike County Agricultural Security Areas (ASAs)	Agricultural Security Areas designated in Pike County allow farmers to be compensated for maintaining agricultural land.	Ongoing	Pike County, PA Outside the study area	Beneficial: Areas preserve cultural and open space aesthetics. Stimulates local economy. Also provides wildlife habitat.

Action Project	Project Description	Date	Location	Impact Type
Fire Management (includes fuel reduction, prescribed fire, habitat management)				
DEWA Prescribed Burn Program	Utilize prescribed fire as a resource management tool.	Past, Present, Future	Parkwide DEWA - PA	Adverse: Visitor use and experience. Beneficial: Perpetuate the overall scenic landscape, maintain wildlife habitat, perpetuate native plant species, reduce or control invasive exotic plant species, and to prevent an increase in hazardous fuel loadings. Hundreds of acres are burned annually.
DEWA Hazard Fuel Reduction Program	Mechanical treatment of vegetation to reduce the threat of wildland fire to communications infrastructure and adjacent landowner property. Provide defensible space around historic structures and culturally significant areas.	Past, Present, Future	Parkwide DEWA – PA, NJ	Adverse: Visitor use and experience. Beneficial: The action includes measures to mitigate potential impacts to federally endangered Indiana bats by imposing a no-cut period of April 1 to September 30 on trees that fit the criteria of summer bat roosts. Hundreds of acres are managed annually.
Residential Development				
Residential Development	Local residential developments planned adjacent to the park in Monroe and Pike Counties, PA.	Ongoing	NJ, PA	Adverse: Increased effects of urbanization and suburbanization in these areas; requiring additional infrastructure to support the communities.
Habitat Restoration/Improvement				
Weed Eradication Programs	Pennsylvania's Resources Conservation and Development programs.	Ongoing	PA Outside the study area	Beneficial: Work to control spread of non-native invasive species and educate landowners on the benefits of native plant species
Wildlife Habitat Incentive Program (WHIP)	USDA NRCS implements this program in both Pennsylvania and New Jersey. The program provides information for landowners and project reimbursements for improvement of wildlife and fish habitat.	Ongoing	PA, NJ Inside and outside the study area	Beneficial: Improvement of wildlife and fish habitat.

Action Project	Project Description	Date	Location	Impact Type
Important Bird/Mammal Areas (IBAs and IMAs)	The designation of Important Bird Areas by the National Audubon Society chapters in New Jersey and Pennsylvania and Important Mammal Areas in Pennsylvania under the joint partnership of the National Wildlife Federation, Pennsylvania Wildlife Federation, Pennsylvania Federation of Sportsmen's Clubs, Mammal Technical Committee/Pennsylvania Biological Survey, and the Carnegie Museum of Natural History.	Ongoing	PA, NJ Inside and outside the study area	Beneficial: Designation helps preserve critical habitat for wildlife, including rare and protected species.
County and Township Open Space and Conservation Plans	All of the counties surrounding the parks, and many of the other counties outside the study area have plans for greenspace, open space, and conservation areas.	Ongoing	PA, NJ Outside the study area	Plans indicate current status and trends of the natural resources, as well as the current growth, and provide recommendations for acreage for conservation and priority conservation areas. Many of these plans also include provisions for parks and green space areas.
County Farmland Preservation Programs	All of the counties surrounding the parks, and many of the other counties outside the study area have plans for farmland preservation	Ongoing	PA, NJ	Beneficial: Plans indicate current status and trends of agricultural resources. The plans aim to preserve agricultural lands through grants or other incentives
State Forest Stewardship Programs	A federal funded program that encourages management of private forestland for non-commodity benefits.	Ongoing	PA, NJ	Beneficial: The program aims to preserve forest land through cost share benefits
Common waters Fund	A privately funded program that is focused on preserving forests and water Quality in the upper Delaware River watershed.	Ongoing		Beneficial: The fund gives grants to landowners for the preservation of forests and the watershed.
NJ DEP Programs	State programs include the Natural Areas system, Natural Heritage Program, and natural land trust.	Ongoing	NJ	Beneficial: Programs are focused on the preservation of natural areas and wildlife inventory
PADCNR Programs	State programs include the Greenway Program, Natural Heritage Program, and the Pocono Forest and Waters Conservation Landscape Initiative.	Ongoing	PA	Beneficial: Programs are focused on the preservation of natural areas and wildlife inventory
The Nature Conservancy	A non-profit organization focusing on conservation nation-wide.	Ongoing	PA, NJ	Beneficial: May buy land for preservation or contribute funds to obtain land for future preservation

Action Project	Project Description	Date	Location	Impact Type
National Wildlife Refuges	The Wallkill National Wildlife Refuge and the Cherry Valley Wildlife Refuge are both located within the study area in NJ and PA, respectively.	Ongoing	PA, NJ	Beneficial: The refuges focus on preserving land for biodiversity.
NJ Highlands Council	A state funded program that was formed under the Highlands Act. The council has issued a master plan that focuses on preservation through land use incentives.	Ongoing	NJ	Beneficial: Issues grants for zooming analysis, sustainable agriculture and other conservation type grants within the planning area.



Appendix I

Agency Consultation

APPENDIX I:
AGENCY CONSULTATION

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Note: Section 106 consultation letters are included within Appendix M

REPRESENTATIVE SCOPING LETTERS

COPY

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

FEB 01 2010

U. S. Army Corps of Engineers
Philadelphia District
Wanamaker Bldg., 100 Penn Forest East
Philadelphia, Pennsylvania 19107-3390

Dear Sir or Madam:

The National Park Service (NPS) is preparing an Environmental Impact Statement (EIS) to analyze the potential impacts for the proposed construction of a high voltage electric transmission line traversing three NPS units in Pennsylvania and New Jersey: Delaware Water Gap National Recreation Area (DEWA), Middle Delaware Scenic and Recreational River (MDSR), and the Appalachian National Scenic Trail (APPA) (Figure 1).

PPL Electric Utilities Corporation and PSE&G, jointly known as the Applicants, have proposed the expansion of an existing 230,000-volt (230kV) electric transmission line from Susquehanna (Berwick, Pennsylvania) to Roseland, New Jersey (the S-R Line) (Figure 1). The project is based on direction for electric transmission expansion provided by the Regional Transmission Operator, PJM Interconnection, which oversees the overall movement of wholesale electricity between many electric utilities throughout a 13 state region. The Applicants' proposed project includes replacing the existing 80-foot towers with new larger towers (up to 200 feet high) and adding an additional 500,000-volt (500kV) transmission line. This would necessitate widening the existing right-of-way, and in areas, would require granting additional legal rights beyond the Applicants' current rights. The Applicants' proposed project would also include the construction of new access roads and the rehabilitation and widening of existing roads for accessing the transmission line corridor. The current EIS study area, developed by NPS (Figure 2), includes the area affected by the 4.18 mile portion of the S-R Line. The study area has been expanded beyond the right of way to include other areas within the parks affected by alternatives not yet developed by NPS and the surrounding human environment affected directly by the NPS action.

The EIS would compare three routes that have been proposed by the Applicants to determine the alternative that would minimize impacts to the natural and human resources within the parks and surrounding areas. The three routes, Alternatives A, B, and C are displayed in Figure 3.

Other alternatives are currently being developed by NPS and may include relocation of the project partially outside of park(s) boundaries; installation of portions of the entire upgraded power line underground; installation of the power line on the bottom of the river; or an alternative that uses direct current from two wires instead of the proposed three to eight wires. Additionally, the No Action Alternative is also being considered, in which the existing power lines running from Susquehanna to Roseland would be kept but the current request for permits would not be granted.

The purpose of this letter is to inform you of the proposed project and to request information you may have on resources potentially affected by the proposed action and suggestions for potential alternatives. Your response within 30 days from the date of receipt of this letter will be greatly appreciated. If you have any questions regarding this request, please write to the address below or contact Amanda Stein by phone at (570) 426-2472 or email at Amanda_Stein@nps.gov. Letters have also been sent to the agencies and tribal governments listed in Enclosure 1.

Please send responses to:

Delaware Water Gap National Recreation Area
HQ 1 River Road, off US 209
Bushkill, PA 18324-9999

Sincerely,

John J. Donahue
Superintendent, DEWA

Pamela Underhill
Superintendent, APPA

Enclosures:

Enclosure 1.	Listing of Agencies and Tribal Governments
Figure 1.	Location Map for the Parks
Figure 2.	Study Area Map
Figure 3.	PPL and PSE&G Proposed Route Map

COOPERATING AGENCY CORRESPONDENCE

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

APR 01 2011

Mr. Michael Horne, Refuge Manager
Wallkill River, Cherry Valley, Shawangunk Grasslands
National Wildlife Refuge Complex
1547 County Route 565
Sussex, New Jersey 07461

Dear Mr. Horne:

This letter is in response to your March 14, 2011, correspondence to support the National Park Service (NPS)-led Environmental Impact Statement (EIS) team for the proposed Susquehanna to Roseland Transmission Line. We welcome your support and know that the technical expertise provided by staff at both the ecological services division and the wildlife refuge will contribute greatly towards reaching an important decision regarding the potential impacts to wildlife and habitat within the EIS study area. First, formal consultation, under Section 7 of the Endangered Species Act, 16 U.S.C. Section 1536(a)(2), will help to insure that any action authorized by the NPS is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat. Second, staff of the Cherry Valley National Wildlife Refuge (CVNRW) brings specific technical expertise and invaluable insight on several of the EIS alternatives crossing the Refuge.

We will need to formalize an Interagency Agreement with the purpose of: 1) formally designating the USFWS as a cooperating agency in this process; 2) formalizing and providing a framework for cooperation and coordination between the parties in order to successfully complete the NEPA process in a timely, efficient, and thorough manner; 3) describing the respective roles, responsibilities and expertise of each entity in the process; and 4) developing cost recovery for services rendered by the USFWS staff. We will be sending a letter under separate cover to discuss next steps in developing the interagency agreement.

Additionally, as lead agency we have two procedural requests that we would like you to address:

1. Please address all written communications to the Superintendent of the Delaware Water Gap National Recreation Area (DEWA) and the Superintendent of the Appalachian National Scenic Trail (APPA), with a copy for the administrative record to the Denver Service Center. The address is:

   Denver Service Center -TIC
   Attn: SRLINE EIS
   12795 W. Alameda Parkway
   Denver, Colorado 80225-0287

2. Please identify the members of your EIS team (including their name, address, email address and phone numbers). Please include your primary point of contact and your EIS project manager (lead), your NEPA specialist, contract specialist, budget analyst, and any other staff person you will have working on this project.

Thank you for your support and your attention to the points above. We expect that the USFWS will bring a great deal of added value to our EIS process as a cooperating agency. If you have any questions please call Superintendent Donahue at (570) 426-2418 or Project Manager, Amanda Stein, at (570) 426-2472.

Sincerely,

John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6279

cc:

Mr. Marvin Moriarty, Regional Director
Northeast Regional Office
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, Massachusetts 01035-9587

Mr. Dennis Reidenbach, Regional Director
Northeast Regional Office
National Park Service
200 Chestnut Street, Suite 502
Philadelphia, Pennsylvania 19106

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WALLKILL RIVER NATIONAL WILDLIFE REFUGE COMPLEX
1547 County Route 565
Sussex, New Jersey 07461

March 14, 2011

Mr. John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area and
Middle Delaware National Scenic and Recreational River
Bushkill, Pennsylvania 18324

Ms. Pamela Underhill
Superintendent
Appalachian Trail Park Office
P O Box 50
Harpers Ferry, West Virginia 25425

Dear Mr. Donahue and Ms. Underhill:

Thank you for your February 7, 2011 letter inviting the U.S. Fish and Wildlife Service to become a cooperating agency in the National Park Service's review under the National Environmental Policy Act of the applications submitted to it for the Susquehanna to Roseland 500-IV transmission line project.

As some alternative routes for the project would cross lands within the acquisition boundary of the Cherry Valley NWR, and as FWS also has interests and expertise to offer concerning wildlife and habitat throughout the study area, we are happy to serve as a cooperating agency. We have already been reviewing the drafts of the EIS chapters made available to us.

We understand that the NPS has a cost-recovery agreement with the permit applicants. It would greatly enhance our ability to provide expertise and review capacity to NPS beyond the bounds of our standard ESA consultation if we could execute an Interagency Agreement for the acquisition of the expertise the FWS will provide, for which cost NPS could be reimbursed. This would allow us to devote additional hands to the necessary review.

Sincerely,

Michael Horne

Michael Horne
Refuge Manager
Wallkill River, Cherry Valley
and Shawangunk Grasslands NWR

Cc: Marvin Moriarty, Regional Director
Susan McMahon, Deputy Regional Chief
Dennis Reidenbach, Regional Director
Michael Chezik, DOI Office of Environmental Policy and Compliance
Andrew Raddant, DOI Office of Environmental Policy and Compliance
Andrew Tittler, DOI Office of the Solicitor
Eric Davis, U.S. Fish and Wildlife Service
Clint Riley, U.S. Fish and Wildlife Service
Pamela Shellenberger, U.S. Fish and Wildlife Service
Wendy Walsh, U.S. Fish and Wildlife Service
Jennifer McConaghie, National Park Service, NER
Patrick Malone, National Park Service, DEWA
Patrick Lynch, National Park Service, DEWA
Kara Deutsch, National Park Service, DEWA
Amanda Stein, National Park Service, DEWA
Denver Service Center-TIC, attn: SRLINE EIS

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

FEB 07 2011

Mr. Michael Horne, Refuge Manager
Wallkill River, Cherry Valley, Shawangunk Grasslands
National Wildlife Refuge Complex
1547 County Route 565
Sussex, New Jersey 07461

Dear Mr. Horne:

We would like to invite the U.S. Fish and Wildlife Service (USFWS) to participate as a cooperating agency in the National Park Service's environmental review of the Susquehanna to Roseland Transmission Line project.

As you are aware, pursuant to the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. 4332(2)(C), the National Park Service (NPS) is preparing an Environmental Impact Statement (EIS) for the evaluation of construction and right-of-way (ROW) permits requested in relation to the proposed Susquehanna (Berwick, Pennsylvania) to Roseland, New Jersey 500,000 volt (500 kV) Transmission Line project. Construction is proposed for a double circuit 500 kV line, although one line will only be energized to 230 kV at the time of project completion. The applicant, (a consortium of Utilities, PPL and PSE&G), has received qualified project approvals from the respective state utility commissions, the Pennsylvania Public Utility Commission and New Jersey Board of Public Utilities. No environmental permits from regulatory agencies have been issued to date.

As part of the NEPA process the NPS will seek consultation with the USFWS New Jersey and Pennsylvania Field Offices under Section 7 of the Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq. , ESA) and the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; the Act of March 10, 1934; Ch. 55; 48 Stat. 401), as amended. But the USFWS has additional interests in this review. As proposed, the project would cross lands and waters of the United States in the Delaware Water Gap National Recreation Area (DEWA), the Middle Delaware National Scenic and Recreational River (MDSR), and the Appalachian National Scenic Trail (APPA). Some alternatives, developed as part of the NEPA process, would also cross lands within the designated boundary of the Cherry Valley National Wildlife Refuge (CVNWR).

The Council on Environmental Quality (CEQ) regulations addressing cooperating agencies status (40 C.F.R. §§ 1501.6 & 1508.5) implement the NEPA mandate that federal agencies responsible for preparing NEPA analyses and documentation do so "in cooperation with State and local

governments" and other agencies with jurisdiction by law or special expertise. (42 U.S.C. §§ 4331(a), 4332(2)). Because of your expertise and local knowledge of the resources within the CVNWR we request your participation as a cooperator in the development and review of the EIS. We expect that coordination in this manner will result in improved understanding of each of our respective bureaus' roles and will result in the most informed decision for protecting and preserving the valuable natural, cultural, scenic and recreational resources of these units. In addition, our close association as sister agencies under the same Assistant Secretary makes our close cooperation even more necessary. In this manner USFW can meet its obligations for ecological services and as a land manager.

As part of the project team, the EIS files are available for your review. Because the schedule continues to be an important consideration, we encourage you to arrange a time with our staff to review and make copies of the materials you may need for the environmental review. We look forward to your response. If you have any questions please call Superintendent Donahue at (570) 426-2418 or Amanda Stein, project manager at (570) 426-2472.

Sincerely,

John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6279

cc:

Mr. Marvin Moriarty, Regional Director
Northeast Regional Office
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, Massachusetts 01035-9587

Mr. Dennis Reidenbach, Regional Director
Northeast Regional Office
National Park Service
200 Chestnut Street, Suite 502
Philadelphia, Pennsylvania 19106

Michael Chezik, DOI Office of Environmental Policy and Compliance
Andrew Raddant, DOI Office of Environmental Policy and Compliance
Andrew Tittler, DOI Office of the Solicitor
Eric Davis, U.S. Fish and Wildlife Service
Clint Riley, U.S. Fish and Wildlife Service

Pamela Shellenberger, U.S. Fish and Wildlife Service
Wendy Walsh, U.S. Fish and Wildlife Service
Jennifer McConaghie, National Park Service, NER
Patrick Malone, National Park Service, DSC
Patrick Lynch, National Park Service, DEWA
Kara Deutsch, National Park Service, DEWA
Amanda Stein, National Park Service, DEWA

Denver Service Center - TIC
Attn: SRLINE EIS
12795 West Alameda Parkway
Denver, Colorado 80225-0287

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

REPLY TO
ATTENTION OF

AUG 03 2010

Regulatory Branch
Application Section II

SUBJECT: CENAP-OP-R 2008-241-30
Project Name: Susquehanna Roseland Power Transmission Line

Mr. John J. Donahue, Superintendent
United States Department of the Interior
Nation Park Service
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

Dear Mr. Donahue:

This is in further response to your agency's letter dated February 1, 2010, regarding the National Park Service's preparation of an Environmental Impact Statement (EIS) to analyze the impacts for the proposed construction of the Susquehanna Roseland Power Transmission Line. The project involves improving an existing 230 kV electric transmission line, and adding a second 500 kV electric transmission line from Susquehanna, Pennsylvania to Roseland, New Jersey.

In a letter dated May 13, 2010, this office indicated that the Corps would be a cooperating agency in the preparation of the EIS under the National Environmental Policy Act (NEPA). The determination by this office to be a cooperating agency was based at the time on the District's understanding of the scope of the project, and the extent of potential regulated work that would require authorization from the Corps.

Since the issuance of our May 13 letter, representatives of the District's Regulatory Branch have met with representatives of both the National Park Service (NPS) and the PPL Electric Utilities Corporation to learn more about the scope of the project. Specifically the District has become more aware of the scope of the project that will be reviewed by both the NPS and the Corps, and the extent of regulated work that will require authorization from the Corps. Preliminarily the District has determined that regulated work may qualify for authorization through applicable Department of the Army (DA) nationwide permits, or Pennsylvania State Programmatic General Permit 3. Both of these are DA general permit processes where an applicable NEPA document has already been prepared, and do not require the Corps to prepare a project specific NEPA document.

Based upon our preliminary finding regarding permitting requirements for the project and the potential applicability of general permits to authorize regulated activities associated with the project, the District has determined that its continuing role as a cooperating agency in the preparation of the EIS is no longer necessary. The District remains willing to assist the NPS in the identification and delineation of wetlands and waters within the three National Park Service units in Pennsylvania and New Jersey that may be impacted by the project, and would require authorization from the Corps.

A copy of this letter is being furnished to Ms. Pamela Underhill, Superintendant of the Appalachian National Scenic Trail so that she is aware of the District's determination. Should you have any questions regarding this matter please contact Wayne Poppich at (570) 842-1044, or write to the above address.

Sincerely,

Frank J. Cianfrani
Chief, Regulatory Branch

-3-

Copies Furnished:

Appalachian National Scenic Trail (Pamela Underhill, Superintendant)
CENAP-OP-RG (Poppich)

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

REPLY TO
ATTENTION OF

MAY 13 2010

Regulatory Branch
Application Section II

SUBJECT: CENAP-OP-R 2008-241-30 (PASPGP-3)
Project Name: Susquehanna Roseland Power Transmission Line

Mr. John J. Donahue, Superintendent
United States Department of the Interior
Nation Park Service
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

Dear Mr. Donahue:

This is in response to correspondence dated February 1, 2010, regarding the Susquehanna Roseland Power Transmission Line project to construct a 500 kilovolt transmission line from Susquehanna, Pennsylvania to Roseland, New Jersey and the request for cooperating agency status in the preparation of a National Environmental Policy Act (NEPA) document for the proposed project.

The U.S. Army Corps of Engineers, Philadelphia District (Corps) will be a cooperating agency in the preparation of an Environmental Impact Statement (EIS) under NEPA. We look forward to working with your agency as the document is developed to ensure that the information presented in the EIS is adequate to fulfill the requirements of the Corps regulations, the Clean Water Act (CWA) Section 404(b)(1) Guidelines, and the Corps public interest review process.

To meet the requirements of the Corps review process, we request that the following topics be comprehensively evaluated in the EIS:

1) Purpose and need for the project. In order to satisfy Department of the Army regulations, the Corps will need to concur on the purpose and need statement for the project. We would be pleased to work with you and the applicant to develop a purpose and need statement that will satisfy the Department of the Army regulations for review of the project under Section 404 of the CWA and Section 10 of the Rivers and Harbors Act.

2) CWA Section 404(b)(1) Guidelines. The 404(b)(1) Guidelines require an Alternatives Analysis, which addresses how impacts to waters of the United States have been avoided and/or minimized. If impacts to waters of the United States, including jurisdictional wetlands, cannot be avoided, the Alternatives Analysis identifies the compensatory mitigation required to replace lost functions and services of the aquatic resources. Information on the Alternatives Analysis

and the results of any studies, assessments, and evaluations of the proposed project are needed in the EIS. The range of Alternatives in the Alternatives Analysis will be based on the project purpose, as determined by the Corps, in accordance with established Corps policy on the review of energy projects. The Corps will need to concur on the range of alternatives retained for detailed study in the NEPA document.

3) Corps public interests review factors. The decision to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. Among the factors that must be evaluated as part of the Corps public interest review include; conservation, economics, aesthetics, general environmental concerns, wetlands and streams, historic and cultural resources, fish and wildlife values, floodplain values, land use navigation, shore erosion and accretion, recreation, water supply and conservation, energy needs, safety, food and fiber production, mineral needs, water quality, consideration of property ownership, air and noise impacts, and, in general the needs and welfare of the people. Each of the Corps public interest factors must be evaluated comprehensively in the NEPA analysis.

4) Delineation of all wetlands and waters within the project study area. This should include roads of accessibility and staging areas.

5) Quantify impacts (permanent, temporary and secondary) to all waters of the United States (e.g., perennial, intermittent, ephemeral streams, river, lakes and ponds), including wetlands, for each project alternative. For streams and rivers, include both the linear feet of streams/rivers (measured along the centerline of the stream/river) and acreage of impact. For temporary impacts, quantify any change in wetland classification (e.g., palustrine forested to palustrine emergent, etc.). For secondary impacts or adverse effects from impoundments to open water (changes to the Ordinary High Water Mark (OHWM) or wetland, provide the acreage of the affected area.

6) Cumulative and indirect impacts resulting from the project.

7) Environmental justice, including compliance with the Executive Order 12898 on environmental justice.

8) Describe and locate the disposal options for any excess fill material resulting from the project.

9) Proposed compensatory wetland and/or stream mitigation plans that provider for the replacement/compensation of lost functions and services, in accordance with the Environmental Protection Agency/Corps mitigation rule.

10) Analysis of the project's compliance with Section 7 of the Endangered Species Act, Section 106 of the National Historic Preservation Act, Section 401 of the Clean Water Act, and the Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 04-267) [essential fish habitat (EFH) assessment].

11) Chemical and physical analysis of any dredged or excavated material.

12) Based on core samples of the chemical/physical composition of any possible sediments to be removed, the method of removal (e.g., mechanical, hydraulic), and the expected resulting conditions in the waterway(s) e.g., flow, currents, circulation patterns, etc.,) describe the maximum expected turbidity plume and any adverse environmental/water quality impacts, both upstream and downstream, and the expected time duration, resulting from the proposed operation. In addition, describe the plans and methods to contain and/or otherwise minimize the deleterious effects of the operation to the aquatic environment.

13) Air quality impacts (i.e., Section 176(c) of the Clean Air Act General Conformity Rule Review).

14) Compliance with the Executive Order on floodplains.

15) Project review schedule and NEPA document preparation schedule. Other important milestones (e.g., public hearings, etc.,) should be listed in the NEPA document.

We look forward to working with your agency as the NEPA document is developed and the review of the project proceeds. A copy of this letter is also being furnished to Ms. Pam Underhill, Superintendant of the Appalachian National Scenic Trail (APPA). Should you have any questions regarding this matter, please contact Wayne Poppich at (570) 842-1044 between the hours of 1:00 and 3:30 p.m. or write to the above address.

Sincerely,

Frank J. Cianfrani
Chief, Regulatory Branch

RECEIVED
MAY 20 2010
BY:

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

JAN 31 2012

John J. Donahue, Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and Recreational River
HQ River Road
Bushkill, PA 18324

Pamela Underhill, Superintendent
Appalachian National Scenic Trail
P.O. Box 50
Harpers Ferry, WV 25425

Dear Mr. Donohue and Ms. Underhill:

We have reviewed the Susquehanna to Roseland 500-kv Transmission Line Right-of-Way and Special Use Permit Draft Environmental Impact Statement (DEIS) prepared for the National Park Service (NPS), the lead action agency, to address potential impacts that would occur in the Delaware Water Gap National Recreation Area (DEWA), Appalachian National Scenic Trail (APPA), and Middle Delaware National Scenic and Recreational River (MDSR) in Pennsylvania and New Jersey. The DEIS describes the proposal of PPL Electric Utilities Corporation (PPL) and Public Service Electric and Gas Company (PSE&G), jointly known as the applicant, to construct a portion of the Susquehanna to Roseland 500-kV transmission line (S-R Line) and reconstruct an existing 230-kV line along their current ROW through the parks. The DEIS describes the six alternatives for the route of the transmission line, the resources that would be affected by the alternatives, and the environmental consequences of each alternative.

General Comments
The DEIS analyzes the impacts of the alternatives in detail for geologic resources (including topography and paleontology); floodplains; wetlands; vegetation; landscape connectivity, wildlife habitat, and wildlife; special-status species; rare and unique communities; archeological resources; historic structures; cultural landscapes; socioeconomics; infrastructure, access, and circulation; visitor use and experience; visual resources; soundscapes; wild and scenic rivers; park operations; and health and safety.

As submitted, the DEIS has addressed many of the concerns, formerly expressed in our prior letter, dated May 13, 2010, regarding NOAA trust resources. Moreover, the individual, cumulative, direct and indirect impacts that would be derived from the proposed activity have been discussed fully throughout the document.

Specific Comments

As a steward of our nation's living marine resources, our focus involves the evaluation of potential impacts to NOAA trust resources and establishing protections regarding their conservation and enhancement. Consequently, we have an obligation and a legal mandate to consult with federal agencies that fund, authorize or undertake actions that may affect living marine resources and their habitats. The MSA, FWCA and other mandates require that we provide advice and recommendations, to federal action agencies which serve to avoid, minimize and mitigate for impacts to living marine resources and their habitats.

The Delaware River and its tributaries provide a variety of commercial and recreational fishing including offering a migratory pathway and spawning, nursery, and forage habitat for a number of anadromous and catadromous fishes including American shad (*Alosa sapidissima*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), American eel (*Anguilla rostrata*), and striped bass (*Morone saxatilis*). Parts of the watershed are subject to tidal influence the upper limit of which is located at RM 134 in Trenton, NJ. Upstream beyond this point to its origin source, the River is completely freshwater.

The federally endangered shortnose sturgeon (*Acipenser brevirostrum*) and the federal candidate species Atlantic sturgeon (*Acipenser oxyrynchus*), which has been proposed for listing, are known to transit through the project area at certain times of the year. The "shad run," the annual migration of spawning American shad up the Delaware also passes through DEWA in May and June (NPS 2010).

We have previously consulted with the NPS and advised its technical consultants on essential fish habitat, federally protected species and other NOAA trust resources that are known to occur in the project area and could be impacted by the proposed project. Our Essential Fish Habitat (EFH) letter regarding the project dated May 13, 2010, noted that there are American shad between the Delaware Water Gap and the New York border; and additionally, there may be also be shad in the Philadelphia reach of the river. Given that a more detailed discussion of potential impacts to trust resources and that further information regarding the transmission line crossing of the River was included in the DEIS, additional EFH consultation with HCD by the federal action agency will not be required as part of the federal permit process.

In a letter dated July 22, 2010, it was determined 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. PRD 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.

References

U.S. Department of the Interior. National Park Service. 2010. Plan Your Visit. Available [online]: http://www.nps.gov/dewa/planyourvisit/index.htm (accessed January 4, 2012)

U.S. Fish and Wildlife Service. 2010. The Delaware River Coordinator's Office. Available at: http://www.fws.gov/delawareriver/. (accessed January 4, 2012).

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

JUL 22 2010
RECEIVED
JUL 26 2010

John J. Donahue
US Department of the Interior
National Park Service
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

Dear Mr. Donahue,

This is in response to your letter dated July 16, 2010 regarding the National Park Service's (NPS) preparation of an Environmental Impact Statement to analyze the potential impacts for the proposed construction of a high voltage electric transmission line traversing three NPS units in Pennsylvania and New Jersey. Your letter requests information on the presence of species listed by NOAA's National Marine Fisheries Service (NMFS) in the project area.

NMFS has reviewed the seven alternatives presented in your letter, all of which involve a crossing of the Delaware River. However, while a population of endangered shortnose sturgeon (*Acipenser brevirostrum*) occurs in the Delaware River, the best available information indicates that the species is limited to the area downstream of Lambertville, New Jersey, which is well downstream of the NPS project area. As no listed species occur in the action area, no further coordination with NMFS Protected Resources Division (PRD) regarding the proposed project is necessary. Should project plans change or new information become available that changes the basis for this determination, further coordination should be pursued. If you have any questions regarding these comments, please contact Julie Crocker of my staff at (978)282-8480 or by e-mail (Julie.Crocker@Noaa.gov).

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

File Code: Sec 7 No Species Present 2010

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat Conservation Division
James J. Howard Marine
Sciences Laboratory
74 Magruder Road
Highlands, NJ 07732

RECEIVED
MAY 24 2010
BY:

May 13 , 2010

John J. Donahue, Superintendent
Delaware Water Gap National Recreation Area
National Park Service,
Bushkill, PA 18324

ATTN: Amanda Stein

Dear Mr. Donahue:

This responds to your letter dated April 9, 2010 concerning the preparation of an environmental impact statement (EIS) to analyze the potential effects of the proposed construction of a high voltage electric transmission line traversing three National Park Service (NPS) units in Pennsylvania and New Jersey: Delaware Water Gap National Recreation Area (DEWA), Middle Delaware National Scenic and Recreation River (MDSR) and the Appalachian National Scenic Trail (APP). PPL Electric Utilities Corporation and PSE&G have proposed to upgrade and to expand the existing 230 kilovolt (kV) power transmission line that currently passes through these three NPS units. The existing line would be replaced with new larger towers to co-locate both the existing 230 kV and anew 500 kV line. This would require the widening of the existing right-of-way and the construction of new access roads and the rehabilitation and widening on existing access roads. The applicant's stated project purpose is to strengthen the reliability of the of the gird at the direction of the Regional Transmission Operator, PJM Interconnection.

The Delaware River and its tributaries provide a migratory pathway, spawning, nursery and forage habitat for anadromous fishes such as American shad. American shad usually enter the Delaware River in mid-March and move past the tidal section below Trenton to the primary spawning reach from the Water Gap (I-80 crossing) up to the New York border. In recent years, some American shad may be spawning in the Philadelphia reach due to improved water quality.

From the information available, it is unclear how the proposed project would cross the Delaware River. If any in-water work within the Delaware River is proposed, or if any work adjacent to the river and its tributaries which would degrade the water quality or habitat values of the Delaware River is planned, NMFS' Habitat Conservation Division should be consulted under the provisions of the Fish and Wildlife Coordination Act.

In addition, the Delaware River Basin Fish & Wildlife Management Cooperative, (Co-op), comprised of the (1) U.S. Fish & Wildlife Service, (2) the National Marine Fisheries Service, (3) the Delaware Division of Fish and Wildlife, (4) the Pennsylvania Fish and Boat Commission, (5) the New York Division of Fish, Wildlife, and Marine Resources, and (6) the New Jersey Division of Fish and Wildlife has developed recommended seasonal work restrictions to protect a variety of important aquatic species found in the Delaware River including American shad, alewife, blueback herring, striped bass, hickory

shad and freshwater species such as large mouth bass, small mouth bass, bluegill, trout and others. These timing restrictions should be incorporated into the project schedule for any work proposed in the Delaware River and its tributaries.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires federal agencies including the NPS to consult with NMFS regarding any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat identified under the MSA. The EFH regulations, 50 CFR Section 600.920, outline that consultation procedure and, further, enable federal agencies to use existing consultation/environmental review procedures to satisfy the MSA consultation requirements when appropriate. Included in this consultation process is the preparation of a complete and appropriate EFH assessment to provide necessary information on which to consult.

No EFH has been designated within the project area. As a result, an EFH consultation by NPS will not be required for the actions proposed. However, should project plans change or if new information becomes available that would change the basis for this determination, consultation should be initiated.

If you have any questions regarding these comments, please contact Karen Greene at 732 872-3023.

Sincerely,

Stanley W. Gorski
Field Offices Supervisor

cc: PRD – J. Crocker
FWS DRC – J. Mohler

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO
D5015

MAY 21 2012

Mr. Eric Davis
U.S. Fish and Wildlife Service
927 North Main Street, Building D
Pleasantville, New Jersey 08232-1454

Mr. Clint Riley
U.S. Fish and Wildlife Service
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

Dear Mr. Davis and Mr. Riley:

In accordance with the requirements of Section 7 of the Endangered Species Act, the National Park Service (NPS) is seeking concurrence from the U.S. Fish and Wildlife Service that the preferred alternative to issue a special use and construction permit to the applicant (PPL Electric Utilities and PSE&G) for their proposal to upgrade and expand the electric transmission line (Susquehanna to Roseland 500kV Transmission Line) across park lands may affect but is not likely to adversely affect the following listed species:

Bog Turtle (*Clemmys [Glyptemys] muhlenbergii*)
Indiana Bat (*Myotis sodalis*)

There is no designated critical habitat for any species within the National Park Service study area; thus, the preferred alternative would not result in adverse modification of any designated critical habitat.

To assist in completing informal consultation, please find enclosed the **Biological Assessment for Indiana Bat (*Myotis sodalis*) and Bog Turtle (*Glyptemys muhlenbergii*).**

If you have questions or require additional information, please contact Morgan Elmer at (303) 969-2317 or by email at morgan_elmer@nps.gov. We are looking forward to your reply and thank you in advance for your cooperation in this matter.

Sincerely,

John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6278

Enclosure

Cc:
Andrew Tittler, DOI Office of the Solicitor
Kara Deutsch, National Park Service, DEWA
Amanda Stein, National Park Service, DEWA
Brent Allen, National Park Service, APPA
Steven Culver, National Park Service, DSC
Morgan Elmer, National Park Service, DSC
Jennifer McConaghie, National Park Service, NER

Pamela Shellenberger, U.S. Fish and Wildlife Service, PAFO
Wendy Walsh, U.S. Fish and Wildlife Service, NJFO

Denver Service Center - TIC
Attn: SRLINE EIS
12795 W. Alameda Parkway
Denver, Colorado 80225-0287

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Jersey Field Office
Ecological Services
927 North Main Street, Building D
Pleasantville, New Jersey 08232
Tel: 609/646 9310
Fax: 609/646 0352
http://www.fws.gov/northeast/njfieldoffice/

In Reply Refer To:

2008-I-0319

JAN 31 2012

Mr. John J. Donahue, Superintendent
Delaware Water Gap National Recreation Area and
Middle Delaware National Scenic and Recreational River
Bushkill, Pennsylvania 18324

Ms. Pamela Underhill, Superintendent
Appalachian Trail Park Office
P.O. Box 50
Harpers Ferry, West Virginia 25425

Dear Mr. Donahue and Ms. Underhill:

As a cooperating agency for the National Park Service's (NPS) Susquehanna to Roseland 500 kV Transmission Line (SRLINE) Environmental Impact Statement (EIS), the U.S. Fish and Wildlife Service (FWS) has reviewed the December 2011 Draft EIS (DEIS). The FWS Pennsylvania and New Jersey Field Offices (PAFO and NJFO, respectively) provide the following comments pursuant to the National Environmental Policy Act of 1969 as amended (83 Stat. 852; 42 U.S.C. 4321 *et seq.*) (NEPA); Section 7 the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA); the Bald and Golden Eagle Protection Act (54 Stat. 250; 16 U.S.C. 668-668d) (Eagle Act); and the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712) (MBTA).

The project proponents, PSE&G and PPL Electric (jointly, the applicant), have applied to NPS to construct a portion of the Susquehanna to Roseland 500kV transmission line and reconstruct an existing 230-kV line along their current Right of Way through three NPS units: the Appalachian National Scenic Trail, the Delaware Water Gap National Recreation Area (DWGNRA), and the Middle Delaware National Scenic and Recreational River. FWS is committed to assisting NPS in meeting its EIS schedule and fulfilling its responsibilities under Federal wildlife laws.

ALTERNATIVES

The FWS appreciates the cooperation of NPS in considering impacts to Cherry Valley National Wildlife Refuge (NWR) in its evaluation of alternatives. Alternative 6/7 has been dropped, in part, to avoid impacts to the NWR. FWS staff will continue to assist NPS and the companies to evaluate alternatives and select a feasible alternative with the least impact on fish and wildlife.

FEDERALLY LISTED SPECIES

Bog Turtle (DEIS page 183)

Within NPS Units

Alternatives 2 and 2b: In a letter dated January 27, 2010, PAFO provided comments on impacts to the federally listed (threatened) bog turtle (*Clemmys [Glyptemys] muhlenbergii*). These comments pertained to Alternatives 2 and 2b and were based on information that had been provided to FWS at that time. As discussed in that letter, there is one known bog turtle site on NPS lands that may be affected by Alternatives 2 and 2b, depending on the specific access route chosen in this area. As indicated in that letter, if the southern route option is used for access, impacts can be avoided and minimized by using a time of year restriction or having a recognized, qualified bog turtle surveyor on-site during construction. Therefore, the January 27, 2010 letter recommended that the southern route be used to minimize impacts to this species. On the other hand, if the northern route is used for access, direct impacts to the bog turtle could occur and formal consultation through Section 7 of the ESA would likely be necessary.

The NJFO addressed the bog turtle via letter dated October 21, 2010. The NJFO subsequently reviewed bog turtle survey reports for NPS lands along Alternatives 2 and 2b. Via comments transmitted July 12, 2010, NJFO concurred with the June 17, 2010 Bog Turtle Habitat Assessment for Wetlands NPS 025A, 025B, and 010, and with the September 10, 2010 Phase 2 Bog Turtle Survey Report. No bog turtles were found. However, if Alternative 2 or 2b is selected, FWS will work with NPS and the applicant to determine if any Conservation Measures are necessary in this area based on proximity to a known bog turtle occurrence and the specific project activities proposed in and near suitable habitat.

No further bog turtle surveys are recommended within NPS units along Alternatives 2 or 2b. If additional information about possible impacts of Alternatives 2 and 2b (*e.g.*, blasting) has become available since our previous review, FWS may reconsider our previous recommendations and/or determinations.

Alternatives 3-5: FWS understands that NPS is undertaking Phase 1 bog turtle surveys along Alternatives 3, 4, and 5 within NPS units. All wetlands within 300 feet of these various alignments should be surveyed by a recognized, qualified surveyor following FWS survey guidelines.[1] The Phase 1 survey reports should be evaluated by the agencies before initiating any presence/absence (Phase 2) surveys. Phase 2 surveys need to be conducted between April 15 and June 15, with at least 2 surveys occurring in May.

If properly implemented species surveys are negative, then the project activities along these routes within NPS units would be considered "not likely to adversely affect" the bog turtle. If surveys reveal presence of this species, then FWS will work with the NPS and applicant to develop Conservation Measures to avoid impacts (*e.g.,* move tower locations). If impacts cannot be fully avoided, formal consultation may be necessary; in this case, FWS would work to expedite issuance of a BO in recognition of NPS' firm schedule to complete the NEPA process.

[1] http://www.fws.gov/northeast/njfieldoffice/pdf/bogturtlesurvey.pdf

Outside NPS Units

Alternatives 2 and 2b: Bog turtle survey work along Alternatives 2 and 2b has conducted been by the applicant, and Conservation Measures have been developed with FWS input. Outside NPS units, the FWS does not anticipate adverse effects to the bog turtle from Alternatives 2 or 2b; however, our analysis of this route is not yet complete (*e.g.*, there are a few outstanding survey reports, Conservation Measures need to be finalized, and blasting has not yet been considered).

Alternatives 3-5: If Alternative 3, 4 or 5 is selected, Phase 1 bog turtle surveys should be conducted for any wetlands within 300 feet of the proposed project route in New Jersey, and in Monroe and Northampton Counties, Pennsylvania, for all portions of the selected route that were not already covered by surveys for Alternative 2 and 2b. FWS and NPS are currently working out a process by which impacts to federally listed species outside NPS units can be evaluated.

Indiana bat (DEIS page 186)

Within NPS Units

Alternatives 2 and 2b: Comments regarding the federally listed (endangered) Indiana (*Myotis sodalis*) bat were included in PAFO's January 27, 2010 letter and NJFO's October 21, 2010 letter. For Alternatives 2 and 2b, surveys for this species were carried out between May 27 and August 12, 2009 in accordance with the FWS Indiana bat mist-net survey guidelines. No Indiana bats were found. Portal searches in these areas, conducted between May 5 and May 9, 2009, also revealed no Indiana bats. Consequently, Alternatives 2 and 2b would not be likely to adversely affect Indiana bats within NPS units.

No further Indiana bat surveys are recommended within NPS units along Alternatives 2 or 2b. If additional information about possible impacts of Alternatives 2 and 2b (*e.g.*, blasting) has become available since our previous review, FWS may reconsider our previous recommendations and/or determinations.

Alternatives 3-5: FWS understands that NPS is undertaking Indiana bat habitat assessments along Alternatives 3, 4, and 5 within NPS units. Results of the habitat assessments should be evaluated by the agencies prior to initiating presence/absence surveys. FWS will likely recommend mist-net surveys and portal searches, to be carried out by a recognized, qualified Indiana bat surveyor for all areas of suitable habitat not covered by the previous surveys. Mist-net surveys should be carried out in forested portions of these alternatives, while portal searches should be carried out along the entire length (if not previously surveyed). Mist-net surveys for this species need to be carried out between May 15 and August 15. [2]

If properly implemented species surveys are negative, then the project activities along these routes within NPS units would be considered "not likely to adversely affect" the Indiana bat. If surveys reveal presence of this species, then FWS will work with the NPS and applicant to

[2] http://www.fws.gov/northeast/njfieldoffice/pdf/Ibatsurvey.pdf
http://www.fws.gov/northeast/njfieldoffice/pdf/IbattelemetryNJ.pdf

develop Conservation Measures to avoid impacts (*e.g.,* move tower locations). If impacts cannot be fully avoided, formal consultation may be necessary; in this case, FWS would work to expedite issuance of a BO in recognition of NPS' firm schedule to complete the NEPA process.

Outside NPS Units

Alternatives 2 and 2b: Indiana bat survey work along Alternatives 2 and 2b has been conducted by the applicant and Conservation Measures developed with FWS input. Outside NPS units, the FWS does not anticipate adverse effects to the Indiana bat from Alternatives 2 or 2b; however, our analysis of this route is not yet complete (*e.g.*, there are a few outstanding survey reports, Conservation Measures need to be finalized, and blasting has not yet been considered).

Alternatives 3-5: If Alternative 3, 4 or 5 is selected, mist-net surveys and portal searches should be conducted by a recognized, qualified Indiana bat surveyor for all areas of suitable habitat not covered by the previous surveys. FWS and NPS are currently working out a process by which impacts to federally listed species outside NPS units can be evaluated.

BALD EAGLE

As described in the DEIS, several alternatives under consideration have the potential to impact nesting and/or wintering bald eagles (*Haliaeetus leucocephalus*). The Kittanny Ridge and an important eagle wintering area along the Delaware River are of particular concern. As noted in the DEIS, FWS recommends adherence to the National Bald Eagle Management Guidelines[3] to minimize impacts to this species, and ensure compliance with the Eagle Act. The FWS is working with NPS to evaluate the need for any permit(s) under the Eagle Act for the various alternatives under consideration.

OTHER MIGRATORY BIRDS

The FWS is the principal Federal agency charged with protecting and enhancing populations and habitat of migratory bird species. The MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for authorizing incidental take, the Service recognizes that some birds may be killed even if all reasonable measures to avoid take are implemented. Unless the take is authorized, it is not possible to absolve individuals, companies or agencies from liability even if they implement avian mortality avoidance or similar conservation measures. However, the Office of Law Enforcement focuses enforcement action on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law.

As discussed in the DEIS, the potential exists for avian mortality from electrocutions or collisions with power lines as well as direct impacts from habitat loss for wintering, migrating, and breeding migratory birds and indirect impacts from fragmentation, site avoidance, and disturbance of birds within the project boundaries. Electrocutions from power lines are of particular concern to raptors, as their size, hunting strategy, and nesting preferences make them

[3] http://www.fws.gov/migratorybirds/CurrentBirdIssues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf

particularly vulnerable. Other species, such as corvids (crows and ravens) and cormorants also show an affinity for nesting on power lines. Collisions are most common at night, or under low visibility conditions, because migratory birds and land birds either cannot see the utility lines, or they lack the ability to negotiate obstacles quickly enough to avoid them. Site-specific factors that should be considered in project siting to avoid and minimize the risk to birds include avian abundance; the quality, quantity, and type of habitat; geographic location; type and extent of bird use (*e.g.*, breeding, foraging, migrating); and landscape features.

The Avian Power Line Interaction Committee (APLIC[4]) and the Service[5] have developed guidelines for power lines to minimize impacts from existing facilities and in the construction of new utility and energy systems and associated infrastructure. According to the DEIS, any "build" alternative selected by NPS would be constructed according to APLIC standards, and the best available deterrence technology would be used.

In addition to following the APLIC standards, we offer the following recommendations to avoid and minimize impacts to migratory birds within and around the project area.

1. Work with FWS to revise and finalize the draft Avian Protection Plan (APP) previously developed by PSE&G to minimize the risk of electrocution, collision, disturbance and habitat impacts for migratory birds. The APP should apply minimum standards along the length of the line, with enhanced protections in sensitive areas.

2. Report bird mortalities and injuries resulting from electrocutions or collisions on the Service's online Bird Fatality/Injury Reporting Program[6] (Bird Report program). The Bird Report program was designed, with significant industry input and feedback, to provide a user-friendly, easily-accessed, method of allowing members of the electric utility industry to voluntarily report bird mortalities and injuries resulting from electrocutions or collisions with electrical utility equipment. Collecting information about the locations and circumstances under which birds are killed or injured on power equipment serves the primary purpose of determining how to prevent future bird interactions. The database is intended for use by utilities to see which structures and equipment are hazardous to birds, and under what conditions, and assists in evaluating and enhancing the effectiveness of retrofitting.

3. Minimize land and vegetation disturbance and reduce habitat fragmentation during project design and construction, especially if habitat cannot be fully restored after construction. Where practicable, concentrate construction activities, infrastructure, and man-made structures (*e.g.*, poles, roads) on lands already altered or cultivated, and away from areas of intact and healthy native habitats. Co-locate roads, staging areas, and other infrastructure in or immediately adjacent to already-disturbed areas (*e.g.*, existing rights-of-way, agricultural fields). If co-location is not feasible, select fragmented or degraded habitats rather than relatively intact areas.

[4] www.aplic.org
[5] http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/BirdHazards.html
[6] https://birdreport.fws.gov/

4. Where disturbance is necessary, clear natural or semi-natural habitats (*e.g.*, forests, woodlots, reverting fields, shrubby areas) between September 1 and March 14, which is outside the nesting season for most native bird species. Without undertaking specific analysis of breeding species and their respective nesting seasons on the project site, implementation of this seasonal restriction will avoid take of most breeding birds, their nests, and their young (*i.e.*, eggs, hatchlings, fledglings).

5. Avoid permanent habitat alterations in areas where birds are highly concentrated or where sizable prey bases exist. Avoid establishing sizable structures along known bird migration pathways or known daily movement flyways (*e.g.*, between roosting and feeding areas). Examples of high concentration areas for birds are wetlands, State or Federal refuges, Audubon Important Bird Areas, private duck clubs, rookeries, roosts, and riparian areas.

6. Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts on vulnerable wildlife. Use only plant species that are native to the local area for revegetation of the project area.

7. Work with FWS to include protective measures for migratory birds into the Vegetation Management Program for each State.

CONCLUSION

The FWS appreciates the opportunity to review the DEIS. FWS will continue working cooperatively with NPS through finalization of the EIS and completion of consultation under Section 7 of the ESA. Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions about the above comments, or require further assistance regarding federally listed threatened or endangered species.

Sincerely,

J. Eric Davis Jr.
Field Supervisor

Enclosure: Specific comments on language in the DEIS

cc: RO, Alex Hoar, Glenn Smith, Paul Phifer, Scott Kahan
PAFO, Pam Shellenberger, Clint Riley
Wallkill NWR, Mike Horne

Amanda J . Stein, Biologist/Project Manager
Delaware Water Gap National Recreation Area
1 River Road
Bushkill, Pennsylvania 18324-9999

National Park Service Denver Service Center – TIC
Attn: SRLINE EIS
12795 W. Alameda Parkway
Denver, Colorado 80225-0287

Susquehanna to Roseland Transmission Line EIS – DEWA Internal Review Comment Form
Draft EIS (November 21, 2011 to January 31, 2012)

Reviewer's Name (Initials) :

	Initials	Page #	Section, paragraph, line #	Your Comment / Proposed Revision	For Consultant's Response / Resolution
1.	wlw	181	Golden-winged warbler	Please change this statement, "The species is federally listed as a species of special concern…" to read, "USFWS is conducting a status review of the golden-winged warbler in response to a petition to list this species under the ESA…."	
2.	wlw	186	small-footed bat	Please change this statement, "The species is federally listed as a species of special concern…" to read, "USFWS is conducting a status review of the small-footed bat in response to a petition to list this species under the ESA…."	
3.	wlw	187	Northern myotis	Please to read, "USFWS is conducting a status review of the Northern myotis in response to a petition to list this species under the ESA. This species is also listed as a species of special concern in Pennsylvania."	
4.	wlw	436	Consultation	NPS is currently preparing a BA for this project, consistent with policy that requires a BA for all "major construction activities" that "may affect" listed species. Please revise this section in the FEIS to reflect the current status of the consultation at that time.	
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United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Jersey Field Office
Ecological Services
927 North Main Street, Building D
Pleasantville, New Jersey 08232
Tel: 609/646 9310
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http://www.fws.gov/northeast/njfieldoffice/

In Reply Refer To:

2008-I-0319

Mr. John J. Donahue, Superintendent
Delaware Water Gap National Recreation Area and
Middle Delaware National Scenic and Recreational River
Bushkill, Pennsylvania 18324

Ms. Pamela Underhill, Superintendent
Appalachian Trail Park Office
P.O. Box 50
Harpers Ferry, West Virginia 25425

Dear Mr. Donahue and Ms. Underhill:

The U.S. Fish and Wildlife Service (FWS) has reviewed the National Park Service's (NPS) "Draft Biological Assessment [BA] for Indiana Bat (*Myotis sodalis*) and Bog Turtle (*Glyptemys* [Clemmys] *muhlenbergii*)," received via e-mail on November 16, 2011. The BA was prepared pursuant to Section 7 the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA) for the Susquehanna to Roseland 500 kV Transmission Line (SRLINE) project. Specific comments on the draft BA from the FWS New Jersey Field Office were transmitted by e-mail. The FWS Pennsylvania Field Office participated in the preparation of this letter.

We have been informed by our Northeast Regional Office that NPS has requested advice by November 23, 2011 on whether formal consultation is necessary. Due to lack of information, the FWS cannot provide such advice at this time. The draft BA does not demonstrate that formal consultation is necessary, and we continue to expect that consultation can likely be concluded informally with a determination of "not likely to adversely affect" (NLAA). However, both the NPS and the FWS must substantiate that determination with information about anticipated effects to listed species. This information is not yet available because NPS has not yet identified the route that it will authorize, if any.

The NPS has also asked the FWS to commit to completion of consultation by May 2, 2012. The NPS is not scheduled to select a preferred alternative until early March 2012. Even after selection of its preferred alternative, NPS is not planning to provide FWS with information about the project route outside of NPS jurisdiction (unless Alternative 2 or 2b is selected). Habitat assessments along Alternatives 3-5 are currently underway within NPS units, but species presence/absence surveys – should any be necessary – cannot be completed until spring. At this time, therefore, FWS cannot commit to completing consultation by May 2, 2012, as requested. Below, we discuss off-park impacts, and offer various options by which NPS can complete consultation prior to its discretionary Federal action (*i.e.*, issuance or denial of the permit requested by the utility companies), which is scheduled for fall 2012.

While we cannot guarantee that consultation will be concluded informally or that consultation will be completed by May 2, 2012, we offer three alternatives to the consultation process that we believe will satisfy both our agencies.

OFF-PARK IMPACTS

Per the Consultation Handbook,[1] and a Department of Interior solicitor's memo dated August 10, 2011, FWS must consider the effects of construction of the entire SRLINE project (*i.e.*, including off-park impacts), but is entitled to make reasonable assumptions about the impacts on those areas in which the line route is uncertain. The memo continues, "If the actual construction deviates from those assumptions, FWS can retain the right to demand alterations, either from NPS under Section 7, as appropriate, or via [Habitat Conservation Plan (HCP)] with [the utility companies] if outside NPS boundaries. Any document resulting from consultation should be explicit about the assumptions made and the degree of take being contemplated, noting that take beyond that is not authorized."

The solicitor's memo supports the HCP option – if off-park take cannot be avoided – because minimization of adverse off-park effects cannot be accomplished through conditions of the NPS permit. However, because the HCP process is often time-consuming, FWS is concerned that this approach could cause project delays after issuance of the NPS' Record of Decision (ROD). The FWS Washington Office has asked the Field Offices to work towards completion of our ESA review prior to or concurrent with the NPS ROD. Therefore, we suggest in this letter other options for concluding consultation. Based on our previous technical assistance to the utility companies, and other review authorities (*e.g.*, wetland permits), FWS anticipates that off-park impacts can be avoided under any of the options presented below. All three options would evaluate off-park impacts through the consultation with NPS, to avoid potential project delays that could be associated with an HCP.

OPTIONS FOR CONCLUDING CONSULTATION

Option A: Traditional Consultation Process

This option would best ensure that adverse effects to listed species are avoided and would best preserve the integrity of the Section 7 process as outlined by regulation and in the Consultation Handbook. This option would work as follows.

1. NPS informs FWS of its preferred alternative, and formally requests that the utility companies provide FWS with their intended off-park route. Selection of the preferred alternative is scheduled for early March 2012.

2. Working with FWS, NPS and the utility companies evaluate the need for, and carry out, field surveys for listed species in spring 2012.

3. FWS works with NPS and the utility companies to evaluate and minimize (through conservation measures) adverse effects to listed species both on and off NPS lands. We anticipate this can be completed in informal consultation by the fall 2012 ROD unless unforeseen circumstances (*e.g.*, discovery of a previously unknown species occurrence) make it impossible to avoid adverse effects to one or more listed species.

[1] http://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf

4. The NPS permit (if one is issued) includes a condition to comply with all conservation measures within NPS units, and a statement that further consultation between NPS and FWS will be necessary – and that construction within NPS units could be delayed – if the companies fail to implement agreed-upon conservation measures outside NPS units.

Option B: Assumptions about Off-Park Impacts

Under this option, NPS and FWS would make assumptions about off-park impacts. Although not preferred, this option is supported by the solicitor's memo. This option should be followed only if NPS and FWS are unable to obtain information about the utility companies' intended off-park route. This option would work as follows.

1. NPS informs FWS of its preferred alternative in early March. After formal requests, neither NPS nor FWS is able to obtain information about the utility companies' intended off park route.

2. Working with FWS, NPS evaluates the need for, and carries out, field surveys for listed species (in NPS units only) in spring 2012.

3. FWS works with NPS to evaluate and minimize (through conservation measures) adverse effects to listed species in NPS units only. We anticipate this can be completed in informal consultation by the fall 2012 ROD unless unforeseen circumstances make it impossible to avoid adverse effects to one or more listed species.

4. The NPS permit (if one is issued) includes a condition that, prior to any construction in NPS units, the companies obtain written FWS concurrence that adverse effects to listed species will be avoided outside of NPS units. FWS will provide technical assistance to the companies, both directly and through other review authorities (*e.g.*, wetland permits), to make this determination. The NPS permit also includes a statement that further consultation between NPS and FWS will be necessary – and that construction within NPS units could be delayed – if the companies fail to obtain this FWS concurrence regarding off-park impacts.

Option C: Generalized Conservation Measures

Under this option, NPS would work with FWS to develop and adopt a broad set of generalized conservation measures that would apply to any alternative selected (other than no-action), both within and outside of NPS units. Preliminary FWS recommendations for generalized conservation measures are enclosed. This option would work as follows.

1. NPS works with FWS to refine and adopt generalized conservation measures that would avoid all adverse effects to listed species both within and outside of NPS units for any alternative selected. This can be completed at any time. FWS issues a NLAA concurrence letter within 30 days of NPS adopting adequately protective generalized conservation measures.

2. Working with FWS, NPS and the utility companies carry out field surveys for listed species as may be necessary to ensure full implementation of the generalized conservation measures. This work would be done in spring 2012.

3. Prior to the ROD, the NPS and the utility companies work with FWS to make any site-specific refinements to the generalized conservation measures that may be necessary based on the selected project route and the results of the field surveys.

4. The NPS permit (if one is issued) includes a condition to comply with all site-specific and generalized conservation measures within NPS units, and a statement that further consultation between NPS and FWS will be necessary – and that construction within NPS units could be delayed – if the companies fail to implement agreed-upon conservation measures outside NPS units.

CONCLUSION

The FWS appreciates the opportunity to review the draft BA. Due to lack of information, we are unable to advise you at this time if formal consultation will be necessary, or to commit to your requested deadline for completing the consultation process. However, we offer several options for completing consultation. Please let us know which option NPS would like to use to conclude Section 7 consultation for the SRLINE project.

We continue to expect that informal consultation can be concluded with a determination of NLAA, but both NPS and FWS must substantiate this determination with information regarding likely effects to listed species. If formal consultation becomes necessary, please note the standards for a complete initiation package are found at 50 CFR 402.14(c). This information standard to initiate formal consultation has not been met by the draft BA or other information provided by NPS to date.

FWS staff will continue working cooperatively with NPS through completion of consultation. Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions or require further assistance regarding federally listed threatened or endangered species.

Sincerely,

J. Eric Davis Jr.

J. Eric Davis Jr.
Field Supervisor

4

cc: RO, Glenn Smith, Paul Phifer
PAFO, Clint Riley, Pam Shellenberger
Wallkill NWR, Mike Horne

Amanda J . Stein, Biologist/Project Manager
Delaware Water Gap National Recreation Area
1 River Road
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Dennis Reidenbach, Director
Northeast Region, National Park Service
200 Chestnut Street, Suite 502
Philadelphia, Pennsylvania 19106

National Park Service Denver Service Center – TIC
Attn: SRLINE EIS
12795 W. Alameda Parkway
Denver, Colorado 80225-0287

PRELIMINARY FWS RECOMMENDATIONS FOR GENERALIZED CONSERVATION MEASURES FOR THE SRLINE PROJECT

Indiana Bat (*Myotis sodalis*)

- The Service will be provided information on tree clearing (acreages, locations, and habitat quality) to ensure that site-specific and cumulative impacts do not rise to the level of harm (a form of take) from habitat loss. If habitat losses may constitute harm, the project will be modified to reduce tree clearing and/or increase compensatory mitigation.

- Mist net, acoustic surveys and/or hibernacula surveys will be conducted at the Service's recommendation to determine presence/absence of Indiana bats, or to assess this species' current usage of previously documented habitats.

- In areas of potential habitat, clearing of trees over 5" in diameter at breast height (dbh) will be seasonally restricted from April 1 to September 30 (restricted season) unless a negative mist net was completed within the past 2 years. (This recommendation may be superseded by new Service guidance for Indiana bat, currently in development.)

- In known maternity habitat, clearing of trees over 5" dbh will be seasonally restricted from April 1 to September 30 (restricted season). No known roost trees will be cut.

- In foraging habitat associated with known hibernacula, clearing of trees over 5" dbh will be seasonally restricted from April 1 to November 15 (restricted season). No trees will be cleared within 0.25 mile of known hibernacula unless the Service concurs in writing. No project activities will occur within or at the entrance to known hibernacula.

- In known maternity habitat and hibernacula foraging areas, no permanent structures will be installed within 300 feet of wetlands or open waters, and no tree clearing will occur within 150 feet of wetlands or open waters.

- Trees with characteristics of high-quality roosts (see attached) will be flagged in the field and preferentially preserved during construction.

- In areas of potential habitat, compensatory mitigation for habitat loss will be provided by planting tree species likely to become suitable roosts (see attached). This mitigation can be combined with mitigation required under other authorities (*e.g.*, for wetland impacts).

- In known maternity habitat and hibernacula foraging areas, compensatory mitigation for habitat loss will be provided via monetary contribution (Pennsylvania) or habitat creation/enhancement (New Jersey) in an amount and type to be developed with the Service.

Bog Turtle (*Clemmys [Glyptemys] muhlenbergii*)

- All wetlands within 300 feet of project activities (including access roads and temporary work spaces) will be evaluated for bog turtle habitat by a recognized, qualified surveyor using the Service's Phase 1 survey guidelines.

- For each wetland containing suitable bog turtle habitat, the following measures will be implemented unless the Service has concurred in writing with a negative Phase 2 (visual) and/or Phase 3 (trapping) survey report for that wetland. All survey work plans and survey reports will be coordinated and approved by the Service.

    - No vegetation, ground disturbance, or motor vehicle use will occur within 150 feet of wetlands that contain suitable bog turtle habitat.

    - No vegetation or ground disturbance will occur within 300 feet of wetlands that contain suitable bog turtle habitat unless the Service concurs in writing. No permanent structures will be installed within 300 feet of such wetlands.

Dwarf Wedgemussel (*Alasmidonta heterodon*)

- No instream work will occur in the Delaware River, the Pequest River, or any of their direct tributaries.

- No vegetation or ground disturbance will occur within 150 feet of the Delaware River, the Pequest River, or any of their direct tributaries.

- No vegetation or ground disturbance will occur within 300 feet of the Delaware River, the Pequest River, or any of their direct tributaries, unless the Service concurs in writing. No permanent structures will be installed within 300 feet of these waters.

Characteristics of Indiana Bat Summer Habitat

Potential summer habitat for Indiana bats features at least 16 suitable roost trees per acre. Tree characteristics such as loose or shaggy bark, crevices, and hollows are more important than tree species. Suitable roost trees include any of the following:

- live shagbark hickories (*Carya ovata*) over 9 inches in diameter at breast height (dbh);
- lightening-struck trees over 9 inches dbh;
- dead, dying, or damaged trees of any species over 9 inches dbh with at least 10 percent exfoliating bark;
- den trees, broken trees, or stumps over 9 inches dbh and over 9 feet in height; and
- live trees of any species over 26 inches dbh.

Trees as small as 5 inches dbh have been used as maternity roosts and trees as small as 3 inches dbh have been used by roosting males; therefore, smaller dbh trees with the aforementioned characteristics should be retained if larger dbh trees are not present.

The following are examples of native tree species that should be included in planting plans designed to provide suitable roosts for Indiana bats in New Jersey.

Red maple	*Acer rubrum*
Silver maple*	*Acer saccharinum*
Sugar maple *	*Acer saccharum*
Yellow birch	*Betula alleghaniensis*
Gray birch	*Betula populifolia*
Bitternut hickory	*Carya cordiformis*
Sweet pignut hickory	*Carya ovalis*
Shagbark hickory *	*Carya ovata*
White ash	*Fraxinus americana*
Green ash*	*Fraxinus pennsylvanica*
White pine	*Pinus strobus*
Eastern cottonwood*	*Populus deltoides*
White oak*	*Quercus alba*
Pin oak	*Quercus palustris*
Northern red oak	*Quercus rubra*
Post oak	*Quercus stellata*
American elm*	*Ulmus americana*
Slippery elm	*Ulmus rubra*

* preferred roost tree species

Revised 12/17/2008

United States Department of the Interior

NATIONAL PARK SERVICE
Northeast Region
United States Custom House
200 Chestnut Street
Philadelphia, PA 19106

IN REPLY REFER TO:

NOV 16 2011

D18 (NER)

Ms. Wendi Weber
Northeast Regional Office
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035-958

Dear Ms. Weber:

The National Park Service has prepared a Draft Biological Assessment according to the Endangered Species Act to evaluate the potential effects of the proposed Susquehanna to Roseland 500-kV Transmission Line action on federally listed species occurring within and near the range of alternatives' project area on federal lands. The *Susquehanna to Roseland 500-kV Transmission Line Right-of-Way and Special Use Permit Draft Environmental Impact Statement (EIS)*is also ready to be released for public comment in the Federal Register at the end of the month.

Both documents may be accessed via the following links:
ftp://ftp.den.nps.gov/incoming/DEWA/SR%20LINE%20PP%26%20L/

Files names are :

Draft_Biological_Assessment_November_2011_ EA.docx - ftp
Draft Biological_Assessment_November_2011_EA Figures 1-8.pdf –
DEWA_DEIS Volume 1.pdf
DEWA_DEIS Volume 2.pdf

The Draft Biological Assessment linked above represents the last step in our informal Section 7 process under which the FWS has been a valued cooperating agency. As you are aware, this project is on an accelerated schedule; therefore, we would greatly appreciate receiving your comments and advice on whether formal consultation is necessary by **November 23, 2011**. We would be available for a teleconference November 18, 2011. Please let us know if you are available and would like us to set this teleconference up.

If you have any questions regarding the Biological Assessment or Draft EIS, please contact Morgan Elmer at 303-969-2317 or morgan_elmer@nps.gov.

Sincerely,

Dennis R. Reidenbach

Dennis R. Reidenbach
Regional Director

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

JAN 10 2011

Mr. J. Eric Davis Jr., Supervisor
U.S. Fish and Wildlife Service
New Jersey Field Office, Ecological Services
927 North Main Street, Building D
Pleasantville, New Jersey 08232

Dear Mr. Davis:

Thank you for your letter of October 21, 2010, (Reference 2008-I-0319) responding to our July 2010, data request. We have reviewed it and appreciate the information you provided therein. We are writing because we would like to clarify the scope of our current analysis and request additional information.

The National Park Service is currently developing the Susquehanna to Roseland Transmission Line Environmental Impact Statement to analyze whether to grant permits to the applicant (PPL and PSE&G) to construct a transmission line and expand the current right-of-way within three units of the National Park System: the Appalachian National Scenic Trail, Delaware Water Gap National Recreation Area, and Middle Delaware National Scenic and Recreation River. Our permitting authority is limited to the line's crossings within these three park units, therefore our analysis of direct effects is focused impacts accruing within the parks' boundaries. We will also be evaluating indirect and cumulative effects outside the parks, but it is critical that we have data to evaluate direct effects inside the three NPS units.

While the October 21, 2010, letter provided information on areas outside the park units, it did not provide information for areas within the park units. Therefore, we would like to request any information you have on federally listed species in the vicinity of the proposed alternatives within the park units.

If you have additional questions regarding this request or need additional maps of the alternative routes please feel free to contact me or the Project Manager, Amanda Stein at phone 570-426-2472 or by email amanda_stein@nps.gov. Thank you for your time and assistance in this matter.

Sincerely,

John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6279

Cc:
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Patrick Lynch, National Park Service, DEWA
Kara Deutsch, National Park Service, DEWA
Amanda Stein, National Park Service, DEWA
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Jennifer McConaghie, National Park Service, NER

Clint Riley, U.S. Fish and Wildlife Service
Pamela Shellenberger, U.S. Fish and Wildlife Service
Wendy Walsh, U.S. Fish and Wildlife Service

Denver Service Center - TIC
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United States Department of the Interior
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http://www.fws.gov/northeast/njfieldoffice/

In Reply Refer To:
2008-I-0319

OCT 21 2010

Amanda J. Stein, Biologist/Project Manager
Delaware Water Gap National Recreation Area
1 River Road
Bushkill, Pennsylvania 18324-9999

Dear Ms. Stein:

The U.S. Fish and Wildlife Service (Service) has reviewed the preliminary alternative routes identified by the National Park Service (NPS) in your July 2010 newsletter for the proposed Susquehanna to Roseland Transmission Line project to be located in Morris, Sussex, and Warren Counties, New Jersey. The NPS identified these alternative routes for analysis in an Environmental Impact Statement you are preparing to evaluate impacts from the proposed project to three park units: the Appalachian National Scenic Trail, the Delaware Water Gap National Recreation Area (DWGNRA), and the Middle Delaware National Scenic and Recreational River. The project proponent in New Jersey, PSE&G, proposes to upgrade an existing overhead electric transmission line from 230 kV to 500 kV between the existing Roseland Switching Station and the Delaware River. The project may also involve construction of a new switching station and expansion of the Roseland Switching Station. Additional project segments are proposed in Pennsylvania by PPL Electric. Separate comments may be provided by the Service's Pennsylvania Field Office regarding portions of the project located in Pennsylvania.

AUTHORITY

This response is pursuant to Section 7 the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA); the Bald and Golden Eagle Protection Act (54 Stat. 250; 16 U.S.C. 668-668d) (Eagle Act); and the National Environmental Policy Act of 1969 as amended (83 Stat. 852; 42 U.S.C. 4321 *et seq.*). These comments do not preclude separate review and comments by the Service pursuant to the Fish and Wildlife Coordination Act (48 Stat. 401; 16 U.S.C. 661 *et seq.*), if any permits are required from the U.S. Army Corps of Engineers pursuant to the Clean Water Act of 1977 (33 U.S.C. 1344 *et seq.*); or the December 22, 1993 Memorandum of Agreement among the U.S. Environmental Protection Agency, New Jersey Department of Environmental Protection (NJDEP), and the Service, if project implementation requires a permit from the NJDEP pursuant to the New Jersey Freshwater Wetlands Protection Act (N.J.S.A. 13:9B *et seq.*).

FEDERALLY LISTED SPECIES

Indiana Bat

Alternative 2

The Service has been working with PSE&G since 2008 to evaluate impacts to the federally listed (endangered) Indiana bat (*Myotis sodalis*) from Alternative 2. Via our June 11, 2010 letter to the NJDEP (enclosed), the Service concurred that the eastern segment of Alternative 2 (from the proposed Hopatcong Switching Station to the Roseland Switching Station) is not likely to adversely affect the Indiana bat, based on PSE&G's adoption of several conservation measures. The Service recommends continued refinement and eventual implementation of these and/or other appropriate project-wide conservation measures, regardless of which alternative is selected. We will review and comment on the revised conservation measures (as detailed in PSE&G's *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project*) after PSE&G and NPS have selected a preferred alternative route through New Jersey.

Among the previously adopted conservation measures for Alternative 2 are buffers on wetlands and open waters within those right-of-way spans identified by the Service as foraging habitat associated with known Indiana bat hibernacula and/or maternity colonies. In such spans, PSE&G will not install any permanent structure (*e.g.*, access road, tower) within 300 feet of wetlands or open waters, and will not clear trees or locate temporary work spaces within 150 feet of wetlands or open waters. If these or any other project-wide conservation measure cannot be implemented for any particular span, PSE&G has agreed to work with the Service to develop alternative site-specific conservation measures sufficient to avoid adverse effects to the Indiana bat. If Alternative 2 is selected, the Service will request an analysis of which spans west of the proposed Hoptacong Switching Station may require alternative site-specific conservation measures. This analysis was already completed for the spans between the Hopatcong and Roseland Stations.

The Service also requests a copy of any survey results that were not previously submitted for the Indiana bat or its habitat in New Jersey (*e.g.*, any Indiana bat surveys conducted within the New Jersey portion of DWGNRA).

Alternatives 3 Through 7

The New Jersey portions of Alternatives 3 through 7 are all located within the geographic range of the Indiana bat. The eastern portions of Alternatives 5 and 6/7 also cross known migratory corridors, swarming habitat associated with known hibernacula, and foraging habitat associated with known maternity colonies. Tree clearing could disturb or injure any roosting bats, and could destroy or degrade roosting sites. To minimize impacts, the Service generally recommends a seasonal restriction on tree clearing from April 1 to November 15 within 10 miles of known hibernacula, and from April 1 to September 30 in other parts of the species' range in New Jersey.

To evaluate potential impacts to Indiana bat habitat, the Service requests information regarding the estimated number of acres of tree clearing associated with the New Jersey portion of each Alternative 3 through 7, including for access roads and temporary work spaces. For Alternative 5, please provide a separate subtotal for the portion of the alignment east of Route 206 (where it intersects Route 80 in Mount Olive Township). For Alternative 6/7, please provide a separate subtotal for the portion of the alignment east of Mount Olive Township. Based on the estimated acres of tree clearing, the Service may request habitat characterizations and/or mist net surveys to determine if further conservation measures are necessary in certain areas.

Bog Turtle

Alternative 2

The Service has been working with PSE&G since 2008 to evaluate impacts to the federally listed (threatened) bog turtle (*Clemmys muhlenbergii*) from Alternative 2. Via our June 11, 2010 letter to the NJDEP (enclosed), the Service concurred that the eastern segment of Alternative 2 (Hopatcong Station to Roseland Station) is not likely to adversely affect the bog turtle, based on PSE&G's adoption of several conservation measures. The Service recommends continued refinement and eventual implementation of these and/or other appropriate project-wide conservation measures, regardless of which alternative is selected. We will review and comment on the revised conservation measures (as detailed in PSE&G's *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project*) after PSE&G and NPS have selected a preferred alternative route through New Jersey.

Among the previously adopted conservation measures for Alternative 2 are buffers on bog turtle habitat, which includes all wetland areas confirmed as bog turtle habitat through field surveys and/or the NJDEP's Landscape Project mapping, or that are treated as such in the absence of a Phase II survey. PSE&G has agreed that no permanent structures (including but not limited to tower footings and new or improved access roads) will be located within 300 feet of bog turtle habitat. Also, no temporary disturbances (including but not limited to removal of existing towers or other structures, use of motorized equipment, earth disturbance, and equipment/materials storage areas) will take place within 150 feet of bog turtle habitat. If these or any other project-wide conservation measure cannot be implemented for any particular span, PSE&G has agreed to work with the Service to develop alternative site-specific conservation measures sufficient to avoid adverse effects to the bog turtle. If Alternative 2 is selected, the Service will request an analysis of which spans west of the proposed Hoptacong Switching Station may require alternative site-specific conservation measures. This analysis was already completed for the spans between the Hopatcong and Roseland Stations.

The Service also requests a copy of any survey results that were not previously submitted for the bog turtle or its habitat in New Jersey (*e.g.*, Phase II surveys within the New Jersey portion of DWGNRA; surveys requested via the Service's May 21, 2010 electronic mail to PSE&G and NJDEP for specific areas between DWGNRA and the Hopatcong Switching Station).

Alternatives 3 Through 7

The New Jersey portions of Alternatives 3 through 7 are all located within the geographic range of the bog turtle. Alternative 5 includes areas of habitat associated with 4 known bog turtle occurrences. Alternative 6/7 includes areas of habitat associated with 3 known bog turtle occurrences. The locations of known, occupied bog turtle habitat along these alternative routes can be obtained from the NJDEP Landscape Project mapping. Further consultation with the Service will be necessary to evaluate and minimize impacts in areas of known, occupied bog turtle habitat if Alternative 5 or 6/7 is selected.

Alternatives 3 through 7 each include areas of scrub/shrub and emergent wetlands that may provide suitable habitat for the bog turtle. Many areas of New Jersey have not been thoroughly surveyed for endangered and threatened species. If present, bog turtles could be injured or disturbed during construction, and could be adversely affected by any temporary or permanent impacts to wetlands. Therefore, the Service requests that a recognized, qualified surveyor (see enclosed list) evaluate all previously unsurveyed wetlands within and adjacent to each Alternative 3 through 7 for the presence or absence of bog turtle habitat (see enclosed guidance). The survey area should include wetlands in and adjacent to proposed access roads and temporary work spaces as well as the proposed right-of-way. The results of any survey, whether showing presence or absence of bog turtle habitat, must be forwarded to this office for review; please include photographs and the qualifications of the surveyor(s).

Dwarf Wedgemussel

Alternative 4 would cross the Pequest River [redacted] downstream of a known occurrence of the federally listed (endangered) dwarf wedgemussel (*Alasmidonta heterodon*). Alternative 5 would cross the Pequest River [redacted] downstream of a known dwarf wedgemussel occurrence. Alternative 6/7 would cross the Pequest River [redacted] dwarf wedgemussel occurrences located both upstream and downstream of the alignment. The dwarf wedgemussel has also been recorded in the Delaware River [redacted] Alternatives 5 and 6/7.

Text contains sensitive species information

To evaluate potential impacts to the dwarf wedgemussel, the Service requests information for each alternative regarding any proposed in-stream or riparian work along the Delaware River and within the Pequest River watershed. The Service may recommend surveys and/or conservation measures for the dwarf wedgemussel if any permanent or temporary disturbances are proposed within, or within 300 feet of, these open waters.

Swamp Pink

The headwaters of tributaries to the Lamington and Raritan Rivers historically supported several occurrences of the federally listed (threatened) swamp pink (*Helonias bullata*), and one known population still persists in this watershed. Many areas of New Jersey have not been thoroughly surveyed for endangered and threatened species. If present, swamp pink could be adversely affected by any temporary or permanent impacts to its forested wetland habitat. Therefore, the Service requests that a qualified surveyor conduct a survey to determine the presence or absence

of swamp pink (see enclosed guidance). The survey area should include all forested wetlands within [redacted] along Alternative 6/7, including access roads and temporary work areas as well as the right-of-way. The results of any survey, whether showing presence or absence of swamp pink, must be forwarded to this office for review; please include photographs and the qualifications of the surveyor(s).

Text contains sensitive species information

BALD EAGLE

Several active nests of the bald eagle (*Haliaeetus leucocephalus*) are located along the eastern terminus of Alternative 2. An active bald eagle nest is also located [redacted] of Alternative 3. Important bald wintering areas occur along the Delaware River in the vicinity of Alternatives 2 and 3, and additional wintering habitat is mapped by the NJDEP Landscape Project near the eastern ends of Alternatives 2 and 3. All of the alternatives cross foraging habitat mapped by the NJDEP Landscape Project.

The bald eagle was removed from the Federal List of Endangered and Threatened Wildlife on August 8, 2007. The bald eagle continues to be protected under the Eagle Act and the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712). The bald eagle also remains a State-listed species under the New Jersey Endangered and Nongame Species Conservation Act (N.J.S.A. 23:2A *et seq.*), which carries protections under the State land use regulation program. These Federal and State laws prohibit take of bald eagles. For the continued protection of bald eagles, and to ensure compliance with Federal and State laws, the Service recommends managing bald eagles in accordance with the National Bald Eagle Management Guidelines and all applicable State regulations. Links to the Guidelines and additional information about the delisting of the bald eagle are available on the New Jersey Field Office web site at http://www.fws.gov/northeast/njfieldoffice/endangered.

OTHER MIGRATORY BIRDS

The Migratory Bird Treaty Act prohibits the take of migratory birds, their parts, nests, and eggs, even when incidental to an otherwise lawful activity. At the Service's recommendation, PSE&G has prepared an Avian Protection Plan (APP) for Alternative 2. The Service recommends adaptation and implementation of the APP for whichever alternative is selected. The Service provided comments on a draft of the APP in June 2010. We will provide further review and comments on the revised APP after PSE&G and NPS have selected a preferred alternative route through New Jersey. In addition, the Service generally recommends a seasonal restriction on tree clearing from March 15 to July 31 to prevent unauthorized take of nests and unfledged chicks.

CONCLUSION

The proposed project may adversely affect the federally listed Indiana bat, bog turtle, dwarf wedgemussel and/or swamp pink. Therefore, further consultation with the Service is necessary pursuant to Section 7 of the ESA. Through the informal consultation process, the Service will continue to work cooperatively with NPS and PSE&G to avoid adverse effects to federally listed

species. We also appreciate your cooperation in evaluating and minimize impacts to the bald eagle and other migratory birds.

Except for the above-mentioned species, no other federally listed or proposed threatened or endangered flora or fauna are known to occur within the vicinity of the proposed project. If additional information on listed and proposed species becomes available or if project plans change, this determination may be reconsidered.

Please refer to our web site at http://www.fws.gov/northeast/njfieldoffice/endangered/ for current lists of federally listed and candidate species in New Jersey. The web site also provides a link to the National Bald Eagle Management Guidelines, and contacts for obtaining current information regarding State-listed and other species of concern from the New Jersey Natural Heritage and Endangered and Nongame Species Programs.

Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions or require further assistance.

Sincerely,

J. Eric Davis Jr.
Supervisor

Enclosures

cc via email:
DLUR, Tina Wolff, John Heilferty, Diane Dow, Larry Torok
PAFO, Clint Riley
PSE&G, Rob Pollock, David Grossmueller

6

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Jersey Field Office
Ecological Services
927 North Main Street, Building D
Pleasantville, New Jersey 08232
Tel: 609/646 9310
Fax: 609/646 0352
http://www.fws.gov/northeast/njfieldoffice/

In Reply Refer To:

2008-I-0319

Thomas Micai, Director
Division of Land Use Regulation
New Jersey Department of Environmental Protection
P.O. Box 439
Trenton, New Jersey 08625-0439
Attention: Lou Cattuna

JUN 11 2010

Re: PSE&G Roseland to Susquehanna Electric Transmission Line
NJDEP File Number 0000-08-0010.1

Dear Mr. Micai:

The U.S. Fish and Wildlife Service (Service) has reviewed additional information provided by PSE&G (applicant) on June 8 and 9, 2010 in response to our May 21 and 24, 2010 (e-mail) and June 8, 2010 (facsimile) requests. This additional information was requested by the Service in regard to PSE&G's application to the New Jersey Department of Environmental Protection (NJDEP) for a New Jersey Freshwater Wetlands Protection Act (N.J.S.A. 13:9B *et seq.*) individual permit and other State authorizations (File Number 0000-08-0010.1) to construct the eastern portion of the Roseland to Susquehanna Electric Transmission Line.

The proposed project involves installation of approximately 25 miles of new 500-kV overhead electric transmission lines along an existing 150-foot-wide right-of-way (ROW) from Hopatcong Borough, Sussex County to Roseland Borough, Essex County, New Jersey. The project also involves construction of a new switching station in Hopatcong and an expanded switching station in Roseland.

PSE&G intends to construct a western portion of the project, roughly 20 miles from Hopatcong to the Delaware River, sometime after the spring of 2012. The subject application does not cover the western portion. Additional project segments are proposed in Pennsylvania by PPL Electric.

AUTHORITY

This response is pursuant to the December 22, 1993 Memorandum of Agreement (MOA) among the U.S. Environmental Protection Agency, the NJDEP, and the Service; the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA); the Bald and Golden Eagle Protection Act (54 Stat. 250; 16 U.S.C. 668-668d); and the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712).

FEDERALLY LISTED SPECIES

Indiana Bat

Pursuant to the 1993 MOA, the subject permit has the potential to affect the federally listed (endangered) Indiana bat (*Myotis sodalis*) unless the following permit conditions are implemented.

- All conservation measures recommended by the Service and adopted by PSE&G, as reflected in the enclosed excerpt of PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.*

- Service concurrence with final compensatory mitigation plans for forest impacts including: (1) preservation, enhancement, and/or restoration of Indiana bat habitat as one component of the 100 to 200-acre Highlands Forest restoration/education pilot site at the Hopatcong Switching Station;[1] and (2) preservation, enhancement, and/or restoration of Indiana bat habitat at a site along the Passaic River. Information regarding Indiana bat habitat requirements is enclosed.

The Service has reviewed the January 29, 2010 Summer Mist Net Survey Report prepared by ESI, Inc., and concurs that no seasonal restriction on tree clearing is necessary at the Hopatcong Switching Station or Fredon Relocation area if work is completed within the next 2 calendar years. The Service has reviewed the June 8, 2010 habitat assessment for the Roseland Switching Station prepared by EcolSciences, Inc., and concurs that no mist net survey is needed for this approximately 2-acre forest.

Via electronic mail dated June 9, 2010, PSE&G agreed to implement Service-recommended conservation measures for the Indiana bat (enclosed), and provided the following estimates of total tree clearing, including rights-of-way, access roads, and temporary work spaces.

	Eastern Portion	Western Portion	Total
Wetland	0.52 acres	0.25 acres	0.77 acres
Transition Area (assumed 150')	6.90 acres	3.04 acres	9.94 acres
Upland	13.60 acres	7.30 acres	20.90 acres
Total	21.02 acres	10.59 acres	31.61 acres

With implementation of the above permit conditions, the Service concurs that, even considering cumulative impacts (*i.e.*, from the western portion), the loss of approximately 21.02 acres of potential Indiana bat summer roosting and foraging habitat from construction of the eastern portion of the project is insignificant based on the following.

- The impacts are spread across a 25-mile linear project.

[1] The Hopatcong forest restoration project is a component of PSE&G's Comprehensive Mitigation Plan, which was part of the basis for NJDEP's January 15, 2010 Highlands Regional Master Plan Consistency Determination.

- The areas with the greatest impacts have been evaluated for Indiana bat habitat (Roseland Switching Station, Picatinny Arsenal) or surveyed using the Service's mist netting guidelines (Hopatcong Switching Station, Fredon Relocation Site).

- In those areas identified by the Service as hibernacula and/or maternity colony foraging habitat, PSE&G will not install any permanent structure (*e.g.*, access road, tower) within 300 feet of wetlands or open waters and will not clear trees or locate temporary work spaces within 150 feet of wetlands or open waters.

- PSE&G will provide compensatory mitigation for forest impacts, as described above.

To minimize cumulative impacts to Indiana bat habitat, additional information, surveys, and/or conservation measures may be necessary for the western portion of the Roseland to Susquehanna Electric Transmission Line project.

With implementation of the above permit conditions, the Service concurs that the risk of disturbance or injury to roosting bats from construction of the eastern portion of the project is discountable based on the seasonal restrictions included in PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.* Except for the Hopatcong Switching Station and Fredon Relocation area, all portions of the project (including access roads, temporary work spaces, Picatinny Arsenal, and the Roseland Switching Station) will be constructed with seasonal restrictions on tree clearing as specified in the revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.*

Bog Turtle

Pursuant to the 1993 MOA, the subject permit has the potential to affect the federally listed (threatened) bog turtle (*Clemmys muhlenbergii*) unless the following permit condition is implemented.

- All conservation measures recommended by the Service and adopted by PSE&G, as reflected in the enclosed excerpt of PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.*

The Service concurs, or has previously concurred, with the following survey reports prepared by EcolSciences, Inc.

- July 8, 2008 (Phase 1 right-of-way)
- December 23, 2008 (Phase 1 Delaware Water Gap National Recreation Area)
- June 18, 2009 (Phase 2 for 5 wetlands)
- July 29, 2009 (Phase 1 Hopatcong Switching Station)
- March 23, 2010 (Phase 1 access roads; concurrence for eastern portion only)
- June 8, 2010 (Phase 1 for 11 additional spans)

With implementation of the above permit condition, the Service expects that impacts to the bog turtle from construction of the eastern portion of the project will be insignificant and

discountable. This determination is based on the extensive surveys (listed above) and on the habitat buffers, fencing, and monitoring protocols detailed in PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.*

Please note that additional bog turtle surveys and information are still needed for the western portion of the project. Based on this information, the Service may recommend additional conservation measures for the western portion.

MIGRATORY BIRDS

The Migratory Bird Treaty Act prohibits the take of migratory birds, their parts, nests, and eggs, even when incidental to an otherwise lawful activity. In response to the Service's recommendation, PSE&G has prepared a draft Avian Protection Plan (APP) dated June 2010. Pursuant to the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, we recommend that NJDEP include a condition in the subject permit to incorporate Service comments on the draft APP, and to fully implement the final APP.

The Service offers the following preliminary comments on the draft APP.

- The draft APP includes all components recommended in the 2005 *Avian Protection Plan (APP) Guidelines*, and provides a thorough overview of avian issues associated with the project.

- Under "Construction Timing (page 18)," PSE&G proposes to initiate activity in the right-of-way prior to the bird breeding season to discourage nesting and thereby minimize bird mortality and nest failure from vegetation clearing. This section should also mention that the seasonal restriction on tree clearing for Indiana bats (April 1 to September 30 or April 1 to November 15, as specified in PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project*) applies to most work areas and will be effective in avoiding take of nests in trees. Note that the Migratory Bird Treaty Act prohibits all take of nests with eggs or young, and that Service permits are required to relocate such nests (see enclosed fact sheet).

- The seasonal restriction on disturbance within 1,000 feet of bald eagle (*Haliaeetus leucocephalus*) nests during the nesting season (December 15 to August 31) (page 18) is consistent with the National Bald Eagle Management Guidelines.

- The Service requests an opportunity to review the "Project-specific Transmission Right-of-Way Vegetation Management Plan" (page 21), and recommends that the plan reflect all adopted conservation measures for federally listed species as described in PSE&G's October 23, 2009 letter to the Service.

- Change "May" to "April" in the first bullet on page 21 of the APP, in reference to the bird breeding season and time to avoid activities such as mowing and cutting. Also add a reference to PSE&G's intention to perform the majority of its transmission vegetation maintenance activities between October 1 through March 31, as indicated in its October 23, 2009 letter.

- The Service appreciates PSE&G's adoption of our guidelines for aviation safety lighting, and supports the choice of the new Obstacle Collision Avoidance System technology to minimize migratory bird collision hazards caused by light entrapment.

- Bald eagle populations in New Jersey are expanding, and the proposed lines will be in place for many decades. The Service recommends that PSE&G implement the "eagle-safe" electrocution standards (first bullet on page 23) in areas of highly suitable (but as yet unoccupied) eagle habitat, not just current nests and foraging habitats.

- The "raptor-safe" electrocution standards (second bullet on page 23) should be adopted as a minimum standard for the entire line, not just the specified spans, as these species may occur across the entire project area. (Of course, the higher standards for eagles and tall birds would apply in the areas specified.)

- The final APP should specify where flight diverters (transmission line marker) will actually be used (fourth bullet on page 23).

- The final APP should specify which avian enhancement opportunities will actually be constructed within project lands, and should add a section describing enhancement efforts outside of project lands (page 28).

CONCLUSION

Pursuant to the 1993 MOA, the subject permit has the potential to affect the federally listed Indiana bat and bog turtle unless the above-listed conditions are included in the permit. The Service also recommends a permit condition to require PSE&G's full implementation of the final APP.

The Service appreciates the cooperation of PSE&G and NJDEP in evaluating and minimizing adverse effects to federally listed species and migratory birds. Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions or require further assistance regarding federally listed threatened or endangered species.

Sincerely,

Acting Supervisor

cc via email:

DLUR, Tina Wolff, John Heilferty, Diane Dow, Larry Torok
PAFO, Clint Riley, Pam Shellenberger
PSE&G, Rob Pollock, David Grossmueller

United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

FEB 02 2011

Ms. Rebecca Bowen
Pennsylvania Department of Conservation and Natural Resources
Bureau of Forestry
Post Office Box 8552
Harrisburg, Pennsylvania 17105-8552

Dear Ms. Bowen:

We are writing to seek clarification regarding letters pertaining to Pennsylvania Natural Diversity Inventory (PNDI) Environmental Receipt Numbers 20098 and 20914. Both PNDI numbers were established in relation to the PPL and PSE&G's (utilities) proposed Susquehanna to Roseland Transmission Line Project. PNDI Number 20098 addresses the utilities' request for clearance along the alignment ("B") as it passes through Lackawanna, Wayne, Luzerne, Pike and Monroe Counties. PNDI Number 20914 addresses the National Park Service's screening request along the utilities' proposal as it crosses the Delaware Water Gap National Recreation Area (DEWA) in Pike and Monroe Counties. The National Park Service (NPS) request (dated July 16, 2010) also sought information on species and resources of concern along the alternative routes created in development of the Environmental Impact Statement (EIS) as required by the National Environmental Policy Act of 1969 (NEPA) .

Project clearances issued by the Pennsylvania Department of Conservation and Natural Resources (DCNR) are based on reports (dated August 2009, January 2010, and September 2010) prepared by Richard Mellon for The Louis Berger Group, Inc. (Berger), a consultant for PPL. In review of these reports, as they relate to the proposal's crossing of lands and waters of the United States in Pike and Monroe counties, the NPS determined the reports incomplete because of missing information about the plant survey methodologies and proposed engineering and construction plans.

Specifically, the Berger reports do not provide detailed descriptions of the areas surveyed for rare plants. Areas identified by the utilities as access roads are not existing park roads, rather remnants of old roadbeds and trails. Because of their designation as natural in the park's General Management Plan these areas are managed to revert back to natural conditions. The Berger Reports do not describe widths of the proposed access roads, while the maps in the appendices do not clearly demonstrate that the existing ROW widths vary as they cross the park. Furthermore, we cannot determine if corridors adjacent to the ROW were inspected. Surveying resources adjacent to the ROW is important because of the utilities' vegetation management practice of cutting danger trees outside the deeded ROW. Crane pads and staging areas will also be required for construction, however, none are identified on the maps in the Berger January 2010 and September 2010 reports. Additional areas of concern for the NPS are pulling and splicing locations, typically 200 feet x 200 feet (or larger). Each of these sites would require vegetation cutting or clearing.

Because of our concerns identified above, DCNR's conclusion of no "lasting impacts to species of concern" needs to be reconsidered. Project clearance assumes no impacts to Arnott Fen, a designated

Natural Heritage Area. This may not be accurate. There may be direct impacts from tree cutting. The Basin Graminoid-forb fen, as delineated by The Nature Conservancy in previous study (1991, 1999) contains trees which may need to be cleared under the utilities' construction and maintenance plans. Indirect effects associated with clear-cutting a wider ROW; vegetation management including cutting danger trees outside the ROW; and the establishment of permanent access roads may be long-term and difficult to mitigate.

In addition, the January 2010 report lists eight (8) species reported in or near the project area. The report states that all but two (2) of them are reportedly found in the fen, but makes no specific mention in the results section of searches for these species. As the other two (2) species are found on the Hogback Ridge (east of the fen) where presence of limestone has contributed to the presence of rare and unique plant communities, the report should address all eight (8) species specifically as to searches and results. Although populations may be directly avoided, indirect impacts could occur from activities that cause disturbance such as sedimentation, habitat fragmentation, soil compaction and introduction of invasive species.

We appreciate your continued efforts in identifying and addressing species and areas of special concern within the park as they pertain to the utilities' proposal. We would like to request some of your time to discuss in further detail the concerns identified. Please feel free to contact Amanda Stein, Project Manager, at 570-426-2472 or amanda_stein@nps.gov to arrange a date and time for a conference call or meeting. Thank you.

Sincerely,

John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6278

cc:
Kara Deutsch, National Park Service, DEWA
Amanda Stein, National Park Service, DEWA
Patrick Malone, National Park Service, DSC
Jennifer McConaghie, National Park Service, NER
Pamela Shellenberger, U.S. Fish and Wildlife Service
Wendy Walsh, U.S. Fish and Wildlife Service

Denver Service Center - TIC
Attn: SRLINE EIS
12795 W. Alameda Parkway
Denver, CO 80225-0287

BIOLOGICAL ASSESSMENT

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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Fax: 609/646 0352
http://www.fws.gov/northeast/njfieldoffice/

In Reply Refer To:

2008-I-0319

JUL 6 2012

Mr. John J. Donahue, Superintendent
Delaware Water Gap National Recreation Area and
Middle Delaware National Scenic and Recreational River
Bushkill, Pennsylvania 18324

Ms. Pamela Underhill, Superintendent
Appalachian Trail Park Office
P.O. Box 50
Harpers Ferry, West Virginia 25425

Dear Mr. Donahue and Ms. Underhill:

The U.S. Fish and Wildlife Service (FWS) has reviewed the National Park Service's (NPS) "Final Biological Assessment [BA] for Indiana Bat (*Myotis sodalis*) and Bog Turtle (*Glyptemys* [Clemmys] *muhlenbergii*)," received June 29, 2012. The BA was prepared pursuant to Section 7 the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA) for the Susquehanna to Roseland 500 kV Transmission Line (SRLINE) project, to be located in Pennsylvania and New Jersey. The FWS previously provided comments on a draft of the BA.

As described in the BA, surveys for the Indiana bat and bog turtle and their habitats have been conducted throughout that part of the action area that occurs within NPS units (Delaware Water Gap National Recreation Area [DEWA], Middle Delaware National Scenic and Recreational River, and Appalachian National Scenic Trail). The surveys were conducted by qualified surveyors in accordance with FWS-recommended survey methods, and FWS has concurred with the results.

No Indiana bats were captured during survey efforts, however, suitable habitat for this species is present in the action area. The BA lists a number of conservation measures that will be implemented for the Indiana bat, including a seasonal restriction on tree clearing.

A known bog turtle population occurs within the action area on the Pennsylvania side of DEWA. An access route has been located to avoid impacts to this population, and potential adverse effects of drilling on the groundwater flows to this wetland habitat have been evaluated and found to be discountable. In addition to the documented bog turtle habitat in Pennsylvania, one wetland area on the New Jersey side of DEWA is considered "confirmed bog turtle habitat," despite a negative Phase 2 (presence/absence) survey, based on the habitat quality and proximity to a nearby known population. The BA lists a number of conservation measures that will be implemented in the vicinity of these two wetlands (one in Pennsylvania, one in New Jersey), including fencing and monitoring during construction.

Based on the information and conservation measures presented in the BA, the FWS concurs that the proposed SRLINE project is not likely adversely affect the Indiana bat or bog turtle within NPS units. Except for the Indiana bat and bog turtle, no other federally listed or proposed threatened or endangered flora or fauna under FWS jurisdiction are known to occur within the NPS portion of the action area. If additional information on listed and proposed species becomes available or if project plans change, this determination may be reconsidered.

As discussed in previous correspondence, FWS must consider the effects of the entire SRLINE project, including off-park impacts, under Section 7 of the ESA. We are currently awaiting final conservation measures from the applicants, PPL and PSE&G, that will apply to off-park portions of the action area in Pennsylvania and New Jersey, respectively. Consultation between NPS and FWS will conclude upon final FWS concurrence with these off-park measures.

The FWS appreciates the cooperation of NPS in evaluating and minimizing potential adverse effects to listed species from the SRLINE project within NPS units. Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions or require further assistance regarding federally listed threatened or endangered species.

Sincerely,

for J. Eric Davis Jr.
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National Park Service

U.S. Department of the Interior

Appalachian National Scenic Trail
Delaware Water Gap National Recreation Area
Middle Delaware National Scenic and Recreational River

FINAL BIOLOGICAL ASSESSMENT FOR INDIANA BAT (*MYOTIS SODALIS*) AND BOG TURTLE (*GLYPTEMYS MUHLENBERGII*)

SUSQUEHANNA TO ROSELAND 500 KV TRANSMISSION RIGHT-OF-WAY AND SPECIAL USE PERMIT

ENVIRONMENTAL IMPACT STATEMENT

MAY 2012

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ACRONYMS AND ABBREVIATIONS

APPA	Appalachian National Scenic Trail
BA	biological assessment
B-K Line	Bushkill to Kittatinny Line
DEWA	Delaware Water Gap National Recreation Area
DBH	diameter at breast height
ESA	Endangered Species Act of 1973
EIS	environmental impact statement
kV	kilovolt
MDSR	Middle Delaware National Scenic and Recreational River
NERC	North American Electric Reliability Corporation
NJDEP	New Jersey Department of the Environmental Protection
NPS	National Park Service
PFBC	Pennsylvania Fish and Boat Commission
PEM	palustrine emergent wetlands
PSS	palustrine scrub shrub
PFO	palustrine forested wetlands
PPL	PPL Electric Utilities Corporation
PSE&G	Public Service Electric and Gas Company
ROW	right-of-way
S-R Line	Transmission Line Upgrade and Expansion from Susquehanna, Pennsylvania, to Roseland, New Jersey
USFWS	U.S. Fish and Wildlife Service
USFWS-NJFO	U.S. Fish and Wildlife Service -New Jersey Field Office
USFWS-PFO	U.S. Fish and Wildlife Service -Pennsylvania Field Office
WNS	white-nose syndrome

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

A consortium of utilities, consisting of PPL Electric Utilities Corporation (PPL) and Public Service Electric and Gas Company (PSE&G), jointly known as the applicant, propose to construct a 500,000-volt (500-kilovolt [kV]) transmission line from the Susquehanna Substation (Berwick, Pennsylvania) to the Roseland Substation (Roseland, New Jersey) (the S-R Line). The proposed transmission line would cross Delaware Water Gap National Recreation Area (DEWA), Middle Delaware National Scenic and Recreational River (MDSR), and Appalachian National Scenic Trail (APPA) in Pennsylvania and New Jersey. The purpose of the proposed action is to respond to the applicant's expressed request to construct a double-500kV power line across three units of the national park system, in light of the purposes and resources of the affected units of the national park system, as expressed in statutes, regulations, and policies. The applicant has applied for construction and right-of-way (ROW) permits for the crossings of these parks. The federal action under consideration for this Environmental Impact Statement (EIS) is granting or denying the applicant's proposal by issuing, issuing with necessary terms and conditions, or not issuing the requested construction and ROW permits. Consultation during the development of the EIS determined that there is potential for the federally endangered Indiana bat (*Myotis sodalis*) and the federally threatened bog turtle (*Glyptemys muhlenbergii*) to occur inside the study area within the boundaries of the parks. The potential presence of Indiana bat and bog turtle, protected under the Endangered Species Act of 1973, as amended (ESA), requires a Biological Assessment (BA).

1.2 PURPOSE

The purpose of this BA is to review the preferred alternative in sufficient detail to determine the potential effects of the proposed action on the federally protected Indiana bat and bog turtle and their habitats in compliance with Section 7 of the ESA. This BA is prepared to ensure that the preferred alternative would not threaten the potential for the existence of the Indiana bat and bog turtle within National Park Service (NPS) boundaries.

1.3 PREFERRED ALTERNATIVE

Alternative 2, the applicant's proposed alternative, has been chosen as the NPS preferred alternative. This BA evaluates the potential impacts to the Indiana bat and bog turtle that would result from the implementation of alternative 2.

1.4 AFFECTED SPECIES

1.4.1 Indiana Bat (*Myotis sodalis*)

The Indiana bat was listed as an endangered species in 1967 and is protected under the ESA. Indiana bats are found in low numbers throughout the eastern United States with an estimated population of 468,260 in 2007 (USFWS 2009). The U.S. Fish and Wildlife Service (USFWS) estimates about 1,000 Indiana bats reside in Pennsylvania (Butchkoski 2010). Indiana bats hibernate during the winter in caves, old mines, and tunnels with temperatures below 50º Fahrenheit but above freezing. During the summer Indiana bats roost in trees that are exposed to direct sunlight and close to a source of water. Reproductive females form small colonies under loose bark. Males also seek loose bark or cavities for summer habitats (Butchkoski 2010).

1.4.2 Bog Turtle (*Glyptemys muhlenbergii*)

The bog turtle is one of smallest turtles in North America and is separated taxonomically into two geographically distinct populations. The northern population, which is the population considered in this BA, ranges from Massachusetts to Maryland and was listed as a threatened species on November 4, 1997. The bog turtle occupies wetland habitat that is often found as transitional strips between drier upland areas and more thickly vegetated, wetter, wooded swamp or marsh. Unlike other turtle species, the bog turtle's home range is small, and the turtles rarely leave the marsh to forage in upland areas. In a survey of 200 colonies, most habitat areas were found to be less than two acres (EcolSciences 2010). As a result, the bog turtle is highly susceptible to habitat loss, degradation, and fragmentation. Bog turtles were formerly known to occur in 18 counties in New Jersey and 17 in Pennsylvania; they now are found in 13 counties in New Jersey and 15 in Pennsylvania. Most are found within the Delaware and Susquehanna River watersheds (USFWS 2001).

CHAPTER 2: PROJECT BACKGROUND AND ALTERNATIVES

2.1 PROJECT DESCRIPTION

The applicant's proposal, alternative 2, would include the construction of a double-circuit 500-kV transmission line consisting of new towers, conductors, and associated telecommunications infrastructure that would cross NPS lands within DEWA, MDSR, and APPA. Because alternative 2 would cross three units of the national park system, NPS permits would be required. The NPS cannot require the applicant to follow a certain route outside of the boundaries of NPS lands; therefore, the scope of the BA is limited to the portion of the route within the NPS boundaries.

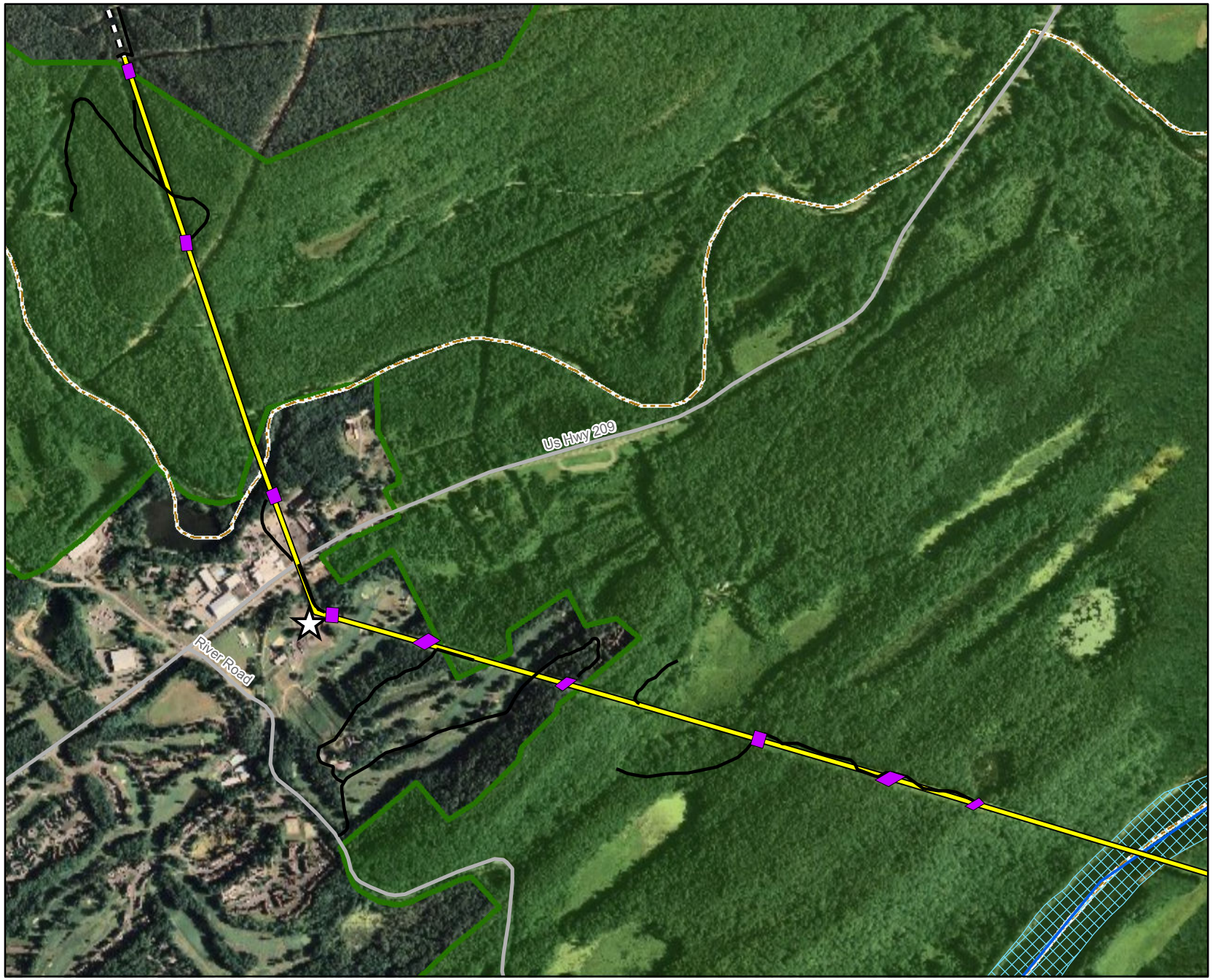
2.2 ALTERNATIVE 2 DESCRIPTION

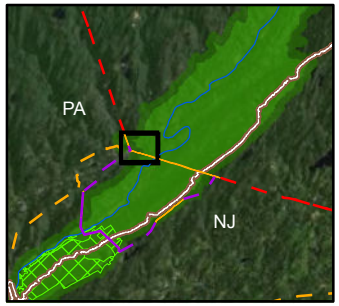
Alternative 2 would follow the corridor of an existing transmission line, the 230-kV Bushkill to Kittatinny Line (B-K Line) that traverses approximately 4.3 miles of DEWA. Within DEWA boundaries, the route also crosses MDSR and APPA. Figures 1 and 2 present the route of the alternative 2 alignment inside DEWA within Pennsylvania and New Jersey, respectively. The figures include the study area, access roads and the proposed tower locations.

The alignment would enter DEWA from the west in Pennsylvania approximately 0.25 mile east of Big Bushkill Creek. The alignment would cross approximately 0.6 mile of DEWA land and then exit the park. In the next approximately 0.68-mile section of the study area, the alignment would travel to the Bushkill Substation, cross a small (0.06-mile) portion of DEWA, cross the Fernwood Golf Course, and then re-enter DEWA south of the South Zone Ranger Station and north of DEWA Headquarters. The alignment would travel southeast within DEWA for approximately 0.85 mile, then cross 0.10 mile of MDSR just north of Depew Island. The route would enter New Jersey as it crosses the Delaware River and continue southeast approximately 2.4 miles past the Watergate Recreation Site and across APPA. The route would then traverse another 0.25 mile from APPA to the eastern DEWA boundary.

2.3 CLEARING AND CONSTRUCTION

Alternative 2 would require clearing vegetation for an additional 50 to 200 feet of ROW (table 1). Within the ROW, low-impact tree clearing is the preferred method. Low-impact tree clearing involves directional tree felling, both mechanically and by hand. A professionally created harvesting contract would provide specific regulations for clearing, which would aid in protection of cultural resources, wetland and stream areas, and overall residual quality of the site. A professional forester would be hired to oversee the project. Tree-clearing contractors experienced in low-impact tree clearing would be used. Equipment used to minimize impacts would include forwarders, feller bunchers, cable and grapple skidders, high-flotation tires, portable bridges, and temporary culverts. Skidding of trees along the ground would be limited to areas with low erosion potential, and a forwarder would be used in sensitive soil conditions. Days of operation would be limited to those days with suitable ground conditions. Additionally, trees would be cut close to the ground, and stumps and root systems would be left in place to provide additional soil stability. A 50-foot buffer would be used near intermittent streams and wetlands and a 100-foot buffer near perennial streams. All vegetation would be removed from access roads and in work areas (wire pulling locations, vegetation disposal areas, and structure erection areas).





Legend

- Substation
- Crane Pad/ Tower Location
- Inside Study Area
- Outside Study Area
- Appalachian National Scenic Trail
- Delaware River
- Proposed Access Road
- Road
- Delaware Water Gap National Recreation Area
- Middle Delaware National Scenic and Recreational River
- County Line

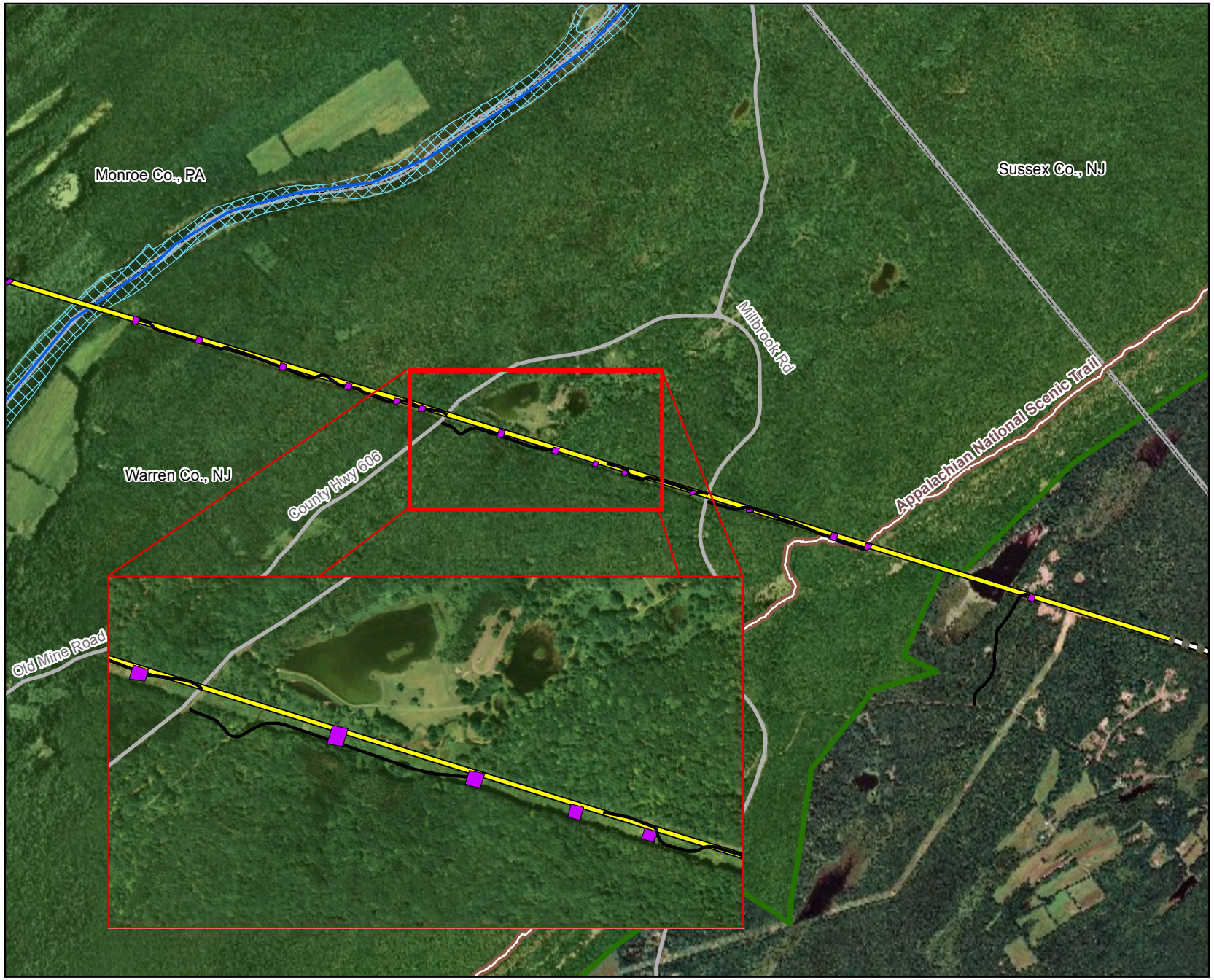
0 500 1,000
Feet

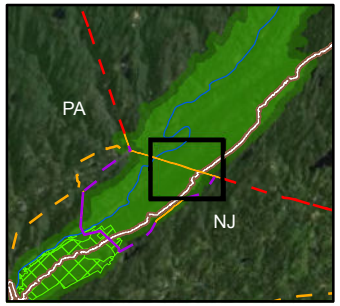
Susquehanna to Roseland Transmission Line Proposal and Right-of-Way Request EIS

Figure 1
Alternative 2 in Pennsylvania

Source: ESRI Streetmap 2006, Penn State 2010, ESRI ArcGISonline Map Service 2010, PennDOT 2011, USGS 2006, NJ DEP 2008, NWI 1977

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





Legend

- Crane Pad/ Tower Location
- Inside Study Area
- Outside Study Area
- Appalachian National Scenic Trail
- Delaware River
- Proposed New Access Road
- Road
- Delaware Water Gap National Recreation Area
- Middle Delaware National Scenic and Recreational River
- County Line

0 1,000 2,000
Feet

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

Figure 2
Alternative 2 in New Jersey

Source: ESRI Streetmap 2006, Penn State 2010, ESRI ArcGISonline Map Service 2010, PennDOT 2011, USGS 2006, NJ DEP 2008, NWI 1977

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

Clearing would be selective, and efforts to preserve native or compatible species would be made to the greatest extent possible. Species of trees recognized as being fast-growing species would be cut to ground level. Additionally, trees within the ROW that would violate the wire security zone either would be removed or would be pruned to create additional space for growth until scheduled maintenance. Cleared salable timber would be removed from the ROW and placed in neat piles at an NPS-designated site to be determined before construction. Timber would be the property of the United States. Other timber would be placed in tree-length piles away from preserved compatible vegetation. These piles would not be placed on access roads, streams, or trails, or in areas where piles would be highly visible from an improved road. Interspersed with these timber piles, slash piles would be stacked in flattened mounds on the edge of the ROW. Slash piles would also not be built where highly visible from improved roads or other locations with high visibility. Slash piles would not be placed near tower or pole sites. Cleared vegetation could also be chipped and scattered on the ROW. The NPS would not allow vegetation burning within the boundaries of the parks. Additionally, no vegetation disposal would occur within known or suspected wetland areas, and all timber piles, slash piles, and other cleared vegetation would be hauled away. After construction, the disturbed areas would be seeded with an NPS-approved conservation seed mix.

Alternative 2 would require new access roads, because old trails and roadbeds on which the access roads would be based are overgrown and would not allow access by large vehicles. Old trails and roadbeds would be cleared of vegetation; blade-graded to remove potholes, ruts, and other surface irregularities; and re-compacted to provide a smooth and dense surface capable of supporting heavy equipment. Proposed access road locations are shown in figures 1 and 2. The new access roads would be 20 feet wide to accommodate large construction vehicles. Generally, access roads would fall within the transmission line ROW, but in some instances, it would be necessary for access roads to extend outside the ROW. Alternative 2 would require a total of 5.3 miles of access roads, 1.9 miles of which would be outside the ROW. Acreages of disturbance due to access roads during and after construction are shown in table 1.

After construction, the roads would be narrowed to 15 feet and maintained permanently for future maintenance and vegetation management. The disturbed areas would be seeded with an NPS-approved conservation seed mix. Drainage structures (e.g., wet crossings, water bars, oversize drains, pipe culverts, energy dissipaters) would be installed along spur and access roads to allow for construction equipment use, as well as to prevent erosion from uncontrolled water flow. Slides, washouts, and other slope failures would be repaired and stabilized along roads by installing retaining walls or other means to prevent future failures. The type of mechanically stabilized earth-retaining structure used would be based on site-specific conditions. The applicant would be responsible for the long-term maintenance of access roads within the road and transmission line ROWs.

New spur roads may be required for pulling and splicing sites along the ROW. To minimize land disturbance, previously disturbed areas would be used where feasible. Locations of spur roads are currently unknown and would be placed according to the applicant's internal policy, subject to approval from the NPS. The applicant would be responsible for the restoration of spur roads immediately following the conclusion of construction activities. Restoration of spur roads would include removing all gravel, disposing of geotextile fabric, and seeding the area with an NPS-approved conservation seed mix.

2.4 OPERATION AND MAINTENANCE

No actions would occur during operation of the proposed S-R Line except for occasional maintenance as described below.

2.4.1 Facility Operations and Maintenance

Operation and maintenance of the S-R Line under alternative 2 would involve periodic inspection via helicopter and truck. Maintenance of the S-R Line would be performed on an as-needed basis, but is expected to occur at least once annually, and would include maintenance of access roads and erosion/drainage control structures.

Telecommunications infrastructure would be co-located on the transmission line and would be operated and maintained by the applicant's technicians. Preventive maintenance of telecommunications infrastructure would typically be scheduled every 6 months to ensure system reliability and performance with NPS approval.

2.4.2 Vegetation Management

PPL and PSE&G have separate vegetation management plans because they are distinct utility companies working in two different states. However, both companies must comply with the regulations issued in April 2006 in North American Electric Reliability Corporation Standard FAC-003-01. The NPS considers the applicant's current vegetation management plans, as described in the following paragraphs, to be insufficient, and the NPS will require a NPS-specific, NPS-approved vegetation management plan.

PPL has produced guidelines, *Specification for Initial Clearing and Control Maintenance of Vegetation on or adjacent to Electric Line Right-of-Way through Use of Herbicides, Mechanical, and Hand-clearing Techniques* (PPL 2010) and *Transmission Vegetation Management Program* (PPL 2011), which specify the wire zone–border zone technique of vegetation management. The wire zone is defined as 10 feet out from the centerline to the conductors. Vegetation that is near the wire zone presents a greater threat to the line; vegetation that grows into or falls onto the transmission lines could cause an outage. Within this zone, all native shrubs, grasses, herbaceous species, and low-growing shrubs would be preserved to the greatest extent possible during maintenance; however tree species would be removed if not compatible. The border zone stretches from the edge of the wire zone to the edge of the ROW. Vegetation allowed in the border zone can be more varied in height and is inclusive of small trees. Maintenance would include removal by cutting, pruning, and use of herbicides in some cases, with prior approval. All vegetation would be removed from access roads. In addition, danger trees outside the proposed ROW would also be pruned or removed. Danger trees are those that, in falling, would either strike the conductor or pass within the minimum conductor clearance, which is 10 feet for 500-kV transmission lines (PPL 2010; PPL 2011). Under PPL's vegetation management guidelines, vegetation would also be cleared within a 15-foot perimeter of towers, or adjacent to any structure.

The vegetation management practices employed in New Jersey by PSE&G are described in *Transmission Rights-of-Way Vegetation Management* (PSE&G 2009; PSE&G 2011). Vegetation management under PSE&G guidelines requires a 50-foot buffer beyond the structure foundation perimeter and the minimum clearance required between conductors and the nearest tree is 30 feet. Vegetation maintenance would be achieved by ground line maintenance and selective tree removal. Ground line maintenance requires all trees and shrubs to be cut to ground level or no more than 3 inches above ground level. Selective tree removal requires that all fast-growing tree species be cut to ground level; these species include white pine and tulip poplar, as well as species of ash and birch. Additionally, all dead, decayed, or dying trees would be removed. Danger trees would be identified and removed or pruned. Herbaceous plants and grasses and low-growing shrubs would be allowed to remain (PSE&G 2009; PSE&G 2011). It is assumed that under alternative 2, vegetation maintenance would require the periodic removal of larger individual trees outside the ROW.

TABLE 1: ELEMENTS OF THE ALTERNATIVES

Alternative Element	Alternative 2		
Route description inside the study area	The alternative 2 alignment would cross a total of 4.3 miles of NPS lands. The route would enter DEWA from Pennsylvania roughly 0.25 mile east of Big Bushkill Creek. The alignment would exit the park, travel across a developed area including Fernwood Golf Course, and reenter DEWA south of the South Zone Ranger Station and north of DEWA Headquarters, crossing MDSR just north of Depew Island. The route would continue southeast past the Watergate Recreation Site and across APPA to the eastern DEWA boundary. There would be no new crossing at APPA or MDSR.		
Total ROW expansion/conductor capacity	50–200 feet; 2 new 500 kV		
Removal of B-K Line from Bushkill Substation to the eastern DEWA boundary	Existing infrastructure would be removed and replaced by the new proposed double 500-kV towers		
Construction cost/Schedule	$2.17 billion; approximately 8 months		
Additional staffing needs for the NPS	2–3 new DEWA/MDSR staff members		
Total Miles/Miles within the study area	147; 5.6 miles, 4.3 miles of which would be on NPS lands		
Numbers of towers and tower foundations inside the study area	26- *6 new towers/tower foundations per mile.* **Typically, the foundation depth will range between 15 and 30 feet with a diameter of 6 to 9 feet.**		
Crane pads inside the study area	23- **Crane pads would be 100×100 feet, and would be used to set up a crane to erect the structures.** *Crane pads would be required at each tower location.*		
Wire pulls inside the study area[a]	5–6- *Wire pulling locations would be 200 feet × 200 feet and placed approximately every mile along the ROW.*		
Pulling and splicing sites inside study area	2- *On average, pulling and splicing equipment setups require an area of 400 feet × 600 feet outside the ROW where angles occur; two sites are needed per angle.*		
Staging area for the entire line[b]	70 acres- **Staging of all equipment/materials for work in DEWA would be located on currently cleared ROW.**[a]		
Access roads inside the study area	**Total:** 5.3 miles (inside ROW: 3.4 miles, outside ROW: 1.9 miles)	**Construction phase** Total: 12.8 acres (inside ROW: 8.3 acres, outside ROW: 4.5 acres)	**Postconstruction phase** Total: 9.6 acres (inside ROW: 6.2 acres, outside ROW: 3.4 acres)
	Access roads would be 20 feet wide during construction and would be reduced to and maintained at 15 feet after construction. The 15-foot-wide access roads would be permanent. Time to return to present conditions: 50 years or perhaps never.		

Note: Items in **bold** are conditions presented in the applicant's proposed plan (PPL and PSE&G 2008). Items in *italics* are presented in chapter 2 of the EIS. These elements were provided where details were absent from the applicant's proposed plan (PPL and PSE&G 2008) and were based on industry standards.

a. The number of wire pulls was estimated based on the assumption that helicopters would not be used to string the conductor. This presents the most conservative estimate; however, impacts would be reduced if helicopters were used for stringing the conductors.

b. Staging area acreage is an estimate based on the length of the line from Susquehanna to Roseland. The applicant's proposed plan states that all equipment and materials would be staged within the currently cleared ROW. The NPS does not agree. Where staging areas extend beyond the cleared ROW, the NPS would require the applicant to construct the staging areas outside NPS lands.

CHAPTER 3: AGENCY CONSULTATION

3.1 DISCUSSIONS BETWEEN THE APPLICANT AND USFWS

During 2008 through 2009, discussions with the USFWS were initiated by PPL for alternative 2 in Pennsylvania. Concurrently, PSE&G and USFWS discussed the portion of the proposed S-R Line in New Jersey. During this discussion, both the Pennsylvania and New Jersey USFWS field offices identified the Indiana bat and the bog turtle as federally-listed species that could be potentially affected by the proposed project. NPS was invited to and attended the meetings, which included a discussion of bog turtles but not Indiana bats. The NPS was involved in these discussions; however, because they were not initiated by NPS as part of the consultation process, the meetings are not considered as consultation within the purview of this BA, but they do provide useful information. The prior history of discussions between the applicant and the USFWS field offices are summarized below.

3.1.1 Indiana Bat

The USFWS Pennsylvania Field Office (USFWS-PFO), in a letter dated October 16, 2008, recommended a bat survey of the project area using USFWS guidelines (USFWS 2008a). USFWS-New Jersey Field Office (USFWS-NJFO) in their letter of March 17, 2008 provided preliminary recommendations to protect Indiana bat and stated that it may request a bat survey within the project area in NJ (USFWS 2008b).

Mist netting and investigations of mine portals within Monroe, Pike, Wayne and Lackawanna counties in Pennsylvania and Warren County, New Jersey along alternative 2 and access roads for the S-R Line were conducted in May, June, July, and August 2009 by Sanders Environmental, Inc. These investigations included NPS lands along alternative 2. Potential hibernacula for Indiana bats were found at mine portals and deployment of harp traps at the mine portals captured thirteen bats of two species; however, none of the bats were Indiana bats. Mist netting was also conducted at 136 mist net sites along alternative 2. Mist net surveys resulted in capturing 665 bats of eight species; however, no Indiana bats were captured during the efforts (Sanders 2009).

After surveys were completed in the summer of 2009, Sanders Environmental, Inc. concluded that the proposed project was unlikely to adversely affect the Indiana bat (2009). USFWS-PFO determined in a letter dated January 27, 2010 that after review of the survey report, alternative 2 was not likely to adversely affect Indiana bat assuming the implementation of proposed protection and mitigation measures (USFWS 2010a). An additional letter was sent to the applicant from the USFWS-PFO on 17 April 2012 providing an update to the 27 January 2010 letter. The letter notes that all known direct impacts to Indiana bats would occur outside of the DEWA (USFWS 2012a).

An agency response letter from the USFWS-NJFO to the applicant was received on June 11, 2010 (USFWS 2010b). ***However, this letter addressed only the eastern segment of alternative 2 within New Jersey, between Hopatcong and Roseland, well are outside of NPS boundaries.*** The June 2010 response letter from USFWS-NJFO stated that the project has the potential to affect the Indiana bat unless specific New Jersey Department of Environmental Protection (NJDEP) permit conditions are implemented (USFWS 2010b), including:

- All conservation measures recommended by the USFWS-NJFO and adopted by the applicant, as stated in the document entitled: *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project*.

- USFWS-NJFO concurrence with final compensatory mitigation plans for forest impacts including: (1) preservation, enhancement, and / or restoration of Indiana bat habitat as one component of the 100- to 200-acre Highlands Forest restoration / education pilot site at the Hopatcong Switching Station; and (2) preservation, enhancement, and / or restoration of Indiana bat habitat at a site along the Passaic River.

In addition, the USFWS-NJFO noted that the applicant agreed to the recommended conservation measures for the Indiana bat. USFWS-NJFO stated that *with implementation of the above permit conditions, the USFWS concurs that, even considering cumulative impacts (i.e., from other portions of the route), the loss of approximately 21 acres of potential summer roosting and foraging habitat from construction of the eastern portion (New Jersey) of the project is insignificant based on the following:*

- The impacts are spread across a 25-mile linear project.
- The areas with the greatest impacts have been evaluated for Indiana bat habitat (Roseland Switching Station, Picatinny Arsenal) or surveyed using the USFWS mist net guidelines (USFWS 2011a) at the Hopatcong Switching Station and Fredon Relocation Site).
- In those areas identified by USFWS-NJFO as hibernacula and / or maternity colony foraging habitat, the applicant will not install any permanent structures (e.g., access road, tower) within 300 feet of wetlands or open waters and will not clear trees or locate temporary work spaces within 150 feet of wetlands or open waters.
- The applicant will provide compensatory mitigation for forest impacts, as described above.

USFWS-NJFO noted that to minimize cumulative impacts to Indiana bat habitat, additional information, surveys, and / or conservation measures may be necessary for the western segment of project in New Jersey (Delaware River to Hopatcong).

With implementation of the above permit conditions, USFWS-NJFO concurred that the risk of disturbance or injury to roosting bats from construction of the eastern segment of the project (outside of NPS lands in New Jersey) would be insignificant and discountable based on the seasonal restrictions included in PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project* (PSE&G 2010).

3.1.2 Bog Turtle

The USFWS-PFO, in a letter dated 16 October 2008, stated a determination that construction of the proposed project is not likely to adversely affect the bog turtle. However, should structures need to be located in the wetland and/or the ROW needs to be widened, further consultation with the USFWS-PFO will be necessary (USFWS 2008a). A letter from the USFWS-PFO from 27 January 2010 noted that the project would be not likely to adversely affect the bog turtle if the southern access route was used for construction and implementation, and if seasonal restrictions were put in place (USFWS 2010a). The 17 April 2012 letter from the USFWS-PFO noted a March 19, 2012 conference call indicating that the southern access road would be used. The letter provides recommendations for a seasonal restriction for construction of access roads and tower replacements, or a bog turtle survey completed with conditions outlined in the letter. A 300-foot buffer around wetlands and no felling of trees into wetlands were suggested for all work activities. The letter concludes that if the project is implemented with the southern access route and conditions for construction, the project is not likely to adversely affect the bog turtle (USFWS 2012a).

The USFWS-NJFO, in a letter dated 17 March 2008, provided locations of known bog turtle populations as well as areas of potential bog turtle habitat and preliminary recommendations to protect the bog turtle. In addition, USFWS-NJFO stated that it may request a Phase I or II bog turtle survey within the project area in New Jersey (USFWS 2008b).

An agency response letter to the applicant was received from the USFWS-NJFO on June 11, 2010 (USFWS 2010b). ***However this consultation response letter addressed only the eastern segment of alternative 2 within New Jersey, between Hopatcong and Roseland, well outside of NPS boundaries.*** The USFWS-NJFO stated that the project has the potential to affect the bog turtle in New Jersey unless specific NJDEP permit conditions are implemented, including all conservation measures recommended by the USFWS-NJFO and adopted by the applicant, as stated in the document entitled: *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project* (PSE&G 2010). Measures listed include no permanent structures located within 300 feet of confirmed bog turtle habitat, no temporary disturbances within 150 feet of confirmed bog turtle habitat, the installation of silt fences in any span with confirmed bog turtle habitat, and no improvement or enlargement of existing access roads (PSE&G 2010). The USFWS-NJFO stated that with the implementation of the above permit conditions, impacts to the bog turtle from construction of the eastern portion of the project will be insignificant and discountable. This determination is based on the extensive surveys already completed in New Jersey (listed below) and on the habitat buffers, fencing, and monitoring protocols adopted and detailed in PSE&G's revised Construction and Restoration Standards as noted above. The following bog turtle surveys have been conducted and the USFWS-NJFO has concurred with the results:

- Phase I ROW (July 8, 2008)
- Phase I DEWA (December 23, 2008)
- Phase II for 5 wetlands (June 18, 2009)
- Phase I Hopatcong Switching Station (July 29, 2009)
- Phase I access roads in eastern portion of project (March 23, 2010)
- Phase I for 11 additional spans (June 8, 2010)
- Phase II for 5 wetlands (July 8, 2010)
- Phase I for 11 additional wetlands (January 25, 2011)
- Phase I for 5 additional wetlands (January 25, 2012)

3.2 ESA SECTION 7 CONSULTATION

NPS initiated consultation with USFWS through letters sent February 10, 2010. No response to the consultation letters was received from USFWS. NPS also consulted with USFWS through a July 2010 *Preliminary Alternatives Newsletter*. A response letter to the newsletter was received from the USFWS-NJFO on October 21, 2010 (USFWS 2010c). The USFWS-NJFO indicated that the Indiana bat and the bog turtle are potential species of concern for this project; ***however the consultation response letter included areas of the alternatives that are outside of NPS boundaries and within New Jersey***. Input from USFWS-PFO has been coordinated through USFWS-NJFO, the lead office for this project, since NPS requested a single point of contact for the consultation. Coordination and consultation between the NPS and the USFWS field offices in New Jersey and Pennsylvania is ongoing at this time in regard to ESA Section 7 Consultation for the Indiana bat and the bog turtle.

On February 7, 2011, NPS invited the USFWS to become a cooperating agency in the environmental review of the S-R Line (NPS 2011a). The USFWS agreed to be a cooperating agency on the project on March 14, 2011, noting that some of the proposed alternatives would cross within the boundary of the Cherry Valley National Wildlife Refuge, and the USFWS has interests and information concerning wildlife and habitat at the site (USFWS 2011b).

The USFWS also provided a letter on 31 January 2012 with comments on the DEIS, and on impacts to the bog turtle and Indiana bat. The letter notes impacts from the alternatives on the Indiana bat and bog turtle. The letter does not provide recommendations for further Indiana bat or bog turtle surveys along alternatives 2 and 2b, and acknowledges surveys for alternatives 3, 4, and 5. The letter concludes that impacts for these alternatives are not likely to adversely affect the Indiana bat or bog turtle, but that if this species is found, conservation measures would need to be developed (USFWS 2012b).

3.2.1 Indiana Bat

In the first agency response letter addressed to NPS dated October 21, 2010, the USFWS-NJFO confirmed concurrence with the determination in the June 11, 2010 USFWS-NJFO letter to the applicant that alternative 2 is not likely to adversely affect the Indiana bat (in New Jersey) based on the adoption of the conservation measures cited in the same letter of June 11, 2010 (USFWS 2010b; 2010c).

If the conservation measures that were agreed upon between the applicant and USFWS previously cannot be implemented for any particular span, the applicant has agreed to work with USFWS-NJFO to develop alternative, site-specific conservation measures sufficient to avoid adverse effects on the Indiana bat.

USFWS-NJFO further recommended a seasonal restriction on tree clearing from April to November 15 within 10 miles of known hibernacula, and from April 1 to September 30 in other parts of the species' range in New Jersey in their letter of October 21, 2010.

3.2.2 Bog Turtle

In the first agency response letter addressed to NPS dated October 21, 2010, the USFWS-NJFO confirmed concurrence with the determination in their June 11, 2010 letter that alternative 2 is not likely to adversely affect the bog turtle (in New Jersey) based on the adoption of the conservation measures cited in the June 11, 2010 letter (USFWS 2010b; 2010c).

CHAPTER 4: INDIANA BAT

The Indiana bat is a temperate, insectivorous, migratory bat that hibernates in mines and caves in the winter and summers in wooded areas. The species was originally listed as being in danger of extinction under the Endangered Species Preservation Act of 1966 (32 FR 4001, March 11, 1967), and is currently listed as endangered under the ESA (USFWS 2007).

4.1 SPECIES DESCRIPTION

The Indiana bat is a medium-sized bat with a total body length of approximately 3-½ to 5-½ inches and a wingspan averaging ten inches. The Indiana bat closely resembles two other species of *Myotis:* the little brown bat (*M. lucifugus*) and the northern long-eared bat (*M. septentrionalis*). Indiana bats are distinguished from the northern long-eared bat by the long, pointed, symmetrical prominence in front of the opening of the external ear (tragus). The Indiana bat is distinguished from the little brown bat by a distinctly keeled calcar (a spur of cartilage that supports the membrane between the foot and tail). In addition, the hind feet of an Indiana bat tend to be small and delicate, with fewer, shorter hairs (the hairs do not extend beyond the claws); the nose is lighter in color; the ears and wing membranes have a dull appearance and flat coloration that does not contrast with the fur, and the fur lacks luster (compared with that of little brown bats); and the skull of an Indiana bat has a small sagittal crest, and the braincase tends to be smaller, lower, and narrower than that of the little brown bat (USFWS 2007).

4.2 GENERAL LIFE HISTORY

The Indiana bat is migratory, hibernating in caves and mines in the winter and migrating to summer roost habitat. Reproductive females may migrate great distances, up to 357 miles, to form maternity colonies to bear and raise their young. Male Indiana bats and non-reproductive females typically do not roost in colonies and may stay close to their hibernaculum or migrate long distances to their summer habitat. Both male and female Indiana bats return to hibernacula in late summer or early fall to mate and enter hibernation (USFWS 2007).

4.2.1 Habitat Requirements

Due to its migratory behavior, the Indiana bat has requirements for two different types of habitat.

Winter Habitat Requirements: Suitable hibernacula in caves or mines provide stable internal temperatures (generally below 10°C [50°F] but above freezing 0°C [32°F]); relatively high humidity, and air flow (Butchkoski 2010). These criteria, in combination provide thermal protection for the Indiana bat and help to maintain physiological requirements during hibernation. Historically, caves that provided large volume, with rooms or vertical passages below the lowest entrance level sheltered the largest populations of hibernating Indiana bats. Caves with large volumes buffer the cave environment against extreme changes in outside temperature, and complex vertical structure offers a wide range of temperatures and, therefore, diversity of roosting sites. In some areas, the largest and most rapidly growing populations of Indiana bat occur in abandoned mines and at caves where measures have been implemented to restore hibernacula (USFWS 2007).

Indiana bats, especially females show site fidelity, returning annually to the same hibernacula, though movement to man-made hibernacula (such as abandoned mines) occurs as sites become available. Indiana bats often winter in the same hibernaculum with other species of bats and are occasionally observed clustered with or adjacent to other species, including gray bats (*Myotis grisescens*), Virginia big-eared bats (*Corynorhinus townsendii virginianus*), little brown bats, and northern long-eared bats.

Summer Habitat Requirements: Indiana bats first arrive at their summer locations as early as April or early May. During this mid-spring period prior to giving birth, adult females occupy trees that are similar to those used in maternity colonies in summer in terms of species, size, and structure. Most maternity colonies of Indiana bats that are known exist in fragmented landscapes with low-to-moderate forest cover. Documented habitat for maternity roosts includes riparian, bottomland and floodplain habitats, as well as upland vegetation communities or a mixture of upland and riparian habitat (USFWS 2007). Approximately 97 % of roost trees at maternity sites are deciduous species; however, Indiana bats consistently use coniferous trees at some sites during autumn swarming (USFWS 2007). Maternity colonies primarily occupy dead and dying trees in early to middle stages of decay. Primary roosts are located under exfoliating bark though living trees can also provide roost habitat such as the naturally peeling bark of shagbark (*Carya ovata*) and shellbark hickories (*Carya lacinosa*), and occasionally white oak (*Quercus alba*). At least thirty-three species of trees have been known to supply roosts for female Indiana bats and their young: 87 % are species of ash (*Fraxinus* spp.), elm (*Ulmus* spp.), hickory (*Carya* spp.), maple (*Acer* spp.), poplar (*Populus* spp.), and oak (*Quercus* spp.); hickory, oak and maple comprise 52 % of the roost tree species (USFWS 2007). Roost trees vary in size and the height and position of the snag relative to surrounding trees is important to selection because relative height and position affect the amount of solar exposure; primary roosts usually receive direct sunlight for more than half the day. The roost tree is typically within canopy gaps in a forest, in a fence line, or along a wooded edge within 50 feet of a forest edge (USFWS 2007).

Maternity colonies typically use 10 to 20 trees each year, but only one to three of these are primary roosts used by the majority of bats for some or all of the summer. In addition to a primary roost, alternate roosts are used by individuals or a small number of bats and may be used intermittently throughout the summer. On average, Indiana bats switch roosts every two to three days. Various trees used by the same individual tend to be clustered, and roost trees most often are in sunny openings in the forest created by human or natural disturbance. Indiana bats exhibit site fidelity to their traditional summer maternity areas and roost trees may be occupied by a colony for a number of years until they are no longer available or suitable (USFWS 2007). Non-reproductive females may also roost individually or in small numbers, including in the same trees as reproductive females (USFWS 2007).

Some adult male Indiana bats form colonies in caves in summer, but most are solitary and roost in trees. Similar to female Indiana bats, adult males roost primarily under bark and less often in narrow crevices. Tree species used by males generally are similar to those chosen by females though males will use smaller trees more often than females and may be more tolerant of shaded sites. Males also occasionally roost with reproductive females in the same tree.

Indiana bats may also use habitat near winter hibernation sites as (1) spring roost sites upon emergence from hibernacula; (2) fall roost sites during swarming and mating prior to hibernation; and (3) by males and non-reproductive females that may not migrate to summer habitat and instead may remain near the winter hibernation site. This habitat is similar to summer roost habitat (i.e., bats typically roost under exfoliating bark, with occasional use of vertical crevices in trees). Tree species are also similar to summer sites, although various pines (*Pinus* spp.) are commonly occupied in spring and fall. During this time, Indiana bats tend to roost more as individuals than in summer (USFWS 2007).

Night roosting may occur most often at sites not generally used as day roost but night roosts may also occur at the bat's day roost in conjunction with nocturnal tending of its young or during inclement weather (USFWS 2007).

4.2.2 Biological and Behavioral Characteristics

Reproduction: Mating occurs in the fall during swarming at hibernation sites, and females store sperm through the winter giving birth to a single young in June or early July while in their maternity roosts. Asynchronous births in the maternity colony result in variable sizes and ages of juveniles in the same colony. Lactation begins at birth and continues through the early flight period of young Indiana bats; young are able to fly (volant) within 3-5 weeks of birth. Once the young Indiana bats are volant, the maternity colony begins to disperse during the first two weeks in August, and the use of primary maternity roosts diminishes. The bats may stay in the maternity roost area until migration, although some large colonies may maintain a steadily declining number of bats into mid-September through early October and it is thought that late migrants may be young-of-the-year (USFWS 2007).

Food Habits: Indiana bats typically forage in closed to semi-open forested habitats and forest edges though visual observations suggest that foraging over open fields or bodies of water, more than 50 meters (150 feet) from a forest edge, does occur (USFWS 2007). Indiana bats hunt primarily around the canopy of trees, and occasionally descend to sub-canopy and shrub layers. In riparian areas, Indiana bats primarily forage around and near riparian and floodplain trees, as well as solitary trees and forest edges on the floodplain (USFWS 2007).

Indiana bats feed primarily on four orders of flying insects: Coleoptera (beetles), Diptera (flies), Lepidoptera (butterflies), and Trichoptera (caddisflies). Hymenopterans (winged ants) are abundant in the diet of Indiana bats for brief, unpredictable periods corresponding with the sudden occurrence of mating swarms.

Home Range: Indiana bats occupy distinct home ranges, particularly in the summer; however, relatively few studies have determined the home ranges of Indiana bats and calculations were based on a small number of individuals and a variety of statistical analyses. In general, mean home range estimates varied from a high of 1,648 acres in Missouri to a low of 205 acres in Vermont; intermediate home range sizes were identified for Virginia (618 acres) Kentucky (385 acres), and Illinois (357 acres). In addition, maternity colonies of Indiana bats also appear to be faithful to their foraging areas within and between years (USFWS 2007).

Migration: Spring emergence of Indiana bats from hibernacula varies across their range by latitude and weather. Females emerge earlier than males, generally emerging in early April and completing emergence by early May; males were found to emerge in early May and by mid-May few were left hibernating. At the Mt. Hope mine complex in New Jersey, peak spring emergence of females was in early April, and emergence of males peaked at the end of April and exit counts from several hibernacula in southern Pennsylvania and Big Springs Cave in Tucker County, West Virginia suggest that peak emergence from hibernation is mid-April (USFWS 2007).

Indiana bats have been found to travel long distances to and from hibernacula from an average of 296 miles to a maximum migration of 357 miles in one study; shorter migration distances are also known to occur (USFWS 2007). Indiana bats at multiple locations in Indiana were found in hibernacula only 34 to 50 miles from their summer range. Insufficient data are available to determine habitat use and needs for Indiana bats during migration.

Use of Corridors: Many species of bats, including the Indiana bat, consistently follow tree-lined paths rather than cross large open areas and as a result, suitable patches of forest may not be available to Indiana bats unless the patches are connected by a wooded corridor. Unfortunately, biologists do not know how large an open area must be before Indiana bats hesitate or refuse to cross. Studies have documented Indiana bats crossing interstate highways and open fields and also showed that Indiana bats

increased commuting distance by 55 % to follow tree-lined paths, rather than flying over large agricultural fields, some of which were at least 1-kilometer (0.6 mile) wide (USFWS 2007).

Hibernation: Most Indiana bats enter hibernation by the end of November (mid-October in northern areas) although populations of hibernating bats may increase throughout fall and into early January at some hibernacula (USFWS 2007).

Indiana bats cluster on the ceilings and side walls of underground hibernacula, in caves or cave-like locations such as abandoned mines. The Indiana bat hibernates in clusters of about 250 to 300 bats per square foot although cluster densities as high as 500 bats per square foot have been recorded. It is thought that behavioral thermoregulation, in the form of clustering, allows Indiana bats to hibernate at a wider range of ambient temperatures than would be possible for non-colonial species.

4.3 HISTORIC RANGE, CURRENT DISTRIBUTION, POPULATION LEVEL

Historically, the winter distribution of Indiana bats was restricted to caves in limestone karst regions of about 24 states from Vermont, Massachusetts and Connecticut through the northeastern states to Alabama, Georgia, Florida and west through Illinois, Indiana, Iowa, Wisconsin, Michigan, Missouri and Oklahoma. Winter hibernacula are no longer active in Florida, Georgia, Iowa, Massachusetts, and Wisconsin (USFWS 2007). However, in a few instances the Indiana bat has expanded its range outside of the historic winter range as a result of occupying man-made structures (USFWS 2009).

The summer distribution of Indiana bat maternity colonies include portions of 16 states from Vermont, New York, New Jersey, Pennsylvania and Maryland through West Virginia, Kentucky, Tennessee, and Alabama then westward to Ohio, Indiana, Illinois, Iowa, Missouri, Arkansas and Oklahoma. The states with the largest number of identified maternity colonies are Indiana (83), Kentucky (32), New York (31), Illinois (28), and Iowa (27) (USFWS 2007).

When listed as an endangered species in 1967, the Indiana bat population was estimated to be around 880,000 bats (USFWS 2009). The 2009 population estimate for Indiana bats was about 387,000 (USFWS 2011c).

In Pennsylvania the Indiana bat was historically found at eight hibernation sites and Indiana bats are now found at 18 hibernation sites within 11 Pennsylvania counties. A total of approximately 1,000 Indiana bats are known to hibernate within the identified sites (Butchkoski 2010). During the summer, nine maternity sites have been found in seven counties. Some counties contain both winter hibernation and summer sites (Butchkoski 2010). In New Jersey Indiana bats are known to hibernate in the Hibernia Mine in northern New Jersey and summer roosts have been identified in riparian areas (NJDEP 2001).

4.4 THREATS

The of decline of Indiana bats can be attributed to commercialization of caves, microclimate changes in caves, loss of summer habitat and habitat connectivity, environmental contaminants, collisions with man-made objects and disease including white-nose syndrome (WNS). Of these the most significant threats are habitat loss / degradation, forest fragmentation, winter disturbance of hibernacula, environmental contaminants, and WNS. WNS is a fungus (*Geomyces destructans*) found on faces and wings of affected bats. WNS has killed over a million bats since 2006 (USFWS 2011c).

The 5-year review of the Indiana Bat Draft Recovery Plan, First Revision (USFWS 2009) raised the recovery priority for Indiana bat from 8 (moderate degree of threat; high recovery potential) to 5 which means that the degree of threat is increased from moderate to high and the potential for recovery is now

considered low. Initially the Indiana bat population increased from 2003-2007 as a result of the implementation of increased conservation measures on hibernation sites. With the introduction of WNS the population has begun to decline in affected areas and recovery of the species is compromised (USFWS 2009).

4.5 DESIGNATED CRITICAL HABITAT

Important caves and mines for the hibernation of the Indiana bat have been designated in as "critical habitat" in six states; however, no critical habitat for Indiana bat has been designated in Pennsylvania or New Jersey (USFWS 2009; USFWS 2011c). USFWS has defined priority hibernacula based on the number of bats that are contained by the hibernacula. Priority 1 hibernacula contain at least 10,000 Indiana bats and are considered essential for the recovery and long-term conservation of the species. The other priority categories are: Priority 2 (1,000 to 9,999), Priority 3 (50-999), and Priority 4 (1-49) hibernacula. Neither Pennsylvania nor New Jersey contains a Priority 1 hibernaculum; however, Pennsylvania contains one Priority 2 hibernacula. Pennsylvania also contains three Priority 3 and seven Priority 4 hibernacula; New Jersey contains two Priority 3 hibernacula (USFWS 2007).

4.6 EFFECTS OF PROJECT ACTIONS

4.6.1 Construction

Summer habitat is present along alternative 2 within NPS boundaries. However, surveys conducted along alternative 2 identified tree roosting bat species, including a state-listed species, northern myotis, but did not detect any Indiana bats. This could indicate that Indiana bats are not present or are present in low numbers and not easily detected by the surveys (Sanders 2009). Approximately 240 acres would be cleared initially in the ROW, with approximately 129 acres of this identified as mature forest. Pulling and splicing sites would be constructed outside the 350-foot corridor, resulting in approximately 22 acres of forest cleared for these sites and the associated spur roads; trees surrounding the pulling and splicing sites would be trimmed but not removed (unless unavoidable) to allow for construction activities. Approximately 9.6 acres of vegetation would be permanently lost through the development of access roads. Summer roosting and foraging habitat could be affected by the removal of trees during clearing and construction activities, which may adversely affect any roost sites or maternity colonies that may be present. As nocturnal foragers, Indiana bats feed mainly in the tree canopy and may use the linear space of ROWs, trails, or over streams as travel and foraging corridors. Foraging activities should not be affected unless construction activities occurred at night. If construction occurred at night, noise and activity could deter foraging; however, the use of lights to illuminate construction sites could also attract bats to the arc of lighting to feed on insects attracted to the light.

Transmission line construction at several river and stream crossings under alternative 2 would be expected to have few impacts on bat foraging and roosting habitat.

Due to the potential impacts to summer habitat for Indiana bat, the applicant has specified that USFWS-approved conservation measures would be implemented to ensure that the project would not be likely to adversely affect the Indiana bat. For example, seasonal restrictions would be followed in the applicant's construction schedule and restoration standards for the S-R Line project would be followed to reduce and avoid any unforeseen disturbance or injury to roosting Indiana bats from the construction of the project. Seasonal restrictions for the cutting of potential roost trees (trees with a diameter at breast height [DBH] greater than 8.7 inches [22 centimeters]) would prohibit cutting between April 1 and September 30, when Indiana bats could be present. Additional conservation measures are listed below in Section 4.7: Proposed Mitigation Measures.

Mitigation that has been specified for impacts on forested habitat could also offset any unforeseen impacts on the Indiana bat resulting from the proposed project under alternative 2. Projects include the Hopatcong Forest Restoration Project and mitigation proposed along the Passaic River (USFWS 2010c).

Two caves, Coppermine and Cold Air Cave occur along MDSR 3.1 and 10.5 miles, respectively, from the centerline of the ROW under alternative 2 and could provide potential winter hibernacula sites. Surveys to determine the potential for winter and summer Indiana bat habitat within the existing ROW of alternative 2 by Sanders (2009) did not extend outside of the ROW to the areas where these caves are located. Indiana bats are known to hibernate in nearby counties, and it is possible that individuals from these wintering sites could be present within NPS boundaries during the breeding season (April through September).

Additional surveys for Indiana bat winter and summer habitat will be conducted by USFWS-approved certified surveyors according to the USFWS protocol prior to the initiation of any construction for alternative 2 as discussed in Section 4.7: Proposed Mitigation Measures.

4.6.2 Operation

No adverse impacts to Indiana bats are expected as a result of the operation of the proposed transmission line. Because Indiana bats are known to forage in the tree canopy and within edge habitat, operation of the S-R Line within NPS boundaries has the potential to create foraging habitat where adjacent potential summer (forested) habitat creates an "edge" to the ROW. Indiana bats may also use the maintained ROW as a travel and foraging corridor, especially in riparian areas and near stream crossings.

4.6.3 Maintenance

Similar to operation of the transmission line, no adverse impacts are expected to Indiana bats during routine maintenance of vegetation under the ROW; however, if it becomes necessary to remove problem trees along the edge of the ROW, mitigation measures should be employed as outlined for tree removal during construction and in Section 4.7: Proposed Mitigation Measures.

4.7 PROPOSED MITIGATION MEASURES

No Indiana bats were captured during mist net survey efforts in 2009 (Sanders 2009), however, suitable habitat for this species is present in the action area. In the spring prior to vegetation clearing, NPS will coordinate with USFWS to determine if any areas of particularly suitable habitat should be re-surveyed for summering Indiana bats. Survey results would be submitted to USFWS for review and concurrence. Surveys conducted prior to vegetation clearing activities are particularly important because construction would not occur for some time following the completion of the NEPA process and Indiana bats could begin using habitat between site surveys and construction activity. Repeat survey efforts may also be warranted if substantial changes to the USFWS summer survey protocols, now in draft, become finalized prior to the start of vegetation removal.

Construction monitoring will be conducted both during construction and during post-construction vegetation maintenance. Areas of high-suitability Indiana bat habitat will be flagged and avoided during construction if possible. The purpose will be to flag and preserve the highest-suitability roost trees to the maximum extent practical, including: live shagbark hickories (*Carya ovata*) over 9 inches dbh; lightening-struck trees over 9 inches dbh; dead, dying, or damaged trees of any species over 9 inches dbh with at least 10% exfoliating bark; den trees, broken trees, or stumps over 9 inches dbh and over 9 feet in height; and live trees of any species over 26 inches dbh. When practical, trees over 9 inches dbh will

girdled instead of cut. Construction monitoring may also include use of acoustic detectors, if such methods are recommended by USFWS.

In addition, a species-specific Conservation and Mitigation Plan will be prepared and implemented by recognized and qualified zoologists, including individuals recognized by the USFWS or state conservation agencies. Adherence to the approved Indiana Bat Conservation and Mitigation Plan will be required as a condition of any NPS permit authorizing the project. A Conservation and Mitigation Plan will include:

- Target areas and methodology for repeat summer survey effort, as discussed above.
- Construction monitoring, as described above.
- A seasonal restriction will prohibit cutting of trees greater than 5 inches dbh between April 1 and September 30 (restricted season), both during construction and during post-construction vegetation maintenance.
- If hibernacula are identified within 10 miles of the action area, the restriction on tree clearing will be implemented from April 1 to November 15.
- The modification of the locations for towers, access roads, laydown areas, and other ground-disturbing activities would be implemented in order to minimize areas of suitable Indiana bat summer habitat. Trees that have the potential to provide roost habitat for Indiana bat would be reserved to the extent practicable.
- Tree clearing for temporary access or temporary work spaces will be prohibited.
- No permanent structure (e.g., access road, tower) will be installed within 300 feet of wetlands or open waters. No temporary work spaces will be located within 150 feet of wetlands or open waters.
- No blasting will be authorized within NPS units.
- For any compensatory mitigation to offset tree loss in NPS units, NPS will work with USFWS to incorporate the planting of tree species that are likely to become suitable roosts for the Indiana bat.

4.8 CUMULATIVE EFFECTS ANALYSIS

Cumulative effects are those effects of future state or private activities, not involving federal activities, which are reasonably certain to occur within the action area of the federal action subject to consultation [50 CFR §402.02]. This definition applies only to Section 7 analyses and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws.

Actions inside the parks could adversely affect Indiana bats including utility projects that may require tree clearing, or disturbance to potential habitat such as: the Tennessee Gas Line Proposal (addition to an existing gas pipeline), the Columbia Gas Transmission Company pipeline (replacement of an existing gas pipeline), and the Northeast Supply Link Expansion (Palmerton Loop gas pipeline). Utility ROW development and expansions within the park boundaries could require vegetation removal including tree clearing that results in a loss or alteration of potential summer roosting habitat.

In addition, climate change may alter species distribution as a result of the expansion or contraction of breeding ranges, changes in food resources, and the availability of seasonally used habitats.

Overall, cumulative impacts on Indiana bats inside the parks from future state or private activities are expected to be adverse.

4.9 CONCLUSION

Based on the currently available information for the potential presence of Indiana bat within the alternative routes, as proposed within NPS boundaries, adverse impacts to Indiana bats, particularly to potential summer roost / maternity colony habitat could occur. The implementation of mitigation measures would minimize impacts to Indiana bat; resulting in a determination that the proposed project "***may affect but is not likely to adversely affect***" the Indiana bat.

CHAPTER 5: BOG TURTLE

5.1 SPECIES DESCRIPTION

The bog turtle is one of smallest turtles in North America and is separated taxonomically into two geographically distinct populations. The northern population ranges from Massachusetts to Maryland and was listed as a federally threatened species on November 4, 1997. The *Recovery Plan* was finalized in 2001 by the USFWS and the USFWS recently announced the initiation of the 5-year status review for the bog turtle in the Federal Register in June of 2011. The USFWS (2001) describes the bog turtle as follows:

> "The bog turtle is the smallest member of the genus *Clemmys* and one of North America's smallest turtles. This species is recognized by two characters: a light brown to ebony lightly sculptured carapace and a bright yellow, orange, or red blotch on each side of the head. The moderately domed and weakly keeled carapace may have a pattern of radiating light lines or be uniformly dark brown. The sides of the carapace are nearly parallel, giving the shell a distinctly oblong appearance when viewed from above. The plastron is variable in coloration, with strongly contrasting cream and black areas. The limbs are dark brown with reddish flecking; the feet are weakly webbed."[1]

5.2 GENERAL LIFE HISTORY

Bog turtles are active during the warmer months (spring through fall), and they typically emerge from overwintering during April. Mating occurs from April through June; egg-laying usually occurs in June and July, with hatching during late August and early September. Throughout the summer they remain concealed in dense wetland vegetation and bask occasionally in the sun. To escape high summer heat, avoid danger, or to hibernate, they burrow into the mucky bottom of the surrounding bog. In Pennsylvania and New Jersey, adults and juveniles usually enter the mud to overwinter during late September and October, where they stay until April. For half of their lives, bog turtles exist in a dormant state buried in the mud (Shiels 1998).

5.2.1 Habitat Requirements

Bog turtles inhabit a variety of wetland types throughout their range, but are usually found in small, open canopy, herbaceous sedge meadows and fens bordered by wooded areas. These wetlands are a mosaic of microhabitats that include dry pockets, saturated areas, and areas that are periodically flooded. Bog turtles depend on this diversity of microhabitats for foraging, nesting, basking, hibernation, and shelter (USFWS 2001). Bog turtles prefer wetlands with soft, saturated soils such as fens or sedge meadows fed by seeps and springs of cold groundwater that have been in contact with calcium rich bedrock or soils (USFWS 2001). Deep, soft, mucky soils allow bog turtles to burrow to avoid predators and to escape climatic extremes (Shiels 1998). Groundwater springs, seeps, and subsurface flows provide areas where the turtles can overwinter without the threat of freezing (Shiels 1998).

The USFWS (2006) recognizes potential bog turtle habitat as wetlands that possess the three suitable criteria: hydrology, soils, and vegetation. The soil and hydrology components are the primary determinants of potentially suitable habitat rather than vegetation. However, all three components are

[1] In 2001, the bog turtle genus was changed from *Clemmys* to *Glyptemys* after research determined that the bog turtle is not directly related to the spotted turtle (*Clemmys guttata*) (Parham and Feldman 2002)

necessary to provide critical wintering sites and nesting habitats for the bog turtle. In general, bog turtles typically spend most of their time in the wetland areas, using the upland areas only as travel corridors.

5.2.2 Biological and Behavioral Characteristics

Reproduction: Bog turtles have been observed copulating on both tussocks and in shallow rivulets (USFWS 2001). Nesting sites have been observed as a cavity dug by the turtle and then backfilled after the eggs have been laid, but that "often no formal nest is dug, but instead eggs are merely laid in the top of sedge tussocks" (USFWS 2001). Bog turtles have also been observed nesting on elevated areas including tussocks, depositing their eggs in moss and moist earth; these tussock nesting sites have been described as a complete absence of woody shrubs and an extremely low and sparse cover of herbaceous vegetation. Bog turtle clutch size normally varies from 1 to 6 eggs; eggs are deposited and left to incubate unattended for approximately six to eight weeks (Shiels 1998). It has been observed that eggs may hatch from August through September (Shiels 1998). In the southern part of the northern range, however, it is possible that eggs may overwinter and hatch the following spring (USFWS 2001).

Movement and Home Range: The movement and home ranges of bog turtles reported are variable. In eastern Pennsylvania, a mean home range averaged 1.28 hectares (3.2 acres) for surveyed bog turtles. It has been found that, although turtles had small activity ranges, they moved extensively within these ranges, and that these home ranges rarely extended beyond the habitat's transitional zone. One of the reasons a bog turtle may extend its home range may be due to decreased habitat quality, such as an increase in invasive vegetation, for example multiflora rose (*Rosa multiflora*). Similarly, individual bog turtles have been found crossing roads a considerable distance from suitable habitat; these long distance movements may result from emigration out of habitats declining in quality through disturbances or succession.

Hibernation: Although bog turtles are dependent upon suitable open-canopy sedge meadows and fens, they generally retreat back into more densely vegetated areas to hibernate (USFWS 2001). Bog turtle hibernation sites have been found on and near shrubby hummocks that can serve as hibernacula at the interface zone between open fen habitats and shrub and wooded swamp (USFWS 2001). Ernst et al. (1989) reported on bog turtle hibernation sites in New Jersey and Pennsylvania and found turtles hibernating in spring-fed rivulets under soft mud, in muskrat burrows, under sedge clumps, at the base of tree stumps, and in meadow vole burrows. Bog turtles have also been found to overwinter together with spotted turtles (*Clemmys guttata*). Bog turtles have demonstrated a strong fidelity to their hibernacula; all hibernacula were flooded and located along spring-fed rivulets, or in a stream on a flood plain. Hibernating turtles were found under water in soft mud, in crevices between rocks, or between tangled roots (USFWS 2001).

Food Habits: The bog turtle primarily feeds on insects but also may consume plants, frogs, slugs, earthworms, crayfish, and carrion (USFWS 2001).

5.3 HISTORIC RANGE AND CURRENT DISTRIBUTION

As stated in the *Bog Turtle (Glyptemys muhlenbergii) Northern Population Recovery Plan*, the northern allopatric population of the bog turtle ranges through seven states from Massachusetts to Maryland, including both New Jersey and Pennsylvania (USFWS 2001). Bog turtles were historically reported throughout New Jersey and once occurred in 18 counties; however, they are now only found in 13 of these counties, including Warren County, New Jersey through which portions of the preferred alternative would be located (USFWS 2001). Along with New Jersey and Maryland, eastern Pennsylvania has been long considered the stronghold of the bog turtle and this species is still found in 15 of the 17 counties from which the species was previously reported, including Northampton and Monroe Counties in

Pennsylvania through which portions of the preferred alternative would be located (USFWS 2001). DEWA is also 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 (eg., 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).

5.4 THREATS

The bog turtle has experienced at least a 50 % reduction in range and numbers over the past 20 years. The greatest threats to its survival include the loss, degradation, and fragmentation of its highly specialized wetland habitat, compounded by the take of long-lived adult animals from wild populations for illegal wildlife trade (USFWS 2001). Habitat fragmentation and alteration also expose adult turtles to elevated risk of incidental mortality including being crushed on roads, as well as increased exposure to predation and collection (USFWS 2001; NPS 2005).

5.5 EFFECTS OF PROJECT ACTIONS

The proposed project alternatives would result in direct effects to emergent wetlands which have the potential to provide bog turtle habitat. Direct effects are related to the physical disturbance/conversion of an area that is caused during the construction period and as a result of the new footprint. The construction of the proposed project under alternative 2 has the potential to impact wetlands that provide the appropriate soils, hydrology and vegetation conditions that may in turn, potentially support the bog turtle. There are concerns about illegal collection and human disturbance to bog turtles as a result of the proposed project. The 2005 Joseph M. McDade Recreational Trail Biological Assessment included measures to protect bog turtles from illegal collection and human disturbance. Measures taken under that Biological Assessment included physical barriers and visual screening to discourage users from leaving the trail, and the restoration of parking areas and road traces to disguise their existence to prevent access and collection of bog turtles. The impact of these measures is ongoing, even through construction activities associated with the McDade Recreational Trail have ceased (NPS 2005).

5.5.1 Construction

Removal of Existing Structures: Alternative 2 would involve the removal of all or a portion of the existing B-K Line. The B-K Line structures would be removed but the foundations for these structures would remain in place. The removal of the structures would require constructing access roads. Because access roads would also be required for the construction and long-term maintenance of the new line, adverse impacts from removing the line would be the same (or less than) the impacts discussed for construction of the S-R Line.

Construction of New Transmission Lines: Construction activities including site preparation and construction of access roads, tower foundations, crane pads, wire pull locations, and pulling and splicing sites, as well as the use of heavy equipment and staging areas should be conducted to avoid wetlands and suitable bog turtle habitat; however, if these areas cannot be avoided these activities would disturb and wetland functions and values. Specifically, the construction of access roads would cause increased sedimentation affecting water clarity and water quality as well as increased siltation and alteration of

drainage patterns. Use of heavy construction equipment and trucks would contribute to the compaction of soil in and near wetland areas that could cause damage to soil structure, which determines the ability of a soil to hold and conduct water, nutrients, and air necessary for plant root activity and growth (UM 2001). Soil compaction would also increase runoff, thus increasing soil erosion and cause changes to hydrology, which would affect wetland function. Alteration of water quality, compaction of soils, and loss of vegetation as a result of construction would potentially alter the availability and use of wetland habitat for the bog turtle. In addition to direct effects from construction, indirect effects to wetlands resulting from construction activities in the adjacent uplands could include:

- changes in hydrology (from roads, detention basins, irrigation, increases in impervious surfaces, sand and gravel mining);
- degradation of water quality (due to herbicides, pesticides, oil and salt from various sources including roads, agricultural fields, parking lots and residential developments);
- acceleration of succession (from fertilizer runoff); and
- introduction of exotic plants (due to soil disturbance and roads) (USFWS 2001).

Specific best management practices to protect wetlands from increased sedimentation and compaction would be used to minimize and mitigate these impacts as described further in Section 5.7: Proposed Mitigation Measures.

5.5.2 Operation

No adverse impacts are expected as a result of the operation of the proposed transmission line under alternative 2.

5.5.3 Maintenance

Vegetation Maintenance: To maintain the ROW for the S-R Line, vegetation would be selectively cleared wetland areas according to a NPS-specific and NPS-approved vegetation management plan that would be developed by the applicant. As part of the NPS-approved vegetation management plan, protection and avoidance measures to maintain and preserve wetland vegetation would be employed. Generally maintenance of vegetation could include actions prescribed within the current applicant vegetation management plans such as the development of a list of compatible and incompatible plant species; guidance for low-impact clearing methods; tree removal and herbicide use. If trees are removed in wetland areas, all associated organic materials (with the exception of stumps) from tree cutting would be removed from the wetlands, wetland buffers, or water-body buffer areas and stored in upland areas. Herbicides would not be used in wetland areas on NPS lands. The only exception to herbicide use would be for stump-treating nonnative invasive plants. Appropriate herbicides would be approved by NPS for specific treatment use.

Invasive Species Management: Nonnative, invasive plant species can compete with native species, and affect the quality of suitable bog turtle habitat. While not all nonnative species are harmful, those that are invasive can have serious consequences for native habitats. Ground disturbance from maintenance activities, especially tree removal, could facilitate the spread of invasive plant species. In addition, the use of dirty equipment can act as a seed source for invasive species. The spread of invasive plant species can be caused by changes in vegetation composition after vegetation management, site clearing and/or access road construction and use. The colonization and spread of invasive plant species causes considerable problems, including competing with native species, contributing to species extinctions, altering the structure of natural plant communities, and disrupting ecosystem functions. If the bog turtle cannot adapt

to the changes, the habitat may become inhospitable and unsuitable for the bog turtle. Invasive species management programs would be implemented through the applicant's NPS-specific, NPS-approved vegetation management plan.

Before the initiation of construction, the applicant would design management guidelines for invasive plant species to be included in the NPS-specific vegetation management plan to avoid the spread of invasive plant species into suitable bog turtle habitats. These guidelines, which would include regular monitoring and treatment of key invasive plant species, would also require approval by the NPS prior to implementation. The invasive species management guidelines included in the applicant's vegetation management plans would be the primary mechanism for preventing and managing the spread of invasive plant species in and adjacent to the ROW and protecting suitable bog turtle habitat.

5.6 ALTERNATIVE 2

A total of 7 wetlands identified in a wetland delineation survey in 2008 were included a Phase 1 bog turtle survey within the NPS boundaries in Pennsylvania (Table 2; Mellon 2009). The Phase I review of wetland soils, hydrology, and vegetation of the seven wetlands determined that only one of the 7 wetlands (Wetland 1) would be affected by alternative 2. Wetland 1 (Arnott Fen), is a calcareous wetland within DEWA that along with surrounding wetlands and forest supports a known population of bog turtles (Figures 3 and 4). The fen vegetation community is classified as a poison sumac / red-cedar / bayberry fen, which also contains calciphytic vegetation and special status plant species as a result of the limestone geology (Mellon 2010). Since the area is known bog turtle habitat, as well as home to a number of Pennsylvania plant species of special concern, Mellon (2009) concluded that there was no reason to further disturb the habitat and no data were collected in the Phase I survey; a Phase II survey was not completed in Arnott Fen for the same reason. In a response letter dated 16 August 2010, the Pennsylvania Fish and Boat Commission (PFBC) stated that *alternative 2 will pass through a wetland on federal lands known to support the bog turtle, thus potentially resulting in adverse impacts to the bog turtle and its habitat* (PFBC 2010).

Within NPS boundaries in New Jersey, a wetland investigation was conducted in 2007 along the ROW on NPS lands for alternatives 2 in accordance with the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation 1989). Following the wetland delineation, a Phase 1 bog turtle survey was conducted in November 2008 by EcolSciences (2008). Wetlands adjacent to access roads (Ridge Road, Hamilton Road, and Samuels Lane) were also identified and reviewed during the Phase I investigation. A total of 10 wetland areas located within the ROW and access roads or within 300 feet of the ROW were included in the Phase 1 bog turtle survey; however, only one wetland, Wetland 44, portion 1, was considered to have potential bog turtle habitat based on the presence of appropriate hydrology, soils and hydrology. Two other wetlands (Wetland 42, portion 1 and portion 2) were considered to have "unlikely" bog turtle habitat because habitat criteria for the bog turtle were only partially met (EcolSciences 2008). The remaining seven wetlands that were surveyed did not contain suitable criterion for hydrology, soils, and vegetation (Table 2). Additional detail on the characteristics of the wetlands surveyed during the Phase 1 bog turtle surveys may be found in the EIS (NPS 2011b).

Following results from the Phase I bog turtle surveys in New Jersey, a Phase 2 Bog Turtle Survey was conducted on Wetland 44 in accordance with USFWS guidelines during May and June of 2009. Based on the EcolScience (2010) investigation, no bog turtles are located within Wetland 44.

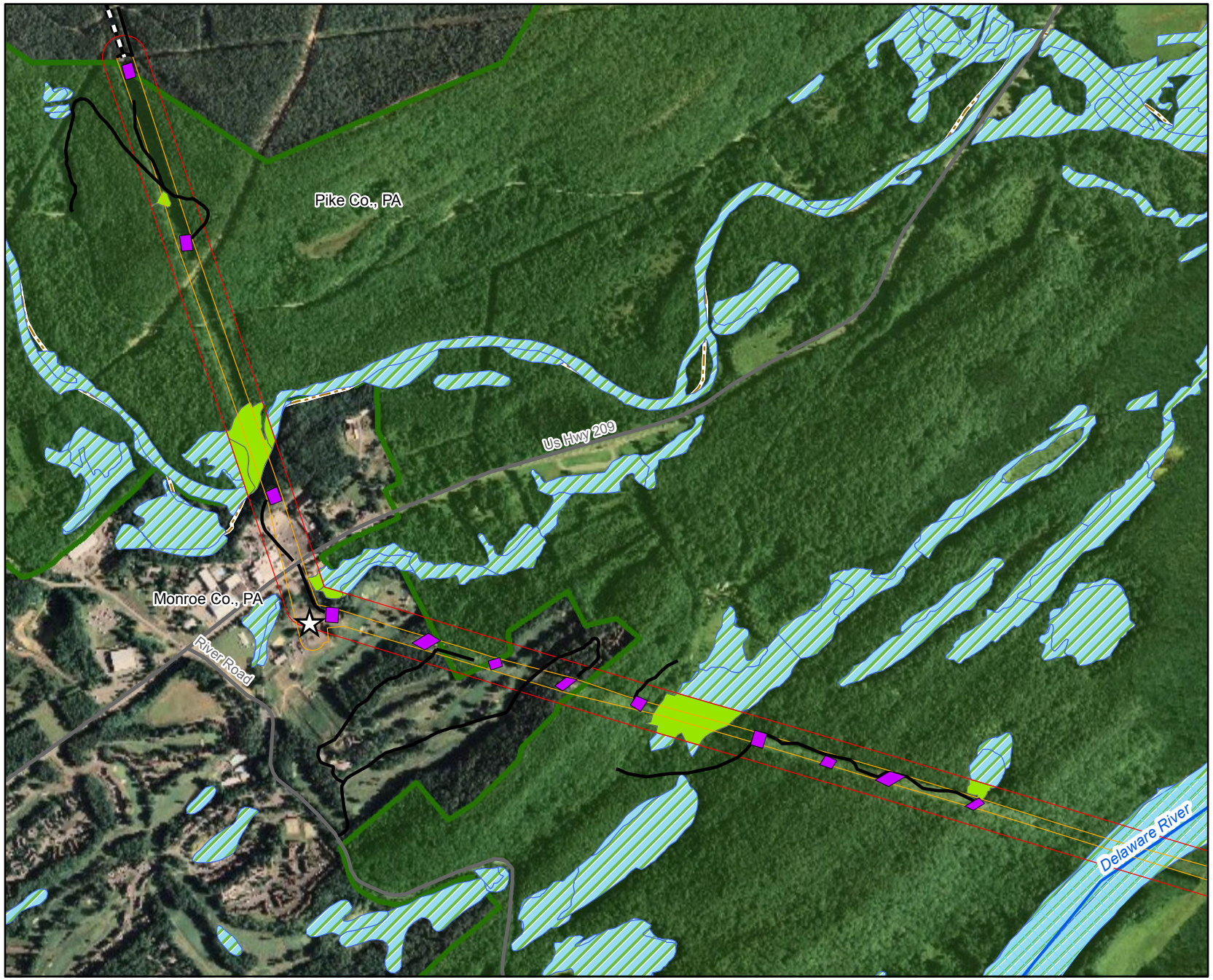
In summary, the Phase I and Phase II bog turtle surveys identified only one wetland, Arnott Fen (Wetland 1), as supporting bog turtles within NPS-lands along alternative 2.

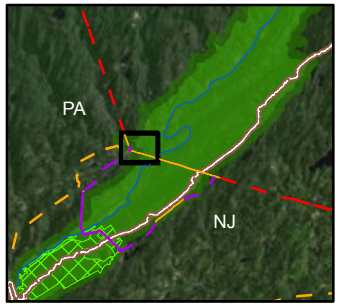
TABLE 2: SUMMARY OF PHASE I SURVEY RESULTS OF WETLANDS ALONG ALTERNATIVE 2 IN PENNSYLVANIA AND NEW JERSEY

Wetland ID	Wetland Size (acres)	Wetland Type and Amount (% or acres)	Extent of "Mucky" Soils (by wetland type)	Survey Effort (in person-hrs)	Bog Turtle Habitat?
State of Pennsylvania					
1	~20	Not surveyed; known bog turtle habitat	N/A	0	**Yes**
2	~12	PEM – 90% Open Water – 10%	<10% 0%	1	No
3	~4	PEM Flooded Forested Wetlands with dead trees – 100%	0%	0.5	No
4	~4	PEM Flooded Forested Wetlands with dead trees and sedges – 100%	70%	0.5	No
5	~0.1	PEM – 100%	0%	0.3	No
6	~2	PEM Flooded Forested Wetlands with dead trees and shrubs – 100%	0%	1	No
7	~0.5	PEM – 50% PFO (forested stream edge) – 50%	0%	0.5	No
State of New Jersey					
42, portion 1	0.1 to 0.5	PFO – 100%	70%	1.33	Unlikely*
42, portion 2	0.5 to 1.0	PEM – 40 % PSS – 60%	30 0	0.83	Unlikely*
44, portion 1	0.5 to 1.0	PEM – 70% PSS – 30%	>70 10-29%	0.83	**Yes**
44, portion 2	> 5	PEM – 90% PSS – 10%	<3 0	0.5	No
45	1.0 to 2.0	PSS – 100%	0	0.5	No
46	<0.1	PEM – 25% POW – 75%	0 0	0.27	No
47		PEM – 50% PSS – 50%	0 0	0.7	No
Hamilton Road	<0.1	PFO – 100%	10-29%	0.43	No
Ridge Road A	0.5 to 1.0	PEM – 100%	0	1.03	No
Ridge Road B	0.1 to 0.5	PEM – 30% PFO – 70%	0 0	0.53	No

PEM - Palustrine Emergent Wetland
PSS - Palustrine Shrub-Scrub Wetland
PFO - Palustrine Forested Wetland
*See wetland descriptions in the above paragraphs for reasoning of unlikely.

Source: EcolSciences 2008, 2010; Mellon 2009





Legend

- Substation
- Crane Pad/ Tower Location
- Outside Study Area
- Existing ROW in Study Area
- 350 ft Corridor
- Applachian National Scenic Trail
- Delaware River
- Proposed Access Road
- Road
- Delaware Water Gap National Recreation Area
- Wetlands within 350ft buffer
- Wetlands
- County Line

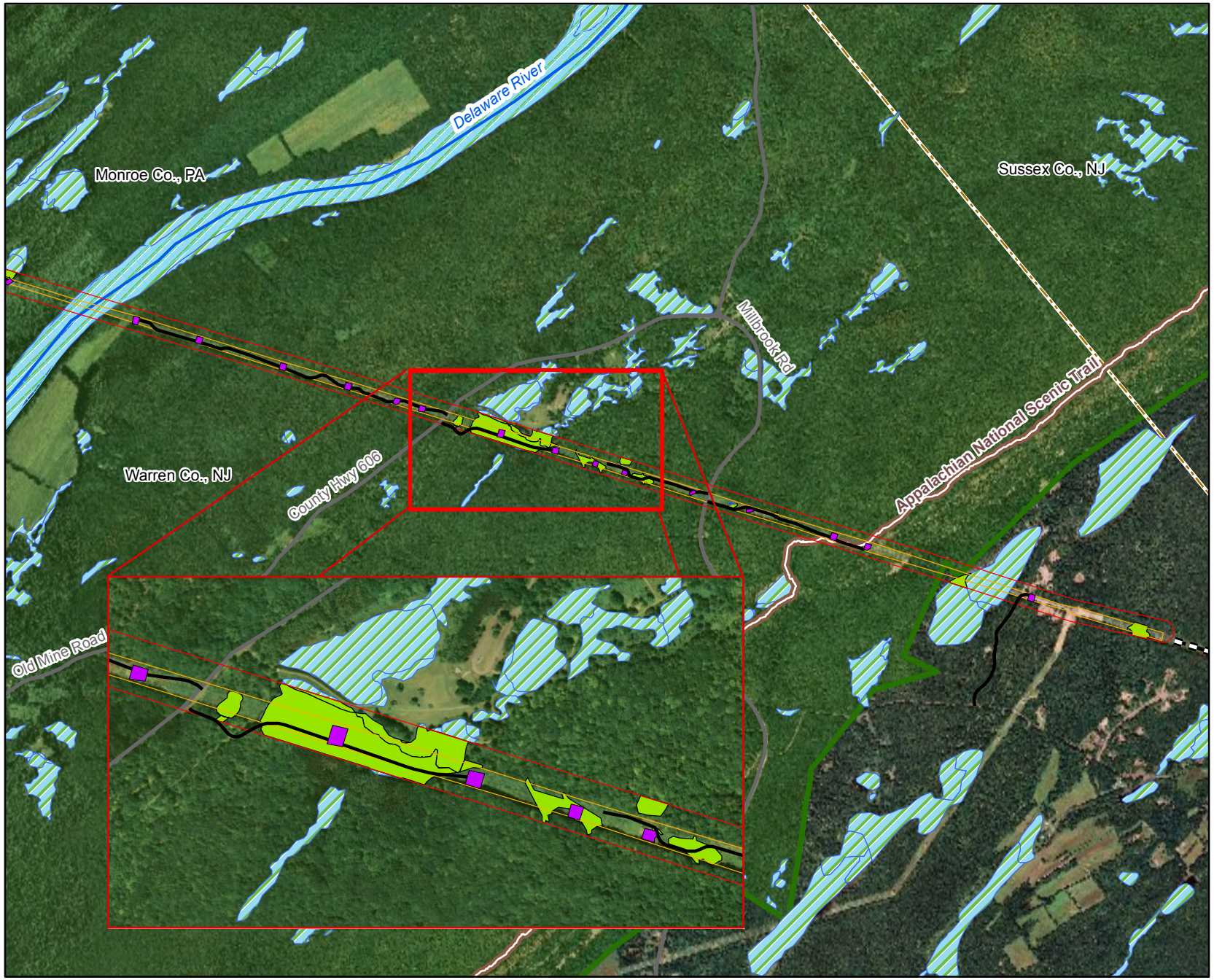
0 500 1,000
Feet

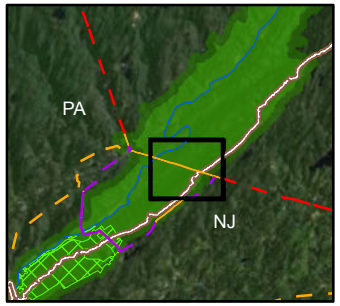
Susquehanna to Roseland Transmission Line Proposal and Right-of-Way Request EIS

Figure 3
Alternative 2 Wetlands in Pennsylvania

Source: ESRI Streetmap 2006, Penn State 2010, ESRI ArcGISonline Map Service 2010, PennDOT 2011, USGS 2006, NJ DEP 2008, NWI 1977

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





Legend

- Substation
- Crane Pad/ Tower Location
- Outside Study Area
- Existing ROW in Study Area
- 350 ft Corridor
- Appalachian National Scenic Trail
- Delaware River
- Proposed Access Road
- Road
- Delaware Water Gap National Recreation Area
- Wetlands within 350ft buffer
- Wetlands
- County Line

0 1,000 2,000
Feet

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

Figure 4
Alternative 2 Wetlands in New Jersey

Source: ESRI Streetmap 2006, Penn State 2010, ESRI ArcGISonline Map Service 2010, PennDOT 2011, USGS 2006, NJ DEP 2008, NWI 1977

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

Under alternative 2, the removal of the B-K Line would require constructing access roads, wire pull sites, and the removal of the line; wire pull sites would not be located in wetland areas or in suitable bog turtle habitat. Adjacent upland travel corridors for bog turtles would also require protection under the recovery plan. The construction of access roads and wire pull sites would not be located in areas of upland travel corridors for bog turtles.

Construction of the new S-R Line would transect Arnott Fen; approximately 4.1 acres of the Arnott Fen wetland complex is located within the 350-foot corridor of the proposed ROW. Calcareous fen habitats such as Arnott Fen are highly vulnerable to degradation from direct disturbance and from activities in nearby upland areas. Runoff from road surfaces, disruption of groundwater flow by nearby excavation, sedimentation from construction activity, or direct physical disturbance can lead to changes in the character of the fen habitat, including a decline in overall plant diversity and invasion by non-native species and tall shrubs. Such changes can render the habitat unsuitable for the bog turtle.

No towers or crane pads would be constructed in the fen and the ROW would be selectively cleared of vegetation during construction. Vegetation clearing would be conducted according to a NPS and USFWS-approved vegetation management plan to be developed by the applicant. Selective clearing of incompatible plant species, and low-impact removal of small trees and shrubs would minimize the impacts to wetlands and bog turtle habitat. Post-construction vegetation maintenance under alternative 2 would also be conducted according to the NPS-approved vegetation management plan. Small trees and shrubs to be removed in Arnott Fen would not be removed by heavy equipment, but would be cleared using low-impact tree-clearing methods and would be felled by hand, which would require a chainsaw and operator (PPL and PSE&G 2008). Generally, herbicides would not be used in wetland areas on NPS lands, unless stump treating for nonnative invasive plants is required. Vegetation clearing and maintenance activities, create a risk of trampling bog turtle nests and inadvertently crushing eggs or individual turtles, particularly if these activities are carried out in the emergent portion of Arnott Fen in mid-May through mid-September. Seasonal restrictions on vegetation maintenance would be implemented during nesting and birthing seasons for bog turtles (typically between April and September) which should avoid the loss of eggs and individual turtles.

The removal of incompatible shrubs or small trees and continued vegetation maintenance could result in the conversion of Arnott Fen to emergent wetlands. As a result, of vegetation maintenance activities, the open canopy areas would increase solar exposure, allowing native herbaceous vegetation to become re-established. Because the bog turtle's habitat is highly susceptible to the natural succession of trees encroaching on wetlands, this could actually increase the amount of emergent habitat available for bog turtle nesting and basking. As a result, vegetation maintenance in Arnott Fen under alternative 2 may help to meet the long-term goal for the bog turtle specified in the Recovery Plan (USFWS 2001) that requires protection against succession to woody vegetation in bog turtle habitat.

Construction and clearing within Arnott Fen would be minimized; however, activities could potentially allow invasive plant species to colonize the fen. Suitable bog turtle habitat could be degraded by invasive plants establishing in disturbed areas adjacent and within the fen following construction. Invasive plant management according to the NPS-approved vegetation management plan would reduce the likelihood of invasive species encroachment into Arnott Fen as a result of the implementation of alternative 2. An access road proposed for construction immediately south of Arnott Fen could act as an attractive nuisance and/or recreation opportunity, by inviting visitors to illegally access areas inhabited by the bog turtle. Visitor encounters with the turtles could lead to the illegal collection of bog turtles. The greatest threat to the survival of the bog turtle includes collection for the wildlife trade and the loss, degradation, and fragmentation of its habitat, including the threat of invasive wetland plants that reduce the value of bog turtle habitat (USFWS 2001). In addition, adverse impacts could occur if bog turtles travel in the upland

community, where there is a risk of direct mortality from contact with construction vehicles and equipment.

Although no new towers would be placed within Arnott Fen, new towers would be constructed on either side of the fen (one of these towers would be placed in the ROW approximately 300 feet from the perimeter of the fen). Placement of new towers would not require blasting; however, the tower construction would require excavation and drilling adjacent to the fen in rare and unique geologic (limestone) resources. Drilling has the potential to connect existing solution features in the limestone and possibly change the groundwater flow path. The probabilities of boreholes intercepting solution features (which typically make up only 1 to 10% of the saturated rock mass, and usually closer to 1%) is extremely low, and a cross-connection over the short depth of the foundation drilling is unlikely to change the greater groundwater flow regime, especially since the boreholes will be filled by grouting for foundations. As a result an alteration in hydrologic regime is considered discountable since it is very unlikely that shallow drilling would intercept the water table.

Specified long-term protection for the bog turtle requires that the habitat areas used by a population are protected against adverse effects from filling or excavation of wetlands, pollution from point and non-point sources, and invasive plant species (USFWS 2001). Alternative 2 could result in direct and indirect adverse impacts on bog turtles within the Arnott Fen wetland; however, avoidance of bog turtle habitat is contained within the current routing described in alternative 2 and avoidance of bog turtle habitat through the implementation of mitigation measures such as pre-construction surveys, avoidance, time of year restrictions and others described in Section 5.7: Proposed Mitigation Measures along with a NPS-approved vegetation management plan would minimize impacts to bog turtle and potential bog turtle habitat. Detailed conservation measures have been identified along with bog turtle conservation zones, with the intent of protecting and recovering known bog turtle populations within the northern range of this species (USFWS 2001, appendix A) and in the mitigation measures discussed in Section 5.7: Proposed Mitigation Measures. ***Therefore, alternative 2 may affect, but is not likely to adversely affect the bog turtle and bog turtle habitat.***

5.7 PROPOSED MITIGATION MEASURES

Various measures to specifically protect bog turtles as a result of this project would be undertaken in accordance with the *Bog Turtle (Clemmys muhlenbergii) Northern Population Recovery Plan* (USFWS 2001), and the identified bog turtle conservation zones presented in Appendix A. If construction requirements in the final design conflict with mitigation measures, the applicant would be required to work with the USFWS and the NPS to determine additional measures to avoid impacts. Prior to any ground-disturbing or vegetation clearing activities, pre-construction surveys for bog turtles would be conducted by a qualified bog turtle surveyor. Surveys conducted prior to vegetation clearing activities are expected to be efficient at reducing direct impacts on special-status species because surveys would identify the presence of bog turtles before site preparation and construction are initiated. Construction monitoring will be conducted both during construction and during post-construction vegetation maintenance. If bog turtle or bog turtle habitat is found in any of the above mentioned surveys, the location or suitable habitat would be flagged, the USFWS would be contacted, and the habitat would avoided during construction.

Mitigation measures that would avoid direct impacts on the bog turtle would be the most efficient measures and would include time-of-year restrictions, and habitat preservation and habitat restoration components. Some mitigation measures, such as modifying the location of towers and access roads, may not be possible and other measures, such as road closures and/or patrols, may not be effective at some locations; however, mitigation measures would be implemented to the extent practical to avoid adverse effects on special-status species. These actions would be undertaken, where appropriate, as mitigation

measures for the preferred alternative to minimize impacts to the bog turtle. The efficacy of mitigation techniques varies widely between mitigation measures, and is considered based on best professional judgment when determining the impacts of each alternative on each special-status species. Specific mitigation measures have been developed by the applicant for alternative 2 and are described in detail in *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project* (PSE&G 2010).

Coordination with appropriate federal and state agencies would continue in the future. The applicant has also adopted specific conservation measures as described under each applicable state in the paragraphs that follow.

5.7.1 Mitigation Measures for NPS Property

To avoid impacts to the bog turtle and its habitat, conservation measures were developed by the PSE&G in cooperation with the USFWS-NJFO (tracking # 2008-I-0319) as described in *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project* (PSE&G 2010). These conservation measures are mitigation that will be implemented under alternative 2 in New Jersey and Pennsylvania and will be incorporated into the construction plans for wetland 44, portion 1, near Van Campen Brook and Arnott Fen. Despite the negative Phase II survey for wetland 44, portion 1, it will be treated as confirmed bog turtle habitat due to its proximity to a known site. Adherence to the following measures will be required as a condition of any NPS permit authorizing the project. If construction requirements in the final design conflict with mitigation measures, the applicant would be required to work with the USFWS and the NPS to determine additional measures to avoid impacts.

1. The applicant has agreed that no permanent structures (including but not limited to tower footings and new or improved access roads) would be located within 300 feet of confirmed bog turtle habitat. All confirmed bog turtle habitat, plus a 150-foot buffer, would be flagged prior to construction and would remain flagged during all work in that span. No temporary disturbances (including but not limited to removal of existing towers or other structures, use of motorized equipment, earth disturbance, and equipment/materials storage areas) would take place within flagged areas. If vegetation must be managed within flagged areas (during or after construction), PSE&G and PPL will follow the conservation measures detailed in PSE&G's June 20, 2012 letter to the USFWS (or the most current version of this agreement, with future updates to be approved by the NPS for areas under NPS jurisdiction). If towers and access roads are within 300 feet of bog turtle habitat in the final design, the applicant would be required to work with the USFWS and the NPS on additional measures to avoid impacts to the bog turtle. The northern access road through Arnott Fen was removed to avoid significant impacts to bog turtles.

2. In any span containing confirmed bog turtle habitat, a double row of silt fencing would be installed around all work areas (e.g., areas for installation of new tower footings or other structures, removal of existing towers or other structures, construction of new or improved access roads, use of motorized equipment, earth disturbance, equipment/materials storage areas, other temporary work spaces) prior to the start of any construction. As described in mitigation measure 1 above, all work areas would be at least 150 feet from confirmed bog turtle habitat (i.e., outside of flagged areas). Work areas would be inspected by a recognized, qualified bog turtle surveyor concurrent with fence installation, to ensure no bog turtles are present. In any such span, a recognized, qualified bog turtle surveyor would inspect work areas and flagged areas daily for any work between April 1 and October 15. The recognized, qualified bog turtle surveyor would take notes and color photographs of the construction area and surrounding wetlands on a regular schedule and during any significant events or unusual circumstances.

3. Where existing paved or unpaved roads within 300 feet of confirmed bog turtle habitat would be utilized for access without any road enlargement or improvement, a double row of silt fencing would be installed along the road, concurrent with inspection by a recognized, qualified bog turtle surveyor to ensure no bog turtles are present. A recognized, qualified bog turtle surveyor would inspect the fence for signs of bog turtle activity at least weekly for any use between April 1 and October 15. Where appropriate, directional funnels would be used to facilitate movement of turtles through culverts between wetland areas; plans for any such turtle crossing would be provided to the USFWS for review and approval. In areas with permanent access roads, gates or other physical barriers would be added to access road entrances to discourage illegal collection, all-terrain vehicle use, and other human disturbances.

4. Silt fencing would be buried six inches into the ground, using large stakes. Silt fencing would be installed by non-mechanical means. No equipment staging, vehicle access, or other activities would be permitted outside of the approved (silt fenced) construction limits, other than for vegetation management as described in mitigation measure 1 above. All silt fencing would be maintained year-round and would be inspected and maintained daily. Inspection and maintenance logs would be kept and provided to the USFWS and/or the NPS upon request.

5. Contractors will designate one or two points of contact to be trained by a recognized, qualified bog turtle surveyor on the identification of bog turtles and reporting protocols if a bog turtle is observed in or near a work area. All other contractor staff working in spans with confirmed bog turtle habitats will be notified of sensitive wetlands, but the bog turtle will not be discussed (to minimize the release of sensitive locational information). As part of the overall environmental training, all contract staff slated to work in spans with confirmed bog turtle habitat will be instructed in the implementation of applicable conservation measures, and a protocol to report any terrestrial wildlife (*e.g.*, mammals, herpetofauna) observed in work areas. The USFWS will be provided a copy of the protocol for review and approval.

6. As of 5 August 2009, a guidance advisory bulletin has been issued by USFWS for all human activities occurring within bog turtle habitat. As long as the advisory guidance is in effect, all monitoring, flagging, and vegetation management activities occurring within 150 feet of confirmed bog turtle habitat would be conducted in accordance with issued decontamination protocols. These practices apply to all equipment and personnel working within bog turtle habitats. Pursuant to the advisory bulletin, if any dead bog turtles are encountered during project implementation, turtles would be collected and shipped for analysis to the National Wildlife Health Center after the USFWS and the New Jersey Endangered and Nongame Species Program have been notified and apprised of the circumstance under which the turtle was found.

7. At periodic intervals (approximately 300 to 500 feet) along the construction corridor, signage would be placed along the limits of the workspace indicating that work is occurring in proximity to designated rare species habitat. The signs would include representative photographs of bog turtles as well as a summary of the protocol to follow should one be encountered within the workspace. Signage would be removed upon completion of work in each span containing confirmed bog turtle habitat. While signage is in place, PSE&G and PPL would limit access to work crews and agency/company staff. PSE&G and PPL would inform all personnel that locations of confirmed bog turtle habitat are considered confidential and should not be disclosed verbally, in print, or electronically.

8. If any bog turtle, live or dead, is found during habitat flagging, silt fence installation, construction, vegetation management or any other phase of project implementation, PSE&G and PPL would stop work and contact the NPS and the USFWS immediately. PSE&G, PPL, and the

applicant's contractors, employees, or representatives would not move any bog turtle except to avoid imminent danger to people or the turtle.

9. Steps will be implemented to minimize human disturbance of bog turtle habitat as a result of the proposed new access road to the ROW from Community Drive. If this will be a temporary road, the applicant will be required to restore and plant it with shrubs and trees to obscure it following construction. If this is to be a permanent access road, the applicant will be required to install gates and signage to enforce an area closure.

10. Any work in the vicinity of Arnott Fen will take place between November 1 and March 31, when bog turtles are hibernating. The applicant will not be permitted to fell any trees into the fen. Stringent sediment and erosion controls will be implemented for tree clearing and ground disturbance upgradient of Arnott Fen.

11. The applicant will be required to thoroughly wash construction equipment offsite before use within 500 feet of bog turtle habitat.

5.8 CUMULATIVE EFFECTS ANALYSIS

Cumulative effects are those effects of future state or private activities, not involving federal activities, which are reasonably certain to occur within the action area of the federal action subject to consultation [50 CFR §402.02]. This definition applies only to Section 7 analyses and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws. Future actions can affect wetlands and ultimately influence conditions that may offer suitable habitat for bog turtle. Wetland ecosystems although generally protected within NPS boundaries may be threatened directly and indirectly by alterations and permanent loss from adjacent development, invasive plant species colonization, and other habitat pressures such as hydrology and water quality changes related to stormwater runoff, erosion and sedimentation. These pressures can result in the loss of wetland functions or values, especially in sensitive habitats like calcareous fens that are uniquely characterized by the geology, hydrology and vegetative communities that also define preferred bog turtle habitat.

In the vicinity of the parks, the following road and utility projects would result in adverse cumulative impacts on wetlands that could also affect bog turtles if suitable habitat exists: the Pennsylvania Department of Transportation State Road 2001 road project (road reconstruction), the Tennessee Gas Line Proposal (addition to an existing gas pipeline), the Columbia Gas Transmission Company pipeline (replacement of an existing gas pipeline), and the Northeast Supply Link Expansion (Palmerton Loop gas pipeline). These projects would result in adverse impacts on wetlands from vegetation clearing and trimming activities as well as disturbance of wetland areas.

Cumulative impacts on the bog turtle from future projects would be adverse as a result of the projects discussed above. When impacts on the bog turtle as a result of alternative 2 are combined with the cumulative projects, an overall adverse cumulative impact would be expected on bog turtles and bog turtle habitat within the NPS boundaries.

5.9 CONCLUSION

The information contained within this BA allows for the conclusion of an effect determination for alternative 2 in regard to the bog turtle listed under Section 7 of the ESA described above.

Alternative 2 ***may affect, but is not likely to adversely affect bog turtle habitat***, and subsequently the turtle itself, which is a federally threatened and state-listed endangered species. A Phase I and Phase II bog turtle survey was previously conducted along alternative 2 and, therefore, no additional studies for the bog turtle are anticipated to be required in support of the conclusion for this alternative. This determination is made based upon and supported by the following information:

- There are calcium rich soils/bedrock in the area at Arnott Fen and drilling will be required approximately 750 feet from the western edge of the fen in unique geologic limestone formations.
- The potential for direct mortality of the bog during construction activities which would be considered a take under ESA, could constitute an adverse impact on the bog turtle as a result of alternative 2. However, due to pre-construction surveys and construction monitoring by qualified bog turtle surveyors, direct mortality is unlikely.
- There are other emergent and scrub-shrub wetlands within the project area that would be affected by the preferred alternative; however, based on Phase I and Phase II Bog Turtle Surveys it was determined that none of the other wetlands either possessed bog turtle habitat or supported populations of bog turtles.
- Vegetation maintenance activities would be conducted by hand clearing only (no machinery) outside of restricted periods and may enhance existing habitat and potentially increase habitat for the bog turtle by preventing the fen habitat to succeed to a forested wetland, benefitting bog turtles by preventing succession in the fen.

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CHAPTER 7: LIST OF CONTACTS AND DOCUMENT PREPARERS

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APPENDIX A

BOG TURTLE CONSERVATION ZONES

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BOG TURTLE CONSERVATION ZONES

The following bog turtle conservation zones have been designated by USFWS (2001) with the intent of protecting and recovering known bog turtle populations within the northern range of this species.

ZONE 1

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. Within this zone, the following activities are likely to result in habitat destruction or degradation and should be avoided. These activities (not in priority order) include:

- development (e.g., roads, sewer lines, utility lines, storm water or sedimentation basins, residences, driveways, parking lots, and other structures)
- wetland draining, ditching, tiling, filling, excavation, stream diversion and construction of impoundments
- heavy grazing
- herbicide, pesticide or fertilizer application
- mowing or cutting of vegetation
- mining
- delineation of lot (e.g., for development, even if the proposed building or structure will not be in the wetland)

Some activities within Zone 1 may be compatible with bog turtle conservation but warrant careful evaluation on a case-by-case basis:

- light to moderate grazing
- non-motorized recreational use (e.g., hiking, hunting, fishing)

ZONE 2

The boundary of Zone 2 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. Some of the indirect effects to wetlands resulting from activities in the adjacent uplands include:

- changes in hydrology (e.g., from roads, detention basins, irrigation, increases in impervious surfaces, sand and gravel mining);
- degradation of water quality (e.g., due to herbicides, pesticides, oil and salt from various sources including roads, agricultural fields, parking lots and residential developments);

- acceleration of succession (e.g., from fertilizer runoff); and
- introduction of exotic plants (e.g., due to soil disturbance and roads).

Zone 2 acts as a filter and buffer, preventing or minimizing the effects of land-use activities on bog turtles and their habitat. This zone is also likely to include at least a portion of the groundwater recharge/supply area for the wetland. Activities that should be avoided in this zone due to their potential for adverse effects to bog turtles and their habitat include:

- development (e.g., roads, sewer lines, utility lines, storm water or sedimentation basins, residences, driveways, parking lots, and other structures)
- mining
- herbicide application
- pesticide or fertilizer application
- farming (with the exception of light to moderate grazing - see below)
- certain types of stream-bank stabilization techniques (e.g., rip-rapping)
- delineation of lot (e.g., for development, even if the proposed building or structure will not be in the wetland)
- Careful evaluation of proposed activities on a case-by-case basis will reveal the manner in which, and degree to which activities in this zone would affect bog turtles and their habitat.

Assuming impacts within Zone 1 have been avoided, evaluation of proposed activities within Zone 2 will often require an assessment of anticipated impacts on wetland hydrology, water quality, and habitat continuity. Activities that are likely to be compatible with bog turtle conservation but that should be evaluated on a case-by-case basis within this zone include:

- light to moderate grazing
- non-motorized recreational use (e.g., hiking, hunting, fishing)
- mowing or cutting of vegetation

ZONE 3

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 addition, some activities (e.g., roads, groundwater withdrawal, water/stream diversions, mining, impoundments, dams, "pump-and-treat" activities) far beyond Zone 1 have the potential to alter the hydrology of bog turtle habitat; therefore, another purpose of Zone 3 is to protect the ground and surface water recharge zones for bog turtle wetlands. Where the integrity of Zone 2 has been compromised (e.g., through increases in impervious surfaces, heavy grazing, channelization of stormwater runoff), there is also a higher risk of activities in Zone 3 altering the water chemistry of bog turtle wetlands (e.g., via nutrient loading, sedimentation, and contaminants). Activities occurring in this zone should be carefully assessed in consultation with the USFWS and/or appropriate State wildlife agency to determine their potential for adverse effects to bog turtles and their habitat. Prior to conducting activities that may directly

or indirectly affect wetlands, bog turtles and/or bog turtle habitat surveys should be conducted in accordance with accepted survey guidelines.

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APPENDIX B

CONSULTATION LETTERS

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COOPERATING AGENCY CORRESPONDENCE

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United States Department of the Interior

NATIONAL PARK SERVICE
Delaware Water Gap National Recreation Area
Bushkill, Pennsylvania 18324

IN REPLY REFER TO:

D5015

FEB 07 2011

Mr. Michael Horne, Refuge Manager
Wallkill River, Cherry Valley, Shawangunk Grasslands
National Wildlife Refuge Complex
1547 County Route 565
Sussex, New Jersey 07461

Dear Mr. Horne:

We would like to invite the U.S. Fish and Wildlife Service (USFWS) to participate as a cooperating agency in the National Park Service's environmental review of the Susquehanna to Roseland Transmission Line project.

As you are aware, pursuant to the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. 4332(2)(C), the National Park Service (NPS) is preparing an Environmental Impact Statement (EIS) for the evaluation of construction and right-of-way (ROW) permits requested in relation to the proposed Susquehanna (Berwick, Pennsylvania) to Roseland, New Jersey 500,000 volt (500 kV) Transmission Line project. Construction is proposed for a double circuit 500 kV line, although one line will only be energized to 230 kV at the time of project completion. The applicant, (a consortium of Utilities, PPL and PSE&G), has received qualified project approvals from the respective state utility commissions, the Pennsylvania Public Utility Commission and New Jersey Board of Public Utilities. No environmental permits from regulatory agencies have been issued to date.

As part of the NEPA process the NPS will seek consultation with the USFWS New Jersey and Pennsylvania Field Offices under Section 7 of the Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq. , ESA) and the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; the Act of March 10, 1934; Ch. 55; 48 Stat. 401), as amended. But the USFWS has additional interests in this review. As proposed, the project would cross lands and waters of the United States in the Delaware Water Gap National Recreation Area (DEWA), the Middle Delaware National Scenic and Recreational River (MDSR), and the Appalachian National Scenic Trail (APPA). Some alternatives, developed as part of the NEPA process, would also cross lands within the designated boundary of the Cherry Valley National Wildlife Refuge (CVNWR).

The Council on Environmental Quality (CEQ) regulations addressing cooperating agencies status (40 C.F.R. §§ 1501.6 & 1508.5) implement the NEPA mandate that federal agencies responsible for preparing NEPA analyses and documentation do so "in cooperation with State and local

governments" and other agencies with jurisdiction by law or special expertise. (42 U.S.C. §§ 4331(a), 4332(2)). Because of your expertise and local knowledge of the resources within the CVNWR we request your participation as a cooperator in the development and review of the EIS. We expect that coordination in this manner will result in improved understanding of each of our respective bureaus' roles and will result in the most informed decision for protecting and preserving the valuable natural, cultural, scenic and recreational resources of these units. In addition, our close association as sister agencies under the same Assistant Secretary makes our close cooperation even more necessary. In this manner USFW can meet its obligations for ecological services and as a land manager.

As part of the project team, the EIS files are available for your review. Because the schedule continues to be an important consideration, we encourage you to arrange a time with our staff to review and make copies of the materials you may need for the environmental review. We look forward to your response. If you have any questions please call Superintendent Donahue at (570) 426-2418 or Amanda Stein, project manager at (570) 426-2472.

Sincerely,

John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area &
Middle Delaware National Scenic and
Recreational River
(570) 426-2418

Pamela Underhill
Superintendent
Appalachian National Scenic Trail
(304) 535-6279

cc:

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Northeast Regional Office
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Andrew Tittler, DOI Office of the Solicitor
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Wendy Walsh, U.S. Fish and Wildlife Service
Jennifer McConaghie, National Park Service, NER
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Patrick Lynch, National Park Service, DEWA
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Denver Service Center - TIC
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
WALLKILL RIVER NATIONAL WILDLIFE REFUGE COMPLEX
1547 County Route 565
Sussex, New Jersey 07461

March 14, 2011

Mr. John J. Donahue
Superintendent
Delaware Water Gap National Recreation Area and
Middle Delaware National Scenic and Recreational River
Bushkill, Pennsylvania 18324

Ms. Pamela Underhill
Superintendent
Appalachian Trail Park Office
P O Box 50
Harpers Ferry, West Virginia 25425

Dear Mr. Donahue and Ms. Underhill:

Thank you for your February 7, 2011 letter inviting the U.S. Fish and Wildlife Service to become a cooperating agency in the National Park Service's review under the National Environmental Policy Act of the applications submitted to it for the Susquehanna to Roseland 500-IV transmission line project.

As some alternative routes for the project would cross lands within the acquisition boundary of the Cherry Valley NWR, and as FWS also has interests and expertise to offer concerning wildlife and habitat throughout the study area, we are happy to serve as a cooperating agency. We have already been reviewing the drafts of the EIS chapters made available to us.

We understand that the NPS has a cost-recovery agreement with the permit applicants. It would greatly enhance our ability to provide expertise and review capacity to NPS beyond the bounds of our standard ESA consultation if we could execute an Interagency Agreement for the acquisition of the expertise the FWS will provide, for which cost NPS could be reimbursed. This would allow us to devote additional hands to the necessary review.

Sincerely,

Michael Horne

Michael Horne
Refuge Manager
Wallkill River, Cherry Valley
and Shawangunk Grasslands NWR

Cc: Marvin Moriarty, Regional Director
Susan McMahon, Deputy Regional Chief
Dennis Reidenbach, Regional Director
Michael Chezik, DOI Office of Environmental Policy and Compliance
Andrew Raddant, DOI Office of Environmental Policy and Compliance
Andrew Tittler, DOI Office of the Solicitor
Eric Davis, U.S. Fish and Wildlife Service
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Amanda Stein, National Park Service, DEWA
Denver Service Center-TIC, attn: SRLINE EIS

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

October 16, 2008

Sue Davis
The Louis Berger Group, Inc.
75 2nd Avenue
Suite 700
Needham, MA 02494

RE: USFWS Project #2008-0677

Dear Ms. Davis:

This responds to your letter of August 13, 2008 and our various email and telephone correspondences since then regarding the proposed PPL Electric Utilities Susquehanna – Roseland 500 kV Transmission Line (Route B) project, located in Luzerne, Lackawanna, Wayne, Pike and Monroe Counties, Pennsylvania. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species.

The transmission line is located within the range of **two** federally listed species, the endangered Indiana bat (*Myotis sodalis*) and threatened bog turtle (*Clemmys muhlenbergii*). Additionally, the transmission line is located within the range of the bald eagle (*Haliaeetus leucocephalus*), a federally protected species. Future development on the site should be evaluated with respect to these species based on the information provided below.

Indiana Bat

Indiana bats hibernate in caves and mines during the winter months (November through March), and use a variety of upland, wetland and riparian habitats during the spring, summer and fall. Indiana bats usually roost in dead or living trees with exfoliating bark, or living or dead trees with crevices or cavities. Female Indiana bats form nursery colonies under the exfoliating bark of dead or living trees, such as shagbark hickory, in upland or riparian areas. However, a variety of tree species such as black birch, red and white oak, and sugar maple are also used.

Land-clearing, especially of forested areas, may adversely affect Indiana bats by killing, injuring or harassing roosting bats, and by removing or reducing the quality of foraging and roosting habitat. Due to the anticipated impacts of the project to forest habitat, a bat survey of the project

area should be conducted between May 15 and August 15 by a qualified, Fish and Wildlife Service-approved biologist (see enclosed list) using the enclosed *Indiana Bat Mist Netting Guidelines*. Survey results should be submitted to the Service for review and concurrence.

In addition, if any natural caves or abandoned mines occur within a project area, it is possible that Indiana bats or other bat species may be using them during hibernation or potentially as summer roost sites. If potential Indiana bat hibernacula (*i.e.*, caves or abandoned mines) occur within a project area, they should be surveyed by a qualified biologist. Prior to conducting any survey, however, the Pennsylvania Game Commission should be contacted to determine whether or not they have surveyed the cave/mine in the past. If adequate surveys have been conducted in the recent past, this may preclude the need to conduct additional surveys. Survey results should be submitted to the Service for review and concurrence.

Bog Turtle

Bog turtles inhabit shallow, spring-fed fens, sphagnum bogs, swamps, marshy meadows, and pastures characterized by soft, muddy bottoms; clear, cool, slow-flowing water, often forming a network of rivulets; high humidity; and an open canopy. Bog turtles usually occur in small, discrete populations occupying suitable wetland habitat dispersed along a watershed. The occupied "intermediate successional stage" wetland habitat is usually a mosaic of micro-habitats ranging from dry pockets, to areas that are saturated with water, to areas that are periodically flooded. Some wetlands occupied by bog turtles are located in agricultural areas and are subject to grazing by livestock.

As you are aware, bog turtles are known to be present at the Arnott Fen in Monroe County. An existing transmission line currently runs through this wetland. This portion of your project proposes to take down the existing line crossing the fen and put a new line in its place, with both the existing wires and the new wires strung on the same set of structures using a helicopter. There will still only be one transmission line crossing Arnott Fen (within the same ROW as the current line). However, you also noted that it is possible, due to different structure sizes, the existing ROW will have to be widened up to approximately 50 feet. This possibility is still being evaluated by engineers.

Based on a review of the information supplied to this office, we have determined that construction of the proposed project is not likely to adversely affect the bog turtle. However, should structures need to be located in the wetland and/or the ROW needs to be widened, further consultation with this office will be necessary.

Bald Eagle

Although no bald eagle nests are known to occur in the project area, the proposed project is located within the range of the bald eagle (*Haliaeetus leucocephalus*). Bald eagles typically occur in the vicinity of aquatic ecosystems; they frequent lakes, reservoirs, large rivers (*e.g.*, Delaware River, Juniata River, Susquehanna River), and wetland systems. Their nests are

usually built in large trees within two miles of these features. Because eagles are vulnerable to human disturbance, particularly during the nesting season, nests are often located in relatively remote forested areas.

The Service published a final rulemaking to remove the bald eagle from the federal *List of Endangered and Threatened Wildlife* on July 9, 2007 (*Federal Register*, Vol. 72, No. 130). This rule became effective on August 8, 2007. Although the bald eagle no longer receives protection under the Endangered Species Act, it continues to be protected under the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act (MBTA). Both acts protect bald eagles by prohibiting killing, selling or otherwise harming eagles, their nests or eggs. The Eagle Act also protects eagles from disturbance. Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Because bald eagles are continuing to recover and expand their breeding range in Pennsylvania, new eagle nests may be found in previously undocumented locations. Should you become aware of an eagle nest in or near your project area, please refer to the Service's *National Bald Eagle Management Guidelines* for specific measures that should be taken to ensure bald eagles are not disturbed. The Service developed these *Guidelines* to advise landowners, land managers and others who share public and private lands with bald eagles when and under what circumstances the protective provisions of the Eagle Act may apply to their activities. The *Guidelines* include general recommendations for land management practices that will benefit bald eagles; however, the document is intended primarily as a tool to provide those who seek information and recommendations regarding how to avoid disturbing bald eagles. Adherence to the *Guidelines* will benefit individuals, agencies, organizations and companies by helping them avoid violations of the law. The *Guidelines* can be found at http://www.fws.gov/migratorybirds/baldeagle.htm. If you have any questions about the *Guidelines* or how they would apply to a particular project, please contact our office.

This response relates only to endangered or threatened species under our jurisdiction, based on an office review of the proposed project's location. No field inspection of the project area has been conducted by this office. Therefore, we suggest contacting a qualified consultant to evaluate your site for potential wetland impacts.

To avoid potential delays in reviewing your project, please use the above-referenced USFWS project tracking number in any future correspondence regarding this project.

If you have any questions regarding these comments, please contact Pamela Shellenberger of my staff at 814-234-4090.

Sincerely,

David Densmore
Supervisor

Enclosures

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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Pleasantville, New Jersey 08232
Tel: 609/646 9310
Fax: 609/646 0352
http://www.fws.gov/northeast/njfieldoffice

In Reply Refer to:

2008-I-0319

MAR 17 2008

PROTECTED INFORMATION

CONFIDENTIAL

Raymond A. Tripodi, Manager
Corporate Licenses and Permits
PSEG Services Corporation
80 Park Plaza
Newark, new Jersey 07102-4194

Dear Mr. Tripodi:

The U.S. Fish and Wildlife Service (Service) has reviewed your February 20, 2008 request for information on the presence of federally listed endangered and threatened species in the vicinity of PSEG's proposed Roseland to Bushkill Electric Transmission Line to be located in Morris, Sussex, and Warren Counties, New Jersey. The proposed project involves installation of 45 miles of new 500-kV overhead electric transmission lines along an existing 150-foot-wide right-of-way (ROW) in 15 municipalities. The project also involves construction of two new switching stations, in Jefferson and East Hanover Townships, Morris County. The proposed station sites comprise approximately 23 acres in East Hanover and 142 acres in Jefferson; these areas are currently wooded.

AUTHORITY

This response is pursuant to Section 7 the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA) to ensure the protection of federally listed endangered and threatened species. These comments do not preclude separate review and comments by the Service pursuant to the National Environmental Policy Act of 1969 as amended (83 Stat. 852; 42 U.S.C. 4321 *et seq.*); the Bald and Golden Eagle Protection Act (54 Stat. 250; 16 U.S.C. 668-668d); or the December 22, 1993 Memorandum of Agreement among the U.S. Environmental Protection Agency, New Jersey Department of Environmental Protection (NJDEP), and the Service, if project implementation requires a permit from the NJDEP pursuant to the New Jersey Freshwater Wetlands Protection Act (N.J.S.A. 13:9B *et seq.*).

FEDERALLY LISTED SPECIES

Indiana Bat

The project area is located within the geographic range of the federally listed (endangered) Indiana bat (*Myotis sodalis*). Most of the ROW, and the proposed Jefferson Station, are located in foraging habitats used by Indiana bats in spring and fall, before and after hibernation. Portions of the ROW, and the proposed Jefferson and East Hanover Stations, are located within the foraging ranges of known Indiana bat maternity colonies. Indiana bats from these maternity colonies may forage and roost in the project area during the summer breeding season. A reproductive female from one of these maternity colonies was previously captured within the ROW in Rockaway Township, Morris County. To date, Indiana bats have not been documented along portions of the ROW west of Newton, Sussex County, but this western section of the project is within the potential range of this species. Additional information about the Indiana bat is enclosed.

The Service offers the following preliminary recommendations to protect the Indiana bat.

1. Seasonally restrict tree clearing from April 1 to September 30 at the proposed East Hanover Station, and along the ROW in Hardwick Township (Warren County), Stillwater and Fredon Townships and Newton (Sussex County), and East Hanover Township (Morris County).

2. Seasonally restrict tree clearing from April 1 to November 15 at the proposed Jefferson Station, and along the ROW in all other municipalities not listed in #1, above.

3. Identify any 1-mile segments of the ROW (each approximately 18 acres) where proposed tree clearing totals over 6 acres. For any such segments, provide the Service with project plans showing the locations and acreage of proposed tree clearing, as well as photographs and a characterization of wooded areas to be cleared (*e.g.*, typical tree species and sizes, understory structure).

4. Preserve at least 150-foot wooded upland buffers around wetlands and open waters at the proposed station locations.

5. Minimize tree clearing at the proposed station locations, preferentially preserving trees that provide suitable roosts for Indiana bats (see enclosed list). If the station footprint will not occupy the entire property, seek to maintain at least 24 suitable roost trees per acre, and consider placing portions of the property not needed for station development under conservation easement.

6. Provide the Service with project plans for the proposed stations, showing the locations and acreage of proposed tree clearing, as well as photographs and a characterization of wooded areas to be cleared (*e.g.*, typical tree species and sizes, under story structure).

Upon review of the project information requested above, the Service may request a site visit and may recommend mist net and telemetry studies to determine bat use of particular areas. If recommended, mist netting must be carried out by a recognized, qualified surveyor (see enclosed list) between May 15 and August 15 according to Service guidelines (enclosed). The Service will work cooperatively with PSEG to identify and refine conservation measures necessary to avoid adverse effect to the Indiana bat.

Bog Turtle

Two known occurrences of the federally listed (threatened) bog turtle (*Clemmys muhlenbergii*) are located along the ROW, within Segments 66/1-66/2 and 48/4-49/1 (reference is to the IGDS field in the GIS file provided with your February 20, 2008 letter). The following eleven segments of the ROW contain of areas of potential bog turtle habitat previously identified by the NJDEP.

42/1-42/2	58/1-58/2
42/2-42/3	59/1-59/2
43/2-43/3	55/3-55/4
52/5-53/1	55/4-55/5
53/1-53/2	59/4-60/1
53/5-53/6	

Additional areas of potential habitat along the ROW may have been previously identified by PSEG during surveys conducted under your NJDEP Freshwater Wetland General Permit for vegetation maintenance. However, other portions of the ROW may not have been surveyed for bog turtle habitat to date. Where present in the ROW, bog turtles may be disturbed or injured by the proposed construction activities, and may be adversely impacted by any temporary or permanent impacts to wetlands including clearing, filling, draining, shading, and changes in erosion, sedimentation, water quality, or surface or groundwater hydrology. Therefore, the Service requests that a recognized, qualified surveyor (see enclosed list) inspect (i.e., Phase 1 survey) all scrub/shrub and emergent wetlands in the ROW that have not been previously surveyed for the presence or absence of bog turtle habitat. Guidance for performing bog turtle habitat surveys is enclosed. Surveyors must avoid stepping on the tops of hummocks because this can destroy turtle nests and eggs. The results of any survey, whether showing presence or absence of bog turtle habitat, must be forwarded to this office for review; please include photographs and the qualifications of the surveyor(s).

The Service recommends that PSEG adopt the following conservation measures for all identified areas of known and potential bog turtle habitat along the ROW.

1. Employ a recognized qualified bog turtle surveyor to mark the known and potential bog turtle habitat in the field, clearly flagging these areas including a 150-foot buffer. Remove all flagging when work is completed in the area.

2. Instruct workers to avoid stepping on hummocks and tussocks when working in flagged wetlands, to avoid the possibility of crushing turtle nests or eggs.

3. Prohibit use of motorized vehicles within flagged wetlands.

Phase 2 (visual) surveys and/or additional conservation measures may be necessary if the above recommendations cannot be adopted. Phase 2 surveys must be carried out at specific times between April 15 and June 15. Additional information on the bog turtle is enclosed.

MIGRATORY BIRDS

The Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712) prohibits the take of migratory birds, their parts, nests, and eggs, even when incidental to an otherwise lawful activity. To minimize avian electrocution and collision risks, the Service recommends constructing the proposed new power line and stations in accordance with the *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006*. If PSEG has not already done so, the Service also recommends preparation of an Avian Protection Plan (APP). Both the *Suggested Practices* document and guidance for preparing APPs are available from the Avian Powerline Interaction Committee (http://www.aplic.org/).

CONCLUSION

The proposed project may adversely affect the federally listed Indiana bat and/or bog turtle. Therefore, further consultation with the Service is necessary pursuant to Section 7 of the ESA. Through the informal consultation process, the Service will work cooperatively with PSEG to avoid adverse effects to federally listed species. In addition, the Service appreciates the cooperation of PSEG in minimizing hazards to migratory birds.

Except for the above-mentioned species, no other federally listed or proposed threatened or endangered flora or fauna are known to occur within the vicinity of the proposed project. If additional information on listed and proposed species becomes available or if project plans change, this determination may be reconsidered.

Please refer to our web site at http://www.fws.gov/northeast/njfieldoffice/Endangered/ for current lists of federally listed and candidate species in New Jersey. The web site also provides a link to the National Bald Eagle Management Guidelines, and contacts for obtaining current information regarding State-listed and other species of concern from the New Jersey Natural Heritage and Endangered and Nongame Species Programs.

Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions or require further assistance regarding federally listed threatened or endangered species.

Sincerely,

John C. Staples
Assistant Supervisor

LISTED SPECIES - MAMMALS

Indiana bat (*Myotis sodalis*)

The Indiana bat was first protected on March 11, 1967 under the Endangered Species Preservation Act of 1966 and is currently listed as endangered pursuant to the ESA. Indiana bats hibernate in caves and abandoned mine shafts from October to April, depending on climatic conditions. Between early August and mid-September, Indiana bats arrive near their hibernation caves and engage in swarming and mating activity. Swarming at cave entrances continues into mid or late October. During this time, the bats forage and build fat reserves for hibernation. Many areas of New Jersey have not been surveyed for the presence of the Indiana bat. The past extensive mining that has taken place in some areas of New Jersey has resulted in numerous abandoned mine shafts that may provide suitable conditions for use by the Indiana bat as hibernacula. However, the openings of many of these shafts have collapsed or been purposefully sealed to prevent human access, making determination of Indiana bat use difficult.

After emerging from hibernation, Indiana bats once again forage in the vicinity of the hibernation site before migrating to summer habitats. Where Indiana bats go after dispersing from their hibernacula in New Jersey is not well known. Until recently, little was known about the summer habitat of the Indiana bat. Female Indiana bats occupy summer maternity roosts under the loose tree bark of dead, dying, or live trees along riparian, floodplain, or upland forests. Female Indiana bats raise a single offspring each year. The summer roosts of adult males are often found near maternity roosts, but where most males spend the day is unknown. Some adult males remain near the hibernaculum and have been found in caves during the summer. Proposed projects in the following counties should be reviewed to determine if suitable summer or winter habitat is present: Essex, Hunterdon, Passaic, Somerset, Sussex, Union, and Warren. If suitable habitat is present and will be altered or removed, the project site should be surveyed for the presence of the Indiana bat.

Indiana bats, as with all eastern United States bat species, feed almost exclusively on insects. Indiana bats forage for flying insects in and around the tree canopy at night. A variety of upland and wetland habitats are used as foraging areas, including flood plain, riparian, and upland forests; pastures; clearings with early successional vegetation; cropland borders; and wooded fencerows. Preferred foraging areas are streams, associated flood plain forests, and impounded bodies of water such as ponds and reservoirs. The abundance of mature trees within the floodplain and upland forest in northern New Jersey provide suitable maternity, summer, and foraging habitat for the Indiana bat. If maternity roost sites are located within a project area, clearing of mature trees could adversely affect the Indiana bat through disturbance to or destruction of maternity or summer roost trees. Threats to the Indiana bat include disturbance or killing of hibernating and maternity colonies; vandalism and improper gating of hibernacula; fragmentation, degradation, and destruction of forested summer habitats; and use of pesticides and other environmental contaminants.

Enclosure – Characteristics of Indiana Bat Summer Habitat

Potential summer habitat for Indiana bats features at least 24 suitable roost trees per acre. Tree characteristics such as loose or shaggy bark, crevices, and hollows are more important than tree species. Suitable roost trees include any of the following:

- live shagbark hickories (*Carya ovata*) over 9 inches in diameter at breast height (dbh);
- lightening-struck trees over 9 inches dbh;
- dead, dying, or damaged trees of any species over 9 inches dbh with at least 10 percent exfoliating bark;
- den trees, broken trees, or stumps over 9 inches dbh and over 9 feet in height; and
- live trees of any species over 26 inches dbh.

Trees as small as 5 inches dbh have been used as maternity roosts and trees as small as 3 inches dbh have been used by roosting males; therefore, smaller dbh trees with the aforementioned characteristics should be retained if larger dbh trees are not present.

The following are examples of native tree species that should be included in planting plans designed to provide suitable roosts for Indiana bats in New Jersey.

Red maple	*Acer rubrum*
Silver maple*	*Acer saccharinum*
Sugar maple *	*Acer saccharum*
Yellow birch	*Betula alleghaniensis*
Gray birch	*Betula populifolia*
Bitternut hickory	*Carya cordiformis*
Sweet pignut hickory	*Carya ovalis*
Shagbark hickory *	*Carya ovata*
White ash	*Fraxinus americana*
Green ash*	*Fraxinus pennsylvanica*
White pine	*Pinus strobus*
Eastern cottonwood*	*Populus deltoides*
White oak*	*Quercus alba*
Pin oak	*Quercus palustris*
Northern red oak	*Quercus rubra*
Post oak	*Quercus stellata*
American elm*	*Ulmus americana*
Slippery elm	*Ulmus rubra*

* preferred roost tree species

Revised 2/6/2008

RECOGNIZED QUALIFIED INDIANA BAT SURVEYORS

The following list includes individuals recognized by the U.S. Fish and Wildlife Service, New Jersey Field Office, and the New Jersey Department of Environmental Protection (NJDEP), Endangered and Nongame Species Program as qualified to conduct surveys for Indiana bats. This list may not include all individuals qualified to survey for this species. This list will be updated periodically. Inclusion of names on this list does not constitute endorsement by the Service, the NJDEP, or any other U.S. Government agency or State agency.

Various techniques are used to sample and study bats in New Jersey, including hibernacula surveys, mist netting, acoustic detection, and radio-telemetry. Some individuals on this list may not be qualified to conduct all techniques. A scientific collecting permit from the NJDEP is required to capture bats in New Jersey.

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Revised December 2007

2008- 0677

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

January 27, 2010

Sue Sutter
The Louis Berger Group, Inc,
75 2nd Avenue, Suite 700
Needham, MA 02494

USFWS #: 2008-0677

Dear Ms. Sutter:

This responds to your Indiana bat survey report submitted to this office on September 15, 2009, and our meeting on November 18, 2009 regarding the proposed Susquehanna Roseland 500kV Transmission Line located in Luzerne County, Pennsylvania. The proposed project is within the range of the Indiana bat (*Myotis sodalis*), a species that is federally listed as endangered and the bog turtle (*Clemmys muhlenbergii*), a species that is federally listed as threatened. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species.

Indiana bat

Mist-net Surveys:

Our letter of October 16, 2008, requested mist net surveys for the entire project right-of-way due to proposed forest clearing associated with construction of the project. However, this excluded the 25 acres of forest impacts proposed within the 10-mile radius around the Dogtown and Glen Lyon Indiana bat hibernaculum. Since we assume presence within this radius, no mist net surveys were conducted in this area.

According to the report, surveys were conducted at 136 sites within the project area between May 27 and August 12, 2009 in accordance with the Fish and Wildlife Service's (USFWS) Indiana bat mist-net survey guidelines. During these surveys, 665 bats of eight species were captured, but this did not include any Indiana bats. Based on these survey results, we have concluded that Indiana bats are either not present in the project area, or are present in such low densities that they were not detected.

Portal Surveys:

Additionally, there were five portals identified within the project boundaries. Spring hibernacula surveys were performed in accordance with USFWS and Pennsylvania Game Commission guidelines between May 5 and May 9, 2009. During these surveys, 13 bats of two species were captured, but this did not include any Indiana bats.

Direct Impacts:

According to the information provided in your August 20, 2009 email, approximately 25 acres of forest habitat will be removed within the ten miles radius of the Glen Lyon and Dogtown Mines. A portion of the project is located approximately 1.5 miles north of the Glen Lyon Mine and approximately 175 feet west of the Dogtown Mine. The proposed transmission line is 175 feet from the Dogtown Mine but no new disturbance is proposed near this mine because there is an existing line in this portion of the project.

Due to the proximity of this 25 acre area to two known Indiana bat hibernacula, removal of trees and forested areas within this area could result in the direct take of roosting Indiana bats, which could be injured or killed when trees are cut. Studies have found that forested areas located within ten miles of hibernacula provide important foraging and roosting habitat for Indiana bats, especially during the fall and spring, when bats are building up their fat reserves prior to and after hibernation. In addition, female maternity colonies and individual male bats may be found in the vicinity of hibernacula throughout the summer months.

To avoid the direct take of Indiana bats, if any tree-cutting activities are proposed within this 25 acre area, they should be carried out from November 16 to March 31, during which time bats are hibernating. If any tree-cutting is necessary from April 1 to November 15, the following trees greater than or equal to five inches diameter breast height (d.b.h.) should not be cut or physically disturbed (*e.g.*, while harvesting any adjacent trees) in order to avoid killing or injuring roosting Indiana bats: 1) dead or dying trees and snags (including lightning struck trees) with exfoliating bark; 2) live trees (such as shagbark and shellbark hickory) which have exfoliating or defoliating bark in the trunk or branches; and 3) trees or snags that have characteristics typical of roost sites for Indiana bats (*i.e.*, have exfoliating or defoliating bark, or contain cracks, crevices, or holes that could be used by the species as a potential roost), especially trees with sun exposure to the trunk. Tree-clearing from November 16 to March 31 may proceed without these restrictions.

If a seasonal restriction on tree-cutting is implemented in the 25 acre area, to avoid the direct take of Indiana bats, and because mist-net surveys and portal searches did not find any Indiana bats outside of this area, construction of the proposed project is not likely to adversely affect this species. If you are unable to implement the above measures to avoid adverse effects, however, further consultation with this office will be necessary. For future conservation of the species, and for the benefit of all wildlife species in the project area, we encourage you to conserve forest habitat on the site whenever possible.

Bog turtle

On November 18, 2009 a meeting was held at the Delaware Water Gap National Recreation Area (DEWA) to discuss impacts of replacing transmission line towers and restringing the transmission lines. The existing transmission line crosses the Arnott Fen, a large wetland complex occupied by bog turtles. The fen is on DEWA property.

After the meeting, we walked two different routes, each of which can access one of the towers. Each route crosses the wetland, however, the northern route will have direct impacts to the bog turtle and would require formal consultation through Section 7 of the Endangered Species Act.

The southern access route crosses a tributary that flows from one wetland to another. The proposed crossing area for the southern access route is located at an incised forested tributary. There are no wetlands within at least 200 feet from this crossing area. However, bog turtles can use this area as a travel corridor. Therefore, in order to avoid direct take of bog turtles, the Service recommends the southern access route be used for construction access and implementation. Additionally, because of the project's proximity to bog turtle habitat, all work associated with the southern access route, access roads and tower replacement should be completed between November 1 and March 31, when bog turtles are hibernating. If the work must be completed outside these dates, a qualified bog turtle surveyor should conduct a pre-construction bog turtle survey immediately prior to all work-related activities, and a silt-fence should be installed between the potential bog turtle habitat and the construction area. If bog turtles are found during the survey, construction work must not be initiated, and the USFWS and Pennsylvania Fish and Boat Commission must be contacted.

If this project is implemented with the above conditions, construction is not likely to adversely affect the bog turtle. This determination is valid for two years from the date of this letter. If the proposed project has not been fully implemented prior to this, an additional review by this office is recommended. Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered.

To avoid potential delays in reviewing your project, please use the above-referenced USFWS project tracking number in any future correspondence regarding this project.

Please contact Pam Shellenberger of my staff at 814-234-4090 if you have any questions or require further assistance regarding this matter.

Sincerely,

Eric Schrading
Acting Supervisor

Enclosure

Enclose:
Appendix A

cc:
PGC, Harrisburg – Jim Leigey
Readers file
ES file – active
Response type
P:\FROFFICE\Drafts\Drafts 2010\Susquehanna-Roseland Transmission Line2.doc

Jim Leigey
Pennsylvania Game Commission
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Harrisburg, PA 17110-9797

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

April 17, 2012

Sue Sutter
The Louis Berger Group, Inc.
100 Commercial Street
2nd Floor, North
Manchester, NH 03101

Dear Ms. Sutter:

This responds to your letter of February 10, 2012, which requested an update to our letter of January 27, 2010, regarding the proposed Susquehanna to Roseland 500 kV Electric Transmission Line Project (SRLINE) proposed route located in Luzerne, Lackawanna, Wayne, Pike and Monroe Counties, Pennsylvania. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species, as well as the Migratory Bird Treaty Act (MBTA, 16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755, as amended) and the Bald and Golden Eagle Protection Act (54 Stat. 250, as amended; 16 U.S.C. 668-668d) to ensure the protection of migratory bird species.

Beginning in 2009, The Louis Berger Group, Inc, worked cooperatively with the FWS to evaluate and minimize adverse effects to federally listed species along your company's preferred route for the SRLINE (*i.e.*, "Alternative 2/2b" in the NPS Draft Environmental Impact Statement [DEIS]). Habitat assessments and species surveys were conducted and conservation measures were developed with FWS input. The FWS appreciates your previous cooperation to protect listed species.

Indiana bat

The proposed project is within the range of the Indiana bat (*Myotis sodalis*), a species that is federally listed as endangered.

Mist-net Surveys:

Mist-net surveys were conducted between May 27 and August 12, 2009 in accordance with the Fish and Wildlife Service's (USFWS) Indiana bat mist-net survey guidelines. No Indiana bats were captured. Based on these survey results, we have concluded that Indiana bats are either not present in portions of the project area surveyed, or are present in such low densities that they were not detected. It should be noted that the 25 acres of forest impacts proposed within the 10-

mile radius around the Dogtown and Glen Lyon Indiana bat hibernaculum were not surveyed, since we assume presence within this radius.

Portal Surveys:

Additionally, there were five portals identified within the project boundaries. Spring hibernacula surveys were performed in accordance with USFWS and Pennsylvania Game Commission guidelines between May 5 and May 9, 2009. During these surveys, 13 bats of two species were captured, but this did not include any federally listed bats. Therefore, we assume Indiana bats are not present in these portal areas.

Direct Impacts:

A portion of the project is located approximately 1.5 miles north of the Glen Lyon Mine and approximately 175 feet west of the Dogtown Mine. The proposed transmission line is 175 feet from the Dogtown Mine but no new disturbance is proposed near this mine because the line already exists in this portion of the project. All known direct impacts to this species in Pennsylvania are occurring outside of the Delaware Water Gap National Recreation Area (DEWA).

According to the information provided in your March 19, 2012 email, approximately 13 acres of forest habitat were cleared from February 27, 2012 to March 21, 2012, within the ten mile radius of the Glen Lyon and Dogtown Mines. This was less than the 25 acres that were originally anticipated to be cleared in this area.

As discussed, forests and woodlots in the vicinity of hibernacula provide important foraging and roosting habitat for Indiana bats, and impacts to forest habitat may adversely affect Indiana bats in two primary ways. First, the cutting of trees during the spring, summer or fall may kill or injure Indiana bats, because they roost in trees during these seasons. Second, habitat within the swarming radius of hibernacula is especially important during the fall and spring, immediately prior to and after hibernation, and therefore the loss of this foraging and roosting habitat itself may harm Indiana bats. When bats are forced to shift their normal foraging or roosting to nearby habitat, they may face a reduction in fitness affecting their survival during hibernation, in addition to potentially increasing competition with or displacement of other bats. Access to suitable foraging habitat is particularly important for bats upon their return to hibernacula in late summer and early fall, when they need to build up fat reserves for the anticipated hibernation period. Consequently, bats that lose a significant amount of foraging habitat are likely to experience an increased risk of mortality due to a reduction in fitness, as well as a reduction in reproductive potential.

If measures can be implemented to reduce the likelihood of take and the Service can conclude project effects to be insignificant or discountable, then no take permit (through Section 7) would be necessary. As one means to implement measures to minimize potential adverse effects on Indiana bat, you may choose to prepare an *Indiana Bat Conservation Plan*, in accordance with the enclosed guidance. If so, please submit the draft plan to our office for review and approval. These areas would be the areas within the swarming habitat of the hibernaculum, and any areas determined to be occupied based on results of cave/mine surveys.

We are aware that we previously commented on impacts to the Indiana bat and requested a time of year restriction for tree clearing to minimize project effects and that this tree clearing has already occurred, consistent with our recommendations. However, due to an increase in the number of projects that have forest disturbance in these radii and the accumulated impacts associated with these disturbances, and the ongoing status of the project, we are now recommending that forest loss be addressed (see attached Indiana Bat Conservation Plan guidance) in order for the project to maintain a status of not likely to adversely affect Indiana bats.

Please advise our office whether you intend to avoid take due to impacts from forest clearing in these areas through an Indiana Bat Conservation Plan, or whether the project will undergo Section 7 consultation due to a federal nexus.

Bog turtle

The proposed project is within the range of the bog turtle (*Clemmys muhlenbergii*), a species that is federally listed as threatened. Of all the counties associated with this project, Monroe County is the only county within the known range of this species.

On November 18, 2009 a meeting was held at the DEWA to discuss access impacts of replacing transmission line towers and restringing the transmission lines. The existing transmission line crosses the Arnott Fen, a large wetland complex occupied by bog turtles. The fen is on DEWA property. After the meeting, we walked two different routes (the northern access route and the southern access route), each of which can access one of the towers. Each route crosses the wetland, however, the northern route will have direct impacts to the bog turtle and its habitat and would require formal consultation through Section 7 of the Endangered Species Act.

According to you letter of February 10, 2012, and during your phone conversation on March 19, 2012, with our office, you indicated that only the southern access route will be used to access tower construction and placement near the Arnott Fen. During the November 2009 field meeting, DEWA viewed the southern access route, the crossing area over the tributary and potential access areas through the forest.

Following the southern access route would require crossing over a forested incised tributary which flows from one wetland to another. Although bog turtles can use this forested tributary as a travel corridor, direct impacts can be avoided by implementing all work associated with the southern access route, access roads and tower replacement between November 1 and March 31, when bog turtles are assumed to be hibernating. If this time-of-year restriction cannot be implemented, we further recommend you conduct a bog turtle survey in accordance with the following conditions, which only apply if project construction is proposed to occur between April 1 and October 31, during which time bog turtles are active:

1. Prior to performing any construction work in wetlands, streams, or uplands within 300 feet of the potential bog turtle habitat, all areas of expected disturbance must be surveyed by a qualified surveyor for the presence of bog turtles.

2. Prior to the survey, herbaceous vegetation should be cut to a height of 4 to 6 inches using a hand-held trimmer/weed-cutter, and then carefully raked away from the area to be searched. A qualified bog turtle surveyor should be present when this vegetation clearing occurs.

3. Immediately following the survey, silt-fencing should be placed between the wetland and the proposed construction zone while the bog turtle surveyor is present to ensure that the fencing is properly installed in the correct location. The silt-fencing should be removed immediately following construction.

4. If any bog turtles are located during these searches, the Service and Pennsylvania Fish and Boat Commission should be contacted immediately, and construction should not proceed until further consultation occurs. Survey results should be submitted to the Service and PFBC.

Additionally, all work activities including: staging areas, tower placement, tree cutting, access roads, etc., should occur at least 300' from the occupied wetland. If project activities are proposed closer than this, but not directly in the wetland, they should occur between November 1 and March 31, when bog turtles are assumed to be hibernating, and follow the same measures listed above.

Finally, to reduce impacts to the species and its habitat, no trees should be felled into the wetland.

If this project is implemented using the southern access route with the above conditions, construction is not likely to adversely affect the bog turtle. We note that using this access route will minimize impacts to a federally threatened species and therefore we are commenting on it consistent with our authority under the Endangered Species Act, but also that the route may require separate evaluation by the DEWA for impacts associated with National Park lands.

This determination is valid for two years from the date of this letter. If the proposed project has not been fully implemented prior to this, an additional review by this office is recommended. Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered.

Assessment of Risks to Migratory Birds including Bald and Golden Eagles

The Fish and Wildlife Service (Service) is the principal Federal agency charged with protecting and enhancing populations and habitat of migratory bird species. The Migratory Bird Treaty Act (MBTA) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for authorizing incidental take, the Service recognizes that some birds may be killed even if all reasonable measures to avoid take are implemented. Unless the take is authorized, it is not possible to absolve individuals, companies or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures). However, the Office of Law Enforcement focuses enforcement action on those individuals, companies, or agencies that take migratory birds with disregard for their

actions and the law. We recognize that this information was not provided to you in our previous correspondence and we apologize for that discrepancy.

In addition to the MBTA, bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (Eagle Act), which prohibits killing; selling; or otherwise harming eagles, their nests, or their eggs. The Eagle Act also includes provisions not included in the MBTA, including the protection of unoccupied nests and a definition of take that prohibits disturbing eagles. There are 43 known eagle nest locations within Lackawanna, Luzerne, Pike and Wayne Counties. While some of these nests may be alternate nests for the same breeding pair, the majority of all nests are located in Pike County. Based on the project area map, it appears that this transmission line will be within two miles of five nests within Pike County, one nest in Lackawanna County and three nests in Luzerne County. Since the transmission line is located near several large waterbodies (*e.g.*, Lake Wallenpaupack, Peck's pond) and since it is in close proximity to both the Susquehanna and the Delaware Rivers, there is potential for new nests to be constructed in the current breeding season and potential for disturbance to occur to nesting and foraging bald eagles. The Service recommends that applicants carefully evaluate their proposed project in light of the *National Bald Eagle Management Guidelines*, which are available at http://www.fws.gov/migratorybirds/BaldEagle.htm. Recommendations will be forthcoming from the FWS Regional Office on the applicability of a permit for take of bald eagles on National Park Service (NPS) lands, however, it is important to note that before a permit can be considered, all reasonable avoidance and conservation measures must be undertaken. We suggest discussing whether or not eagles might be disturbed, injured or killed as a direct or indirect result of the proposed project in the rest of the project area, as well as on NPS lands, with the Regional Office to determine applicability of take permits.

In addition to disturbance, the potential exists for avian mortality from electrocutions or collisions with power lines as well as direct impacts from habitat loss for wintering, migrating, and breeding migratory birds and indirect impacts from fragmentation and site avoidance within the project boundaries. Electrocutions from power lines are of particular concern to raptors, as their size, hunting strategy, and nesting preferences make them particularly vulnerable. Other species, such as corvids (crows and ravens) and cormorants also show an affinity for nesting on power lines. Collisions are most common at night, or under low visibility conditions, because migratory birds and land birds either cannot see the utility lines, or they lack the ability to negotiate obstacles quickly enough to avoid them. Site-specific factors that should be considered in project siting to avoid and minimize the risk to birds include avian abundance; the quality, quantity, and type of habitat; geographic location; type and extent of bird use (*e.g.* breeding, foraging, migrating, etc.); and landscape features.

The Avian Power Line Interaction Committee (APLIC; www.aplic.org) and the Service (http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/BirdHazards.html) have developed guidelines for power lines to minimize impacts from existing facilities and in the construction of new utility and energy systems and associated infrastructure (APLIC 1994, 1996, and 2006; APLIC and Service 2005). In addition to those recommendations and suggestions, we offer the following recommendations to avoid and minimize impacts to migratory birds within and around the project area.

1. Develop an Avian Protection Plan that minimizes the risk of electrocution, collision, and nest disturbance for migratory birds (APLIC and Service 2005).

2. Minimize the risk of bird electrocutions by using horizontal and vertical separation between energized and/or grounded parts that allows sufficient clearance for wrist-to-wrist (flesh-to-flesh) and head-to-foot (flesh-to-flesh) clearance for the largest migratory birds in the project area (the standard is 60 inches of horizontal separation and 40-48 inches of vertical separation for eagles) and apply insulating conductors on corner and transformer poles. Apply covers on phases or grounds where adequate separation is not feasible (*e.g.*, insulator/conductor covers, bushing covers, arrester covers, cutout covers, jumper wire covers).

3. Minimize the risk of collisions by marking the wires to increase visibility to flying birds (*e.g.*, hanging markers, bird flight diverters, aviation marker balls).

4. Report bird mortalities and injuries resulting from electrocutions or collisions on the Service's Bird Fatality/Injury Reporting Program (Bird Report program). The Bird Report program was designed, with significant industry input and feedback, to provide a user-friendly, easily-accessed, method of allowing members of the electric utility industry to voluntarily report bird mortalities and injuries resulting from electrocutions or collisions with electrical utility equipment. Collecting information about the locations and circumstances under which birds are killed or injured on power equipment serves the primary purpose of determining how to prevent future bird interactions. The database is intended for use by utilities to see which structures and equipment are hazardous to birds, and under what conditions and assists in evaluating and enhancing the effectiveness of retrofitting.

5. Minimize land and vegetation disturbance and reduce habitat fragmentation during project design and construction, especially if habitat cannot be fully restored after construction. Where practicable, concentrate construction activities, infrastructure, and man-made structures (*e.g.*, poles, roads) on lands already altered or cultivated, and away from areas of intact and healthy native habitats. Co-locate roads, staging areas, and other infrastructure in or immediately adjacent to already-disturbed areas (*e.g.*, existing rights-of-way, agricultural fields). If co-location is not feasible, select fragmented or degraded habitats rather than relatively intact areas.

6. Where disturbance is necessary, clear natural or semi-natural habitats (*e.g.*, forests, woodlots, reverting fields, shrubby areas) and perform maintenance activities (*e.g.*, mowing) between September 1 and March 31, which is outside the nesting season for most native bird species. Without undertaking specific analysis of breeding species and their respective nesting seasons on the project site, implementation of this seasonal restriction will avoid take of most breeding birds, their nests, and their young (*i.e.*, eggs, hatchlings, fledglings).

7. Avoid permanent habitat alterations in areas where birds are highly concentrated or where sizable prey bases exist. Avoid establishing sizable structures along known bird migration pathways or known daily movement flyways (*e.g.*, between roosting and feeding areas).

Examples of high concentration areas for birds are wetlands, State or Federal refuges, Audubon Important Bird Areas, private duck clubs, rookeries, roosts, and riparian areas.

8. Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts on vulnerable wildlife. Use only plant species that are native to the local area for revegetation of the project area.

If you have any questions regarding this matter, please contact Pamela Shellenberger of my staff at 814-234-4090.

Sincerely,

Clinton Riley
Field Office Supervisor

References

Avian Power Line Interaction Committee (APLIC). 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute, Washington, D.C.

_____. 1996 (reprinted 2000). Suggested practices for raptor protection on power lines: the state of the art in 1996. Edison Electric Institute/Raptor Research Foundation. Washington, D.C.

_____. 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

USFWS. 2005. Avian Protection Plan (APP) Guidelines. The Edison Electric Institute, APLIC and U.S. Fish and Wildlife Service. Available online at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/APP/AVIAN%20PROTECTION%20PLAN%20FINAL%204%2019%2005.pdf

Enclose:
Qualified BT surveyor list
Indiana Bat Conservation Plan Guidance

cc:
Patrick McMackin
PPL Electric Utilities
Two North Ninth Street
GENN5
Allentown, PA 18101-1179

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United States Department of the Interior

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In Reply Refer To:

2008-I-0319

Thomas Micai, Director
Division of Land Use Regulation
New Jersey Department of Environmental Protection
P.O. Box 439
Trenton, New Jersey 08625-0439
Attention: Lou Cattuna

JUN 11 2010

Re: PSE&G Roseland to Susquehanna Electric Transmission Line
NJDEP File Number 0000-08-0010.1

Dear Mr. Micai:

The U.S. Fish and Wildlife Service (Service) has reviewed additional information provided by PSE&G (applicant) on June 8 and 9, 2010 in response to our May 21 and 24, 2010 (e-mail) and June 8, 2010 (facsimile) requests. This additional information was requested by the Service in regard to PSE&G's application to the New Jersey Department of Environmental Protection (NJDEP) for a New Jersey Freshwater Wetlands Protection Act (N.J.S.A. 13:9B *et seq.*) individual permit and other State authorizations (File Number 0000-08-0010.1) to construct the eastern portion of the Roseland to Susquehanna Electric Transmission Line.

The proposed project involves installation of approximately 25 miles of new 500-kV overhead electric transmission lines along an existing 150-foot-wide right-of-way (ROW) from Hopatcong Borough, Sussex County to Roseland Borough, Essex County, New Jersey. The project also involves construction of a new switching station in Hopatcong and an expanded switching station in Roseland.

PSE&G intends to construct a western portion of the project, roughly 20 miles from Hopatcong to the Delaware River, sometime after the spring of 2012. The subject application does not cover the western portion. Additional project segments are proposed in Pennsylvania by PPL Electric.

AUTHORITY

This response is pursuant to the December 22, 1993 Memorandum of Agreement (MOA) among the U.S. Environmental Protection Agency, the NJDEP, and the Service; the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA); the Bald and Golden Eagle Protection Act (54 Stat. 250; 16 U.S.C. 668-668d); and the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712).

FEDERALLY LISTED SPECIES

Indiana Bat

Pursuant to the 1993 MOA, the subject permit has the potential to affect the federally listed (endangered) Indiana bat (*Myotis sodalis*) unless the following permit conditions are implemented.

- All conservation measures recommended by the Service and adopted by PSE&G, as reflected in the enclosed excerpt of PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.*

- Service concurrence with final compensatory mitigation plans for forest impacts including: (1) preservation, enhancement, and/or restoration of Indiana bat habitat as one component of the 100 to 200-acre Highlands Forest restoration/education pilot site at the Hopatcong Switching Station;[1] and (2) preservation, enhancement, and/or restoration of Indiana bat habitat at a site along the Passaic River. Information regarding Indiana bat habitat requirements is enclosed.

The Service has reviewed the January 29, 2010 Summer Mist Net Survey Report prepared by ESI, Inc., and concurs that no seasonal restriction on tree clearing is necessary at the Hopatcong Switching Station or Fredon Relocation area if work is completed within the next 2 calendar years. The Service has reviewed the June 8, 2010 habitat assessment for the Roseland Switching Station prepared by EcolSciences, Inc., and concurs that no mist net survey is needed for this approximately 2-acre forest.

Via electronic mail dated June 9, 2010, PSE&G agreed to implement Service-recommended conservation measures for the Indiana bat (enclosed), and provided the following estimates of total tree clearing, including rights-of-way, access roads, and temporary work spaces.

	Eastern Portion	Western Portion	Total
Wetland	0.52 acres	0.25 acres	0.77 acres
Transition Area (assumed 150')	6.90 acres	3.04 acres	9.94 acres
Upland	13.60 acres	7.30 acres	20.90 acres
Total	21.02 acres	10.59 acres	31.61 acres

With implementation of the above permit conditions, the Service concurs that, even considering cumulative impacts (*i.e.*, from the western portion), the loss of approximately 21.02 acres of potential Indiana bat summer roosting and foraging habitat from construction of the eastern portion of the project is insignificant based on the following.

- The impacts are spread across a 25-mile linear project.

[1] The Hopatcong forest restoration project is a component of PSE&G's Comprehensive Mitigation Plan, which was part of the basis for NJDEP's January 15, 2010 Highlands Regional Master Plan Consistency Determination.

- The areas with the greatest impacts have been evaluated for Indiana bat habitat (Roseland Switching Station, Picatinny Arsenal) or surveyed using the Service's mist netting guidelines (Hopatcong Switching Station, Fredon Relocation Site).

- In those areas identified by the Service as hibernacula and/or maternity colony foraging habitat, PSE&G will not install any permanent structure (*e.g.*, access road, tower) within 300 feet of wetlands or open waters and will not clear trees or locate temporary work spaces within 150 feet of wetlands or open waters.

- PSE&G will provide compensatory mitigation for forest impacts, as described above.

To minimize cumulative impacts to Indiana bat habitat, additional information, surveys, and/or conservation measures may be necessary for the western portion of the Roseland to Susquehanna Electric Transmission Line project.

With implementation of the above permit conditions, the Service concurs that the risk of disturbance or injury to roosting bats from construction of the eastern portion of the project is discountable based on the seasonal restrictions included in PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.* Except for the Hopatcong Switching Station and Fredon Relocation area, all portions of the project (including access roads, temporary work spaces, Picatinny Arsenal, and the Roseland Switching Station) will be constructed with seasonal restrictions on tree clearing as specified in the revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.*

Bog Turtle

Pursuant to the 1993 MOA, the subject permit has the potential to affect the federally listed (threatened) bog turtle (*Clemmys muhlenbergii*) unless the following permit condition is implemented.

- All conservation measures recommended by the Service and adopted by PSE&G, as reflected in the enclosed excerpt of PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.*

The Service concurs, or has previously concurred, with the following survey reports prepared by EcolSciences, Inc.

- July 8, 2008 (Phase 1 right-of-way)
- December 23, 2008 (Phase 1 Delaware Water Gap National Recreation Area)
- June 18, 2009 (Phase 2 for 5 wetlands)
- July 29, 2009 (Phase 1 Hopatcong Switching Station)
- March 23, 2010 (Phase 1 access roads; concurrence for eastern portion only)
- June 8, 2010 (Phase 1 for 11 additional spans)

With implementation of the above permit condition, the Service expects that impacts to the bog turtle from construction of the eastern portion of the project will be insignificant and

discountable. This determination is based on the extensive surveys (listed above) and on the habitat buffers, fencing, and monitoring protocols detailed in PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project.*

Please note that additional bog turtle surveys and information are still needed for the western portion of the project. Based on this information, the Service may recommend additional conservation measures for the western portion.

MIGRATORY BIRDS

The Migratory Bird Treaty Act prohibits the take of migratory birds, their parts, nests, and eggs, even when incidental to an otherwise lawful activity. In response to the Service's recommendation, PSE&G has prepared a draft Avian Protection Plan (APP) dated June 2010. Pursuant to the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, we recommend that NJDEP include a condition in the subject permit to incorporate Service comments on the draft APP, and to fully implement the final APP.

The Service offers the following preliminary comments on the draft APP.

- The draft APP includes all components recommended in the 2005 *Avian Protection Plan (APP) Guidelines*, and provides a thorough overview of avian issues associated with the project.

- Under "Construction Timing (page 18)," PSE&G proposes to initiate activity in the right-of-way prior to the bird breeding season to discourage nesting and thereby minimize bird mortality and nest failure from vegetation clearing. This section should also mention that the seasonal restriction on tree clearing for Indiana bats (April 1 to September 30 or April 1 to November 15, as specified in PSE&G's revised *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project*) applies to most work areas and will be effective in avoiding take of nests in trees. Note that the Migratory Bird Treaty Act prohibits all take of nests with eggs or young, and that Service permits are required to relocate such nests (see enclosed fact sheet).

- The seasonal restriction on disturbance within 1,000 feet of bald eagle (*Haliaeetus leucocephalus*) nests during the nesting season (December 15 to August 31) (page 18) is consistent with the National Bald Eagle Management Guidelines.

- The Service requests an opportunity to review the "Project-specific Transmission Right-of-Way Vegetation Management Plan" (page 21), and recommends that the plan reflect all adopted conservation measures for federally listed species as described in PSE&G's October 23, 2009 letter to the Service.

- Change "May" to "April" in the first bullet on page 21 of the APP, in reference to the bird breeding season and time to avoid activities such as mowing and cutting. Also add a reference to PSE&G's intention to perform the majority of its transmission vegetation maintenance activities between October 1 through March 31, as indicated in its October 23, 2009 letter.

- The Service appreciates PSE&G's adoption of our guidelines for aviation safety lighting, and supports the choice of the new Obstacle Collision Avoidance System technology to minimize migratory bird collision hazards caused by light entrapment.

- Bald eagle populations in New Jersey are expanding, and the proposed lines will be in place for many decades. The Service recommends that PSE&G implement the "eagle-safe" electrocution standards (first bullet on page 23) in areas of highly suitable (but as yet unoccupied) eagle habitat, not just current nests and foraging habitats.

- The "raptor-safe" electrocution standards (second bullet on page 23) should be adopted as a minimum standard for the entire line, not just the specified spans, as these species may occur across the entire project area. (Of course, the higher standards for eagles and tall birds would apply in the areas specified.)

- The final APP should specify where flight diverters (transmission line marker) will actually be used (fourth bullet on page 23).

- The final APP should specify which avian enhancement opportunities will actually be constructed within project lands, and should add a section describing enhancement efforts outside of project lands (page 28).

CONCLUSION

Pursuant to the 1993 MOA, the subject permit has the potential to affect the federally listed Indiana bat and bog turtle unless the above-listed conditions are included in the permit. The Service also recommends a permit condition to require PSE&G's full implementation of the final APP.

The Service appreciates the cooperation of PSE&G and NJDEP in evaluating and minimizing adverse effects to federally listed species and migratory birds. Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions or require further assistance regarding federally listed threatened or endangered species.

Sincerely,

Acting Supervisor

cc via email:

DLUR, Tina Wolff, John Heilferty, Diane Dow, Larry Torok
PAFO, Clint Riley, Pam Shellenberger
PSE&G, Rob Pollock, David Grossmueller

United States Department of the Interior

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In Reply Refer To:
2008-I-0319

OCT 21 2010

Amanda J. Stein, Biologist/Project Manager
Delaware Water Gap National Recreation Area
1 River Road
Bushkill, Pennsylvania 18324-9999

Dear Ms. Stein:

The U.S. Fish and Wildlife Service (Service) has reviewed the preliminary alternative routes identified by the National Park Service (NPS) in your July 2010 newsletter for the proposed Susquehanna to Roseland Transmission Line project to be located in Morris, Sussex, and Warren Counties, New Jersey. The NPS identified these alternative routes for analysis in an Environmental Impact Statement you are preparing to evaluate impacts from the proposed project to three park units: the Appalachian National Scenic Trail, the Delaware Water Gap National Recreation Area (DWGNRA), and the Middle Delaware National Scenic and Recreational River. The project proponent in New Jersey, PSE&G, proposes to upgrade an existing overhead electric transmission line from 230 kV to 500 kV between the existing Roseland Switching Station and the Delaware River. The project may also involve construction of a new switching station and expansion of the Roseland Switching Station. Additional project segments are proposed in Pennsylvania by PPL Electric. Separate comments may be provided by the Service's Pennsylvania Field Office regarding portions of the project located in Pennsylvania.

AUTHORITY

This response is pursuant to Section 7 the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA); the Bald and Golden Eagle Protection Act (54 Stat. 250; 16 U.S.C. 668-668d) (Eagle Act); and the National Environmental Policy Act of 1969 as amended (83 Stat. 852; 42 U.S.C. 4321 *et seq.*). These comments do not preclude separate review and comments by the Service pursuant to the Fish and Wildlife Coordination Act (48 Stat. 401; 16 U.S.C. 661 *et seq.*), if any permits are required from the U.S. Army Corps of Engineers pursuant to the Clean Water Act of 1977 (33 U.S.C. 1344 *et seq.*); or the December 22, 1993 Memorandum of Agreement among the U.S. Environmental Protection Agency, New Jersey Department of Environmental Protection (NJDEP), and the Service, if project implementation requires a permit from the NJDEP pursuant to the New Jersey Freshwater Wetlands Protection Act (N.J.S.A. 13:9B *et seq.*).

FEDERALLY LISTED SPECIES

Indiana Bat

Alternative 2

The Service has been working with PSE&G since 2008 to evaluate impacts to the federally listed (endangered) Indiana bat (*Myotis sodalis*) from Alternative 2. Via our June 11, 2010 letter to the NJDEP (enclosed), the Service concurred that the eastern segment of Alternative 2 (from the proposed Hopatcong Switching Station to the Roseland Switching Station) is not likely to adversely affect the Indiana bat, based on PSE&G's adoption of several conservation measures. The Service recommends continued refinement and eventual implementation of these and/or other appropriate project-wide conservation measures, regardless of which alternative is selected. We will review and comment on the revised conservation measures (as detailed in PSE&G's *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project*) after PSE&G and NPS have selected a preferred alternative route through New Jersey.

Among the previously adopted conservation measures for Alternative 2 are buffers on wetlands and open waters within those right-of-way spans identified by the Service as foraging habitat associated with known Indiana bat hibernacula and/or maternity colonies. In such spans, PSE&G will not install any permanent structure (*e.g.*, access road, tower) within 300 feet of wetlands or open waters, and will not clear trees or locate temporary work spaces within 150 feet of wetlands or open waters. If these or any other project-wide conservation measure cannot be implemented for any particular span, PSE&G has agreed to work with the Service to develop alternative site-specific conservation measures sufficient to avoid adverse effects to the Indiana bat. If Alternative 2 is selected, the Service will request an analysis of which spans west of the proposed Hoptacong Switching Station may require alternative site-specific conservation measures. This analysis was already completed for the spans between the Hopatcong and Roseland Stations.

The Service also requests a copy of any survey results that were not previously submitted for the Indiana bat or its habitat in New Jersey (*e.g.*, any Indiana bat surveys conducted within the New Jersey portion of DWGNRA).

Alternatives 3 Through 7

The New Jersey portions of Alternatives 3 through 7 are all located within the geographic range of the Indiana bat. The eastern portions of Alternatives 5 and 6/7 also cross known migratory corridors, swarming habitat associated with known hibernacula, and foraging habitat associated with known maternity colonies. Tree clearing could disturb or injure any roosting bats, and could destroy or degrade roosting sites. To minimize impacts, the Service generally recommends a seasonal restriction on tree clearing from April 1 to November 15 within 10 miles of known hibernacula, and from April 1 to September 30 in other parts of the species' range in New Jersey.

To evaluate potential impacts to Indiana bat habitat, the Service requests information regarding the estimated number of acres of tree clearing associated with the New Jersey portion of each Alternative 3 through 7, including for access roads and temporary work spaces. For Alternative 5, please provide a separate subtotal for the portion of the alignment east of Route 206 (where it intersects Route 80 in Mount Olive Township). For Alternative 6/7, please provide a separate subtotal for the portion of the alignment east of Mount Olive Township. Based on the estimated acres of tree clearing, the Service may request habitat characterizations and/or mist net surveys to determine if further conservation measures are necessary in certain areas.

Bog Turtle

Alternative 2

The Service has been working with PSE&G since 2008 to evaluate impacts to the federally listed (threatened) bog turtle (*Clemmys muhlenbergii*) from Alternative 2. Via our June 11, 2010 letter to the NJDEP (enclosed), the Service concurred that the eastern segment of Alternative 2 (Hopatcong Station to Roseland Station) is not likely to adversely affect the bog turtle, based on PSE&G's adoption of several conservation measures. The Service recommends continued refinement and eventual implementation of these and/or other appropriate project-wide conservation measures, regardless of which alternative is selected. We will review and comment on the revised conservation measures (as detailed in PSE&G's *Construction and Restoration Standards for the Susquehanna-Roseland Transmission Project*) after PSE&G and NPS have selected a preferred alternative route through New Jersey.

Among the previously adopted conservation measures for Alternative 2 are buffers on bog turtle habitat, which includes all wetland areas confirmed as bog turtle habitat through field surveys and/or the NJDEP's Landscape Project mapping, or that are treated as such in the absence of a Phase II survey. PSE&G has agreed that no permanent structures (including but not limited to tower footings and new or improved access roads) will be located within 300 feet of bog turtle habitat. Also, no temporary disturbances (including but not limited to removal of existing towers or other structures, use of motorized equipment, earth disturbance, and equipment/materials storage areas) will take place within 150 feet of bog turtle habitat. If these or any other project-wide conservation measure cannot be implemented for any particular span, PSE&G has agreed to work with the Service to develop alternative site-specific conservation measures sufficient to avoid adverse effects to the bog turtle. If Alternative 2 is selected, the Service will request an analysis of which spans west of the proposed Hoptacong Switching Station may require alternative site-specific conservation measures. This analysis was already completed for the spans between the Hopatcong and Roseland Stations.

The Service also requests a copy of any survey results that were not previously submitted for the bog turtle or its habitat in New Jersey (*e.g.*, Phase II surveys within the New Jersey portion of DWGNRA; surveys requested via the Service's May 21, 2010 electronic mail to PSE&G and NJDEP for specific areas between DWGNRA and the Hopatcong Switching Station).

Alternatives 3 Through 7

The New Jersey portions of Alternatives 3 through 7 are all located within the geographic range of the bog turtle. Alternative 5 includes areas of habitat associated with 4 known bog turtle occurrences. Alternative 6/7 includes areas of habitat associated with 3 known bog turtle occurrences. The locations of known, occupied bog turtle habitat along these alternative routes can be obtained from the NJDEP Landscape Project mapping. Further consultation with the Service will be necessary to evaluate and minimize impacts in areas of known, occupied bog turtle habitat if Alternative 5 or 6/7 is selected.

Alternatives 3 through 7 each include areas of scrub/shrub and emergent wetlands that may provide suitable habitat for the bog turtle. Many areas of New Jersey have not been thoroughly surveyed for endangered and threatened species. If present, bog turtles could be injured or disturbed during construction, and could be adversely affected by any temporary or permanent impacts to wetlands. Therefore, the Service requests that a recognized, qualified surveyor (see enclosed list) evaluate all previously unsurveyed wetlands within and adjacent to each Alternative 3 through 7 for the presence or absence of bog turtle habitat (see enclosed guidance). The survey area should include wetlands in and adjacent to proposed access roads and temporary work spaces as well as the proposed right-of-way. The results of any survey, whether showing presence or absence of bog turtle habitat, must be forwarded to this office for review; please include photographs and the qualifications of the surveyor(s).

Dwarf Wedgemussel

Alternative 4 would cross the Pequest River [redacted] downstream of a known occurrence of the federally listed (endangered) dwarf wedgemussel (*Alasmidonta heterodon*). Alternative 5 would cross the Pequest River [redacted] downstream of a known dwarf wedgemussel occurrence. Alternative 6/7 would cross the Pequest River [redacted] dwarf wedgemussel occurrences located both upstream and downstream of the alignment. The dwarf wedgemussel has also been recorded in the Delaware River [redacted] Alternatives 5 and 6/7.

Text contains sensitive archeological resource information

To evaluate potential impacts to the dwarf wedgemussel, the Service requests information for each alternative regarding any proposed in-stream or riparian work along the Delaware River and within the Pequest River watershed. The Service may recommend surveys and/or conservation measures for the dwarf wedgemussel if any permanent or temporary disturbances are proposed within, or within 300 feet of, these open waters.

Swamp Pink

The headwaters of tributaries to the Lamington and Raritan Rivers historically supported several occurrences of the federally listed (threatened) swamp pink (*Helonias bullata*), and one known population still persists in this watershed. Many areas of New Jersey have not been thoroughly surveyed for endangered and threatened species. If present, swamp pink could be adversely affected by any temporary or permanent impacts to its forested wetland habitat. Therefore, the Service requests that a qualified surveyor conduct a survey to determine the presence or absence

of swamp pink (see enclosed guidance). The survey area should include all forested wetlands within [redacted] along Alternative 6/7, including access roads and temporary work areas as well as the right-of-way. The results of any survey, whether showing presence or absence of swamp pink, must be forwarded to this office for review; please include photographs and the qualifications of the surveyor(s).

Text contains sensitive archeological resource information

BALD EAGLE

Several active nests of the bald eagle (*Haliaeetus leucocephalus*) are located along the eastern terminus of Alternative 2. An active bald eagle nest is also located [redacted] of Alternative 3. Important bald wintering areas occur along the Delaware River in the vicinity of Alternatives 2 and 3, and additional wintering habitat is mapped by the NJDEP Landscape Project near the eastern ends of Alternatives 2 and 3. All of the alternatives cross foraging habitat mapped by the NJDEP Landscape Project.

The bald eagle was removed from the Federal List of Endangered and Threatened Wildlife on August 8, 2007. The bald eagle continues to be protected under the Eagle Act and the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712). The bald eagle also remains a State-listed species under the New Jersey Endangered and Nongame Species Conservation Act (N.J.S.A. 23:2A *et seq.*), which carries protections under the State land use regulation program. These Federal and State laws prohibit take of bald eagles. For the continued protection of bald eagles, and to ensure compliance with Federal and State laws, the Service recommends managing bald eagles in accordance with the National Bald Eagle Management Guidelines and all applicable State regulations. Links to the Guidelines and additional information about the delisting of the bald eagle are available on the New Jersey Field Office web site at http://www.fws.gov/northeast/njfieldoffice/endangered.

OTHER MIGRATORY BIRDS

The Migratory Bird Treaty Act prohibits the take of migratory birds, their parts, nests, and eggs, even when incidental to an otherwise lawful activity. At the Service's recommendation, PSE&G has prepared an Avian Protection Plan (APP) for Alternative 2. The Service recommends adaptation and implementation of the APP for whichever alternative is selected. The Service provided comments on a draft of the APP in June 2010. We will provide further review and comments on the revised APP after PSE&G and NPS have selected a preferred alternative route through New Jersey. In addition, the Service generally recommends a seasonal restriction on tree clearing from March 15 to July 31 to prevent unauthorized take of nests and unfledged chicks.

CONCLUSION

The proposed project may adversely affect the federally listed Indiana bat, bog turtle, dwarf wedgemussel and/or swamp pink. Therefore, further consultation with the Service is necessary pursuant to Section 7 of the ESA. Through the informal consultation process, the Service will continue to work cooperatively with NPS and PSE&G to avoid adverse effects to federally listed

species. We also appreciate your cooperation in evaluating and minimize impacts to the bald eagle and other migratory birds.

Except for the above-mentioned species, no other federally listed or proposed threatened or endangered flora or fauna are known to occur within the vicinity of the proposed project. If additional information on listed and proposed species becomes available or if project plans change, this determination may be reconsidered.

Please refer to our web site at http://www.fws.gov/northeast/njfieldoffice/endangered/ for current lists of federally listed and candidate species in New Jersey. The web site also provides a link to the National Bald Eagle Management Guidelines, and contacts for obtaining current information regarding State-listed and other species of concern from the New Jersey Natural Heritage and Endangered and Nongame Species Programs.

Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions or require further assistance.

Sincerely,

J. Eric Davis Jr.
Supervisor

Enclosures

cc via email:
DLUR, Tina Wolff, John Heilferty, Diane Dow, Larry Torok
PAFO, Clint Riley
PSE&G, Rob Pollock, David Grossmueller

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Jersey Field Office
Ecological Services
927 North Main Street, Building D
Pleasantville, New Jersey 08232
Tel: 609/646 9310
Fax: 609/646 0352
http://www.fws.gov/northeast/njfieldoffice/

In Reply Refer To:

2008-I-0319

JAN 31 2012

Mr. John J. Donahue, Superintendent
Delaware Water Gap National Recreation Area and
Middle Delaware National Scenic and Recreational River
Bushkill, Pennsylvania 18324

Ms. Pamela Underhill, Superintendent
Appalachian Trail Park Office
P.O. Box 50
Harpers Ferry, West Virginia 25425

Dear Mr. Donahue and Ms. Underhill:

As a cooperating agency for the National Park Service's (NPS) Susquehanna to Roseland 500 kV Transmission Line (SRLINE) Environmental Impact Statement (EIS), the U.S. Fish and Wildlife Service (FWS) has reviewed the December 2011 Draft EIS (DEIS). The FWS Pennsylvania and New Jersey Field Offices (PAFO and NJFO, respectively) provide the following comments pursuant to the National Environmental Policy Act of 1969 as amended (83 Stat. 852; 42 U.S.C. 4321 *et seq.*) (NEPA); Section 7 the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA); the Bald and Golden Eagle Protection Act (54 Stat. 250; 16 U.S.C. 668-668d) (Eagle Act); and the Migratory Bird Treaty Act (40 Stat. 755; 16 U.S.C. 703-712) (MBTA).

The project proponents, PSE&G and PPL Electric (jointly, the applicant), have applied to NPS to construct a portion of the Susquehanna to Roseland 500kV transmission line and reconstruct an existing 230-kV line along their current Right of Way through three NPS units: the Appalachian National Scenic Trail, the Delaware Water Gap National Recreation Area (DWGNRA), and the Middle Delaware National Scenic and Recreational River. FWS is committed to assisting NPS in meeting its EIS schedule and fulfilling its responsibilities under Federal wildlife laws.

ALTERNATIVES

The FWS appreciates the cooperation of NPS in considering impacts to Cherry Valley National Wildlife Refuge (NWR) in its evaluation of alternatives. Alternative 6/7 has been dropped, in part, to avoid impacts to the NWR. FWS staff will continue to assist NPS and the companies to evaluate alternatives and select a feasible alternative with the least impact on fish and wildlife.

FEDERALLY LISTED SPECIES

Bog Turtle (DEIS page 183)

Within NPS Units

Alternatives 2 and 2b: In a letter dated January 27, 2010, PAFO provided comments on impacts to the federally listed (threatened) bog turtle (*Clemmys [Glyptemys] muhlenbergii*). These comments pertained to Alternatives 2 and 2b and were based on information that had been provided to FWS at that time. As discussed in that letter, there is one known bog turtle site on NPS lands that may be affected by Alternatives 2 and 2b, depending on the specific access route chosen in this area. As indicated in that letter, if the southern route option is used for access, impacts can be avoided and minimized by using a time of year restriction or having a recognized, qualified bog turtle surveyor on-site during construction. Therefore, the January 27, 2010 letter recommended that the southern route be used to minimize impacts to this species. On the other hand, if the northern route is used for access, direct impacts to the bog turtle could occur and formal consultation through Section 7 of the ESA would likely be necessary.

The NJFO addressed the bog turtle via letter dated October 21, 2010. The NJFO subsequently reviewed bog turtle survey reports for NPS lands along Alternatives 2 and 2b. Via comments transmitted July 12, 2010, NJFO concurred with the June 17, 2010 Bog Turtle Habitat Assessment for Wetlands NPS 025A, 025B, and 010, and with the September 10, 2010 Phase 2 Bog Turtle Survey Report. No bog turtles were found. However, if Alternative 2 or 2b is selected, FWS will work with NPS and the applicant to determine if any Conservation Measures are necessary in this area based on proximity to a known bog turtle occurrence and the specific project activities proposed in and near suitable habitat.

No further bog turtle surveys are recommended within NPS units along Alternatives 2 or 2b. If additional information about possible impacts of Alternatives 2 and 2b (*e.g.*, blasting) has become available since our previous review, FWS may reconsider our previous recommendations and/or determinations.

Alternatives 3-5: FWS understands that NPS is undertaking Phase 1 bog turtle surveys along Alternatives 3, 4, and 5 within NPS units. All wetlands within 300 feet of these various alignments should be surveyed by a recognized, qualified surveyor following FWS survey guidelines.[1] The Phase 1 survey reports should be evaluated by the agencies before initiating any presence/absence (Phase 2) surveys. Phase 2 surveys need to be conducted between April 15 and June 15, with at least 2 surveys occurring in May.

If properly implemented species surveys are negative, then the project activities along these routes within NPS units would be considered "not likely to adversely affect" the bog turtle. If surveys reveal presence of this species, then FWS will work with the NPS and applicant to develop Conservation Measures to avoid impacts (*e.g.,* move tower locations). If impacts cannot be fully avoided, formal consultation may be necessary; in this case, FWS would work to expedite issuance of a BO in recognition of NPS' firm schedule to complete the NEPA process.

[1] http://www.fws.gov/northeast/njfieldoffice/pdf/bogturtlesurvey.pdf

Outside NPS Units

Alternatives 2 and 2b: Bog turtle survey work along Alternatives 2 and 2b has conducted been by the applicant, and Conservation Measures have been developed with FWS input. Outside NPS units, the FWS does not anticipate adverse effects to the bog turtle from Alternatives 2 or 2b; however, our analysis of this route is not yet complete (*e.g.*, there are a few outstanding survey reports, Conservation Measures need to be finalized, and blasting has not yet been considered).

Alternatives 3-5: If Alternative 3, 4 or 5 is selected, Phase 1 bog turtle surveys should be conducted for any wetlands within 300 feet of the proposed project route in New Jersey, and in Monroe and Northampton Counties, Pennsylvania, for all portions of the selected route that were not already covered by surveys for Alternative 2 and 2b. FWS and NPS are currently working out a process by which impacts to federally listed species outside NPS units can be evaluated.

Indiana bat (DEIS page 186)

Within NPS Units

Alternatives 2 and 2b: Comments regarding the federally listed (endangered) Indiana (*Myotis sodalis*) bat were included in PAFO's January 27, 2010 letter and NJFO's October 21, 2010 letter. For Alternatives 2 and 2b, surveys for this species were carried out between May 27 and August 12, 2009 in accordance with the FWS Indiana bat mist-net survey guidelines. No Indiana bats were found. Portal searches in these areas, conducted between May 5 and May 9, 2009, also revealed no Indiana bats. Consequently, Alternatives 2 and 2b would not be likely to adversely affect Indiana bats within NPS units.

No further Indiana bat surveys are recommended within NPS units along Alternatives 2 or 2b. If additional information about possible impacts of Alternatives 2 and 2b (*e.g.*, blasting) has become available since our previous review, FWS may reconsider our previous recommendations and/or determinations.

Alternatives 3-5: FWS understands that NPS is undertaking Indiana bat habitat assessments along Alternatives 3, 4, and 5 within NPS units. Results of the habitat assessments should be evaluated by the agencies prior to initiating presence/absence surveys. FWS will likely recommend mist-net surveys and portal searches, to be carried out by a recognized, qualified Indiana bat surveyor for all areas of suitable habitat not covered by the previous surveys. Mist-net surveys should be carried out in forested portions of these alternatives, while portal searches should be carried out along the entire length (if not previously surveyed). Mist-net surveys for this species need to be carried out between May 15 and August 15. [2]

If properly implemented species surveys are negative, then the project activities along these routes within NPS units would be considered "not likely to adversely affect" the Indiana bat. If surveys reveal presence of this species, then FWS will work with the NPS and applicant to

[2] http://www.fws.gov/northeast/njfieldoffice/pdf/Ibatsurvey.pdf
http://www.fws.gov/northeast/njfieldoffice/pdf/IbattelemetryNJ.pdf

develop Conservation Measures to avoid impacts (*e.g.,* move tower locations). If impacts cannot be fully avoided, formal consultation may be necessary; in this case, FWS would work to expedite issuance of a BO in recognition of NPS' firm schedule to complete the NEPA process.

Outside NPS Units

Alternatives 2 and 2b*:* Indiana bat survey work along Alternatives 2 and 2b has been conducted by the applicant and Conservation Measures developed with FWS input. Outside NPS units, the FWS does not anticipate adverse effects to the Indiana bat from Alternatives 2 or 2b; however, our analysis of this route is not yet complete (*e.g.*, there are a few outstanding survey reports, Conservation Measures need to be finalized, and blasting has not yet been considered).

Alternatives 3-5*:* If Alternative 3, 4 or 5 is selected, mist-net surveys and portal searches should be conducted by a recognized, qualified Indiana bat surveyor for all areas of suitable habitat not covered by the previous surveys. FWS and NPS are currently working out a process by which impacts to federally listed species outside NPS units can be evaluated.

BALD EAGLE

As described in the DEIS, several alternatives under consideration have the potential to impact nesting and/or wintering bald eagles (*Haliaeetus leucocephalus*). The Kittanny Ridge and an important eagle wintering area along the Delaware River are of particular concern. As noted in the DEIS, FWS recommends adherence to the National Bald Eagle Management Guidelines[3] to minimize impacts to this species, and ensure compliance with the Eagle Act. The FWS is working with NPS to evaluate the need for any permit(s) under the Eagle Act for the various alternatives under consideration.

OTHER MIGRATORY BIRDS

The FWS is the principal Federal agency charged with protecting and enhancing populations and habitat of migratory bird species. The MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for authorizing incidental take, the Service recognizes that some birds may be killed even if all reasonable measures to avoid take are implemented. Unless the take is authorized, it is not possible to absolve individuals, companies or agencies from liability even if they implement avian mortality avoidance or similar conservation measures. However, the Office of Law Enforcement focuses enforcement action on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law.

As discussed in the DEIS, the potential exists for avian mortality from electrocutions or collisions with power lines as well as direct impacts from habitat loss for wintering, migrating, and breeding migratory birds and indirect impacts from fragmentation, site avoidance, and disturbance of birds within the project boundaries. Electrocutions from power lines are of particular concern to raptors, as their size, hunting strategy, and nesting preferences make them

[3] http://www.fws.gov/migratorybirds/CurrentBirdIssues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf

particularly vulnerable. Other species, such as corvids (crows and ravens) and cormorants also show an affinity for nesting on power lines. Collisions are most common at night, or under low visibility conditions, because migratory birds and land birds either cannot see the utility lines, or they lack the ability to negotiate obstacles quickly enough to avoid them. Site-specific factors that should be considered in project siting to avoid and minimize the risk to birds include avian abundance; the quality, quantity, and type of habitat; geographic location; type and extent of bird use (*e.g.*, breeding, foraging, migrating); and landscape features.

The Avian Power Line Interaction Committee (APLIC[4]) and the Service[5] have developed guidelines for power lines to minimize impacts from existing facilities and in the construction of new utility and energy systems and associated infrastructure. According to the DEIS, any "build" alternative selected by NPS would be constructed according to APLIC standards, and the best available deterrence technology would be used.

In addition to following the APLIC standards, we offer the following recommendations to avoid and minimize impacts to migratory birds within and around the project area.

1. Work with FWS to revise and finalize the draft Avian Protection Plan (APP) previously developed by PSE&G to minimize the risk of electrocution, collision, disturbance and habitat impacts for migratory birds. The APP should apply minimum standards along the length of the line, with enhanced protections in sensitive areas.

2. Report bird mortalities and injuries resulting from electrocutions or collisions on the Service's online Bird Fatality/Injury Reporting Program[6] (Bird Report program). The Bird Report program was designed, with significant industry input and feedback, to provide a user-friendly, easily-accessed, method of allowing members of the electric utility industry to voluntarily report bird mortalities and injuries resulting from electrocutions or collisions with electrical utility equipment. Collecting information about the locations and circumstances under which birds are killed or injured on power equipment serves the primary purpose of determining how to prevent future bird interactions. The database is intended for use by utilities to see which structures and equipment are hazardous to birds, and under what conditions, and assists in evaluating and enhancing the effectiveness of retrofitting.

3. Minimize land and vegetation disturbance and reduce habitat fragmentation during project design and construction, especially if habitat cannot be fully restored after construction. Where practicable, concentrate construction activities, infrastructure, and man-made structures (*e.g.*, poles, roads) on lands already altered or cultivated, and away from areas of intact and healthy native habitats. Co-locate roads, staging areas, and other infrastructure in or immediately adjacent to already-disturbed areas (*e.g.*, existing rights-of-way, agricultural fields). If co-location is not feasible, select fragmented or degraded habitats rather than relatively intact areas.

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[4] www.aplic.org
[5] http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/BirdHazards.html
[6] https://birdreport.fws.gov/

4. Where disturbance is necessary, clear natural or semi-natural habitats (*e.g.*, forests, woodlots, reverting fields, shrubby areas) between September 1 and March 14, which is outside the nesting season for most native bird species. Without undertaking specific analysis of breeding species and their respective nesting seasons on the project site, implementation of this seasonal restriction will avoid take of most breeding birds, their nests, and their young (*i.e.*, eggs, hatchlings, fledglings).

5. Avoid permanent habitat alterations in areas where birds are highly concentrated or where sizable prey bases exist. Avoid establishing sizable structures along known bird migration pathways or known daily movement flyways (*e.g.*, between roosting and feeding areas). Examples of high concentration areas for birds are wetlands, State or Federal refuges, Audubon Important Bird Areas, private duck clubs, rookeries, roosts, and riparian areas.

6. Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts on vulnerable wildlife. Use only plant species that are native to the local area for revegetation of the project area.

7. Work with FWS to include protective measures for migratory birds into the Vegetation Management Program for each State.

CONCLUSION

The FWS appreciates the opportunity to review the DEIS. FWS will continue working cooperatively with NPS through finalization of the EIS and completion of consultation under Section 7 of the ESA. Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions about the above comments, or require further assistance regarding federally listed threatened or endangered species.

Sincerely,

J. Eric Davis Jr.
Field Supervisor

Enclosure: Specific comments on language in the DEIS

cc: RO, Alex Hoar, Glenn Smith, Paul Phifer, Scott Kahan
PAFO, Pam Shellenberger, Clint Riley
Wallkill NWR, Mike Horne

Amanda J . Stein, Biologist/Project Manager
Delaware Water Gap National Recreation Area
1 River Road
Bushkill, Pennsylvania 18324-9999

National Park Service Denver Service Center – TIC
Attn: SRLINE EIS
12795 W. Alameda Parkway
Denver, Colorado 80225-0287

Susquehanna to Roseland Transmission Line EIS – DEWA Internal Review Comment Form
Draft EIS (November 21, 2011 to January 31, 2012)

Reviewer's Name (Initials) :

	Initials	Page #	Section, paragraph, line #	Your Comment / Proposed Revision	For Consultant's Response / Resolution
1.	wlw	181	Golden-winged warbler	Please change this statement, "The species is federally listed as a species of special concern…" to read, "USFWS is conducting a status review of the golden-winged warbler in response to a petition to list this species under the ESA…."	
2.	wlw	186	small-footed bat	Please change this statement, "The species is federally listed as a species of special concern…" to read, "USFWS is conducting a status review of the small-footed bat in response to a petition to list this species under the ESA…."	
3.	wlw	187	Northern myotis	Please to read, "USFWS is conducting a status review of the Northern myotis in response to a petition to list this species under the ESA. This species is also listed as a species of special concern in Pennsylvania."	
4.	wlw	436	Consultation	NPS is currently preparing a BA for this project, consistent with policy that requires a BA for all "major construction activities" that "may affect" listed species. Please revise this section in the FEIS to reflect the current status of the consultation at that time.	
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Pennsylvania Fish & Boat Commission

established 1866

Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823-9620
(814) 359-5237 Fax: (814) 359-5175

August 16, 2010

RECEIVED
AUG 19 2010

IN REPLY REFER TO:
SIR# 33368

John J. Donahue
Delaware Water Gap National Recreation Area
HQ 1 River Road, off US 209
Bushkill, PA 18324-9999

RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
EIS for Electric Transmission Line Expansion across NPS lands
Multiple Townships/Boroughs, Pike, Monroe, and Northampton Counties, Pennsylvania

Dear Mr. Donahue:

I have examined the maps accompanying your recent correspondence, which shows the location of six proposed alternatives for the above-referenced project. Based on records maintained in the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files, the bog turtle (*Glyptemys muhlenbergii*, state endangered, federal threatened), the timber rattlesnake (*Crotalus horridus*, PA candidate) and several rare or protected freshwater mussel and fish species are known from portions of the project area within the three NPS units in northeastern Pennsylvania. Results of our review by alternative are in the table below, and following is a description of recommended actions for each of the species of concern.

Alternative #	Potential conflicts within NPS boundaries	Potential conflicts over route in PA (based on shapefiles provided for review)
2	Bog Turtle, Mussels in Delaware River	Timber Rattlesnake
3	Mussels in Delaware River	Bog Turtle
4	Timber Rattlesnake	Bog Turtle, Timber Rattlesnake, state endangered fish species, Mussels in Delaware River
5	Timber Rattlesnake	Bog Turtle, Timber Rattlesnake, Mussels in Delaware River
6	Timber Rattlesnake	Bog Turtle, Blue-spotted Salamander (both require direct consultation for avoidance of impact), Mussels in Delaware River
7	Timber Rattlesnake	Bog Turtle, Blue-spotted Salamander (both require direct consultation for avoidance of impact), Timber Rattlesnake, Mussels in Delaware River

Bog Turtle

The bog turtle is a small (up to a 4 inch carapace) semi-aquatic, omnivorous turtle that prefers open marshy wetlands associated with springs and groundwater, specific vegetative communities and mucky soils for burrowing. This species is restricted to the southcentral and southeast portions of Pennsylvania. However, due to the lack of pristine habitat found in its range from disturbance and plant successional processes, the bog turtle has, in some cases, become accustomed to disturbed, low quality wetland complexes often with semi-closed canopies. Bog turtles are also known to be transients in forested habitat that are associated with springs and small streams leading to more open marshes. They use these habitats as dispersal corridors to other wetlands. The bog turtle is threatened by habitat destruction, poor water quality and poaching.

Alternative 2 will pass through a wetland on federal lands known to support the bog turtle, thus potentially resulting in adverse impacts to the bog turtle and its habitat. Consultation with both the PFBC and the US Fish and Wildlife Service will be required to avoid impacts to the bog turtle if this alternative is chosen. Details regarding the route alignment, proposed project activities, and project plans should be sent to the agencies for review. Alternatives identified above with bog turtle conflicts outside the boundaries of the NPS property will require further coordination between the electric company and the agencies if there will be wetland impacts associated with the lines.

Fish and Mussels

Freshwater mussels are the most imperiled taxonomic group in North America. Nearly half of the species known to occur in the Commonwealth are now extirpated (locally extinct) from Pennsylvania. The freshwater mussel species and fish species known from the project area are especially vulnerable to physical (dredging, rip-rap, etc.) and chemical (pH, dissolved oxygen, temperature, heavy metals and organic contaminants) changes to their aquatic environment. We are concerned about direct and indirect (i.e., runoff) effects that the proposed project may have on the species of concern. Therefore, we recommend using directional boring or attaching to existing bridges for the following stream/river crossings:

River/stream name	Species at risk
Delaware River (all Alternatives)	rare mussels, multiple species
Marshalls Creek (Alternative 4)	state endangered fish

Open cutting will most likely adversely impact the species of concern. Work should be conducted from the bank (e.g., no in-stream disturbance). Likewise, no erosion or sediment should be allowed to enter into the river (e.g., strict erosion and sedimentation control measures need to be employed). **Provided that instream impacts will be avoided with these aforementioned crossings, then I do not anticipate the proposed activity to have any significant adverse impacts to the fish or mussel species of special concern or any other rare or protected species under Pennsylvania Fish & Boat Commission jurisdiction. However, if these recommendations cannot be adhered to, further consultation with this office will be necessary.**

Timber Rattlesnake

Timber rattlesnakes occur in the forested, mountainous regions of the Commonwealth. They prefer forested areas to forage for small mammals (e.g., mice and chipmunks) and southerly-facing slopes for hibernating and other thermoregulatory activities. The timber rattlesnake is threatened by habitat loss/alteration, wanton killing, and poaching.

Given the proximity of the project to known timber rattlesnake den areas, we recommend that a timber rattlesnake habitat assessment be conducted in the project area for those alternatives identified

above by a recognized/qualified timber rattlesnake surveyor. For guidance on areas of conflict with the timber rattlesnake on lands outside the jurisdiction of the NPS, the "applicants" should contact this office. We have included a list of PFBC qualified/recognized surveyors and habitat assessment protocol for your convenience. Upon completion of the habitat survey, the recognized/qualified rattlesnake biologist is to submit a report to this office (Natural Diversity Section) for review and comment. The habitat survey report should include color photographs of the project area and a description of habitats occurring within the immediate area to be developed (including access roads), as well as the surrounding area. Potential timber rattlesnake foraging, denning and/or basking areas should be photographed and mapped accordingly. In addition, the report should also include detailed project plans and maps with a description of the proposed work (including access roads), project impacts and alternatives. Pending the review of this information, a survey targeting the presence of the timber rattlesnake in the project area and/or other project modifications may be requested in order to avoid impacts to timber rattlesnake critical habitat.

Note that this office performed no field inspection of the project area. Consequently, comments in this letter are not meant to address other issues or concerns that might arise concerning matters under Pennsylvania Fish and Boat Commission jurisdiction or that of other authorities. Please contact Kathy Gipe of my staff at (814) 359-5186 if you have any additional concerns regarding this response. In any future correspondence with us regarding this specific project, please **refer to the SIR tracking number** indicated above. Thank you for your cooperation and attention to this matter of nongame species conservation.

Sincerely,

Christopher A. Urban, Chief
Natural Diversity Section

CAU/KDG/mr

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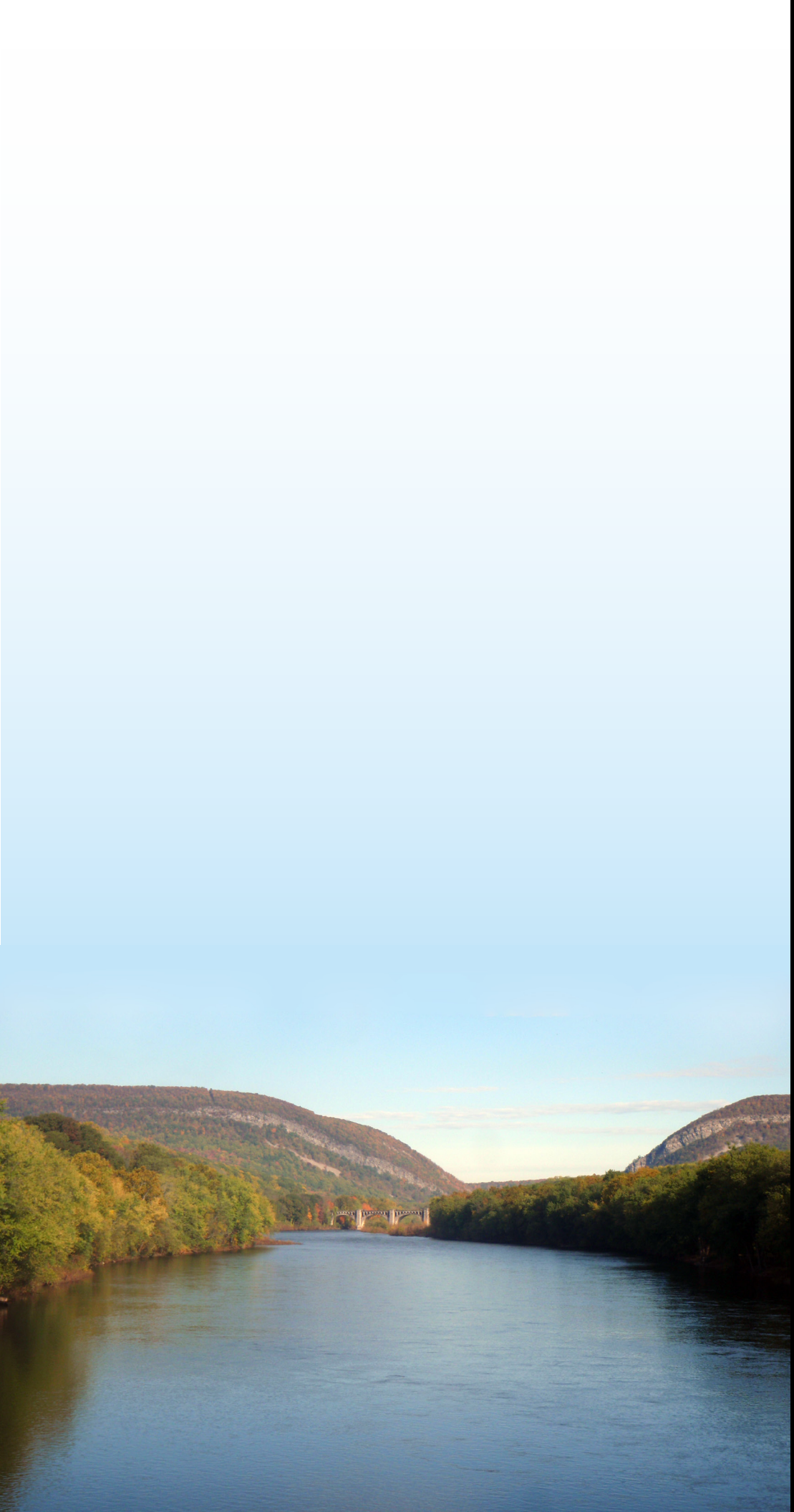


Appendix J

Cultural Landscape Resource Tables

APPENDIX J:
CULTURAL LANDSCAPE RESOURCE TABLES

TABLE J-1: SUMMARY OF CULTURAL LANDSCAPE IMPACTS (NEPA) AND EFFECTS (NHPA) UNDER ALTERNATIVE 2

Cultural Landscape	Type of Impact	Documentation	Impact	Effect	Summary
Abraham Van Campen III		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions No integrity issues
Abraham Van Campen House/Zipser		Listed as part of the Old mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Appalachian Trail (Appalachian National Scenic Trail)	Physical and visual impacts	Determined Eligible in Pennsylvania and New Jersey	**Moderate Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, design
Arnott Fen and Hogback Ridge	Visual impact	*Undetermined*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Benjamin B. Van Campen House		Listed as part of the Old Mine Road Historic District	**Negligible Impact**	**Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Broadhead Farm “Wheat Plains” (Heller Farm)		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Bushkill Dutch Reformed Church	Visual impact	Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Bushkill School	Visual impact	*Ineligible*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Camp Ken-Etiwa-Pec		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Camp Mohican		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions
Camp Pahaquarra		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions
Captain Jacob Shoemaker	Visual impact	Listed	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Chado Farm Broadstone Farms		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions

Cultural Landscape	Type of Impact	Documentation	Impact	Effect	Summary
Cold Spring Farm Spring House		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography vegetation precludes any visual intrusions
Copper Mine Inn		Listed as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Decker Ferry House	Visual impact	Listed as part of Old Mine Road Historic District	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Dimmick's Ferry		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
E.L. Garris House	Visual impact	Listed as part of the Old Mine Road Historic District	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Fort Hynshaw		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
G. Trauger House	Visual impact	Listed as part of Old Mine Road Historic District	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Garris Mill site		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any seasonal visual intrusions
Grube Cemetery	Visual impact	*Undetermined*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Hidden Lake Lodge		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Horace Van Auken House	Physical and visual impacts	Determined Eligible for Listing	**Major Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria jeopardized: location, setting, feel, design
Isaac Van Campen Inn		Listed as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Jacob Roe House		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions

Cultural Landscape	Type of Impact	Documentation	Impact	Effect	Summary
James Van Campen Farm (Blasi)	Visual impact	Determined Eligible for Listing	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
John Michael Farm		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
John P. House Farmstead		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
John Turn Farm: Limekiln, Smokehouse, Weavehouse		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
McManus House		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any seasonal visual intrusions
Michael Cemetery		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any seasonal visual intrusions
Millbrook Schoolhouse	Visual impact	Listed as part of Old Mine Road Historic District	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Millbrook Village Historic District	Visual impact	Determined Eligible for Listing	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Miller Farm (Amos Van Campen House (outbuildings)		Listed as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Seasonal visual intrusion possible, vegetation and development screen site
Minard-Hamilton Farmstead	Visual impact	*Ineligible*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, vegetation and development screen the site
Myers Farmstead	Visual impact	*Ineligible*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, vegetation and development screen the site
Newcomb House (Larch Hollow)		Recommended Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any seasonal visual intrusions
Nyce Farm-Van Gordon House (Eshback Farm)		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Oakley Stoll Farmstead		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any seasonal visual intrusions

Cultural Landscape	Type of Impact	Documentation	Impact	Effect	Summary
Old Mine Road Historic District	Physical and visual impacts	Listed	**Moderate Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, design
Otto Nehland House	Physical and visual impacts	*Ineligible*	**Major Impact**	**Not Applicable**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Overfield Cemetery	Visual impact	*CLI*	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Owens, Stone Spring Farm Springhouse	Visual Impact	Determined Eligible for Listing	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Pennsylvania-New Jersey Interconnection (PNJ)	Physical and Visual impacts	Determined Eligible for Listing	**Major Impact**	**Adverse Effect**	Existing **Corridor Physical Change** Eligible criteria jeopardized: location, setting, feel design
Pennsylvania Subdistrict Office	Visual impact	*Ineligible*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, vegetation and development screen the site
Peter's House		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Ralph G. Turn, Jr. Farmstead	Visual impact	*Undetermined*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Richard Layton Farmstead		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
River Road (PA) Shawnee to Decker's Ferry	Physical and visual impacts	*Undetermined*	**Moderate Impact**	**Not Applicable**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, design
Rosenkrans House		Listed as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Route 209 (Community Drive to Spackman's creek)	Physical and visual impacts	*CLI - Undetermined*	**Moderate Impact**	**Not Applicable**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, design

Cultural Landscape	Type of Impact	Documentation	Impact	Effect	Summary
Sadie Van Campen Farm		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Salamovka	Visual impact	Listed as part of Old Mine Road Historic District	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, vegetation and development screen the site
Schoonover Farm (also called Schoonover Mountain House	Visual impact	Listed	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Shoemaker-Houck Farm (Silver Spray Farm)		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Smithfield Beach		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Sylvester Hill House	Visual impact	Listed as part of Old Mine Road Historic District	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Trieble-Rouch House		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Van Auken Cemetery	Visual impact	*Undetermined*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Van Campen Sawmill site		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Walpack Center Historic District		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Watergate Recreation Site	Physical and visual impacts	*Recommended Ineligible,* Awaiting SHPO concurrence	**Major Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria jeopardized: location, setting, feel, design
Zion Lutheran Church		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions

TABLE J-2: SUMMARY OF CULTURAL LANDSCAPE IMPACTS (NEPA) AND EFFECTS (NHPA) UNDER ALTERNATIVE 2B

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Abraham Van Campen III		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions No integrity issues
Abraham Van Campen House/Zipser		Listed as part of the Old Mine Road Historic District and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Appalachian Trail (Appalachian National Scenic Trail)	Physical and visual impacts	Determined Eligible in Pennsylvania and New Jersey	**Moderate Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria threatened; location, setting feel and design
Arnott Fen and Hogback Ridge		*Undetermined*	**Minor Impact**	**Not Applicable**	
Benjamin B. Van Campen House		Listed as part of the Old Mine Road Historic District	**Negligible Impact**	**Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Broadhead Farm “Wheat Plains” (Heller Farm)		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Bushkill Dutch Reformed Church		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Bushkill School	Visual impact	*Ineligible*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Camp Ken-Etiwa-Pec		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Camp Mohican		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions
Camp Pahaquarra		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions
Captain Jacob Shoemaker	Visual impact	Listed	**Moderate Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria threatened: location, setting, feel, design
Chado Farm Broadstone Farms		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Cold Spring Farm Spring House		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Copper Mine Inn		Listed as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Decker Ferry House	Visual impact	Listed as part of Old Mine Road Historic District	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Dimmick's Ferry		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
E.L. Garris House	Visual impact	Listed as part of the Old Mine Road Historic District	**Moderate Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria threatened: location, setting, feel, design
Fort Hynshaw		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
G. Trauger House	Visual impact	Listed as part of Old Mine Road Historic District	**Moderate Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria threatened: location, setting, feel, design
Garris Mill site		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any seasonal visual intrusions
Grube Cemetery	Visual impact	*Undetermined*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Hidden Lake Lodge		*Ineligible*	**Negligible Impact**	**Not Applicable**	Development, vegetation and topography preclude any visual intrusions
Horace Van Auken Farmstead	Physical and visual impacts	Determined Eligible for Listing	**Major Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria jeopardized: location, setting, feel, design
Isaac Van Campen Inn		Listed as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Jacob Roe House		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
James Van Campen Farm (Blasi)	Visual impact	Determined Eligible for Listing	**Moderate Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria threatened: location, setting, feel, design

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
John Michael Farm		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
John P. House farmstead		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
John Turn Farm: Limekiln, Smokehouse, Weavehouse		Listed	**Negligible Impact**	**No Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
McManus House		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any seasonal visual intrusions
Michael Cemetery		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any seasonal visual intrusions
Millbrook Schoolhouse	Visual impact	Listed as part of Old Mine Road Historic District	**Moderate Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria threatened: location, setting, feel, design
Millbrook Village Historic District	Visual impact	Determined Eligible for Listing	**Moderate Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria threat: location, setting, feel, design
Miller Farm (Amos Van Campen House (outbuildings)		Listed as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions No integrity issues
Minard-Hamilton Farmstead	Visual impact	*Ineligible*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, vegetation and development screen the site
Myers Farmstead	Visual impact	*Ineligible*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, vegetation and development screen the site
Newcomb House (Larch Hollow)		Recommended Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any seasonal visual intrusions
Nyce Farm-Van Gordon House (Eshback Farm)		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Oakley Stoll Farmstead		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any seasonal visual intrusions
Old Mine Road Historic District	Physical and visual impacts	Listed	**Moderate Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, design

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Otto Nehland House	Physical and visual impacts	*Ineligible*	**Major Impact**	**Not Applicable**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Overfield Cemetery	Visual impact	*CLI*	**Moderate Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria threatened: location, setting, feel, design
Owens, Stone Spring Farm Springhouse	Visual Impact	Determined Eligible for Listing	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Pennsylvania-New Jersey Interconnection (PNJ)	Physical and visual impacts	Determined Eligible for Listing	**Major Impact**	**Adverse Effect**	Existing **Corridor Physical Change** Eligibility criteria jeopardized: location, setting, feel, design
Pennsylvania Subdistrict Office	Visual impact	*Ineligible*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, vegetation and development screen the site
Peter's House		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Ralph G. Turn, Jr. Farmstead	Visual impact	*Undetermined*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Richard Layton Farmstead		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any seasonal visual intrusions
River Road (PA) Shawnee to Decker's Ferry	Physical and visual impacts	*Undetermined*	**Moderate Impact**	**Not Applicable**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, design
Route 209 (Community Drive to Spackman's creek)	Physical and visual impacts	*CLI Undetermined*	**Moderate Impact**	**Not Applicable**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, design
Sadie Van Campen Farm		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Salamovka	Visual impact	Listed as part of Old Mine Road Historic District	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, vegetation and development screen the site

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Schoonover Farm (also called Schoonover Mountain House	Visual impact	Listed	**Major Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria jeopardized: location, setting, feel, design
Shoemaker-Houck Farm (Silver Spray Farm)		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Sylvester Hill House	Visual impact	Listed as part of Old Mine Road Historic District	**Moderate Impact**	**Adverse Effect**	Physical proximity to the alternative corridor Eligibility criteria threatened: location, setting, feel, design
Rosenkrans House		Listed as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Smithfield Beach		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Trieble-Rouch House		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Van Auken Cemetery	Visual impact	*Undetermined*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Van Campen Sawmill site		Determined Eligible for Listing	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
Walpack Center Historic District		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Watergate Recreation Site	Physical and visual impacts	*Recommended Ineligible,* Awaiting SHPO concurrence	**Major Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria jeopardized: location, setting, feel, design
Zion Lutheran Church		Listed	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusion

TABLE J-3: SUMMARY OF CULTURAL LANDSCAPE IMPACTS (NEPA) AND EFFECTS (NHPA) UNDER ALTERNATIVE 3

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Abraham Van Campen III Barn		*Ineligible* HABS, Millbrook Village CLI, moved in 1974	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Abraham Van Campen Farm/Zipser		National Register of Historic Places as part of the Old mine Road Historic District and CLI	**Negligible impact**	**No Adverse Effect**	Distance/topography and vegetation precludes any visual intrusions
Appalachian Trail (Appalachian National Scenic Trail)	Physical and visual impacts	Eligible for the National Register of Historic Places	**Moderate Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, design
Benjamin B. Van Campen Farm		National Register of Historic Places as part of the Old Mine Road Historic District and CLI	**Negligible Impact**	**Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Bushkill Dutch Reformed Church		Eligible for the National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Bushkill School		CLI / *Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Camp Mohican		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any seasonal visual intrusions
Camp Pahaquarra		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Camp Weygadt		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Captain Jacob Shoemaker		National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Cold Spring Farm Spring House		National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Copper Mine Inn	Visual impact	National Register of Historic Places as part of Old Mine Road Historic District	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Decker Ferry House		National Register of Historic Places as part of Old Mine Road Historic District, CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Delaware Water Gap Slate Company Quarry and Building Sites Historic District		Eligible for the National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Dimmick's Ferry	Visual impact	Eligible for the National Register of Historic Places	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
E.L. Garris house		National Register of Historic Places as part of the Old Mine Road Historic District, Millbrook Village CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Fort Hynshaw		Eligible for the National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
G. Trauger House		National Register of Historic Places as part of the Old Mine Road Historic District, Millbrook Village CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Garris Mill site		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Grube Cemetery		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Hidden Lake Lodge		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Horace Van Auken Farmstead		Eligible for the National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
James Van Campen Farm (Blasi)		Eligible for the National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
John Michael Farm	Visual impact	National Register of Historic Places	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
John Turn Farm		National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Laurel Falls Schoolhouse		CLI / *Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
McManus House	Visual impact	Eligible for the National Register of Historic Places	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource

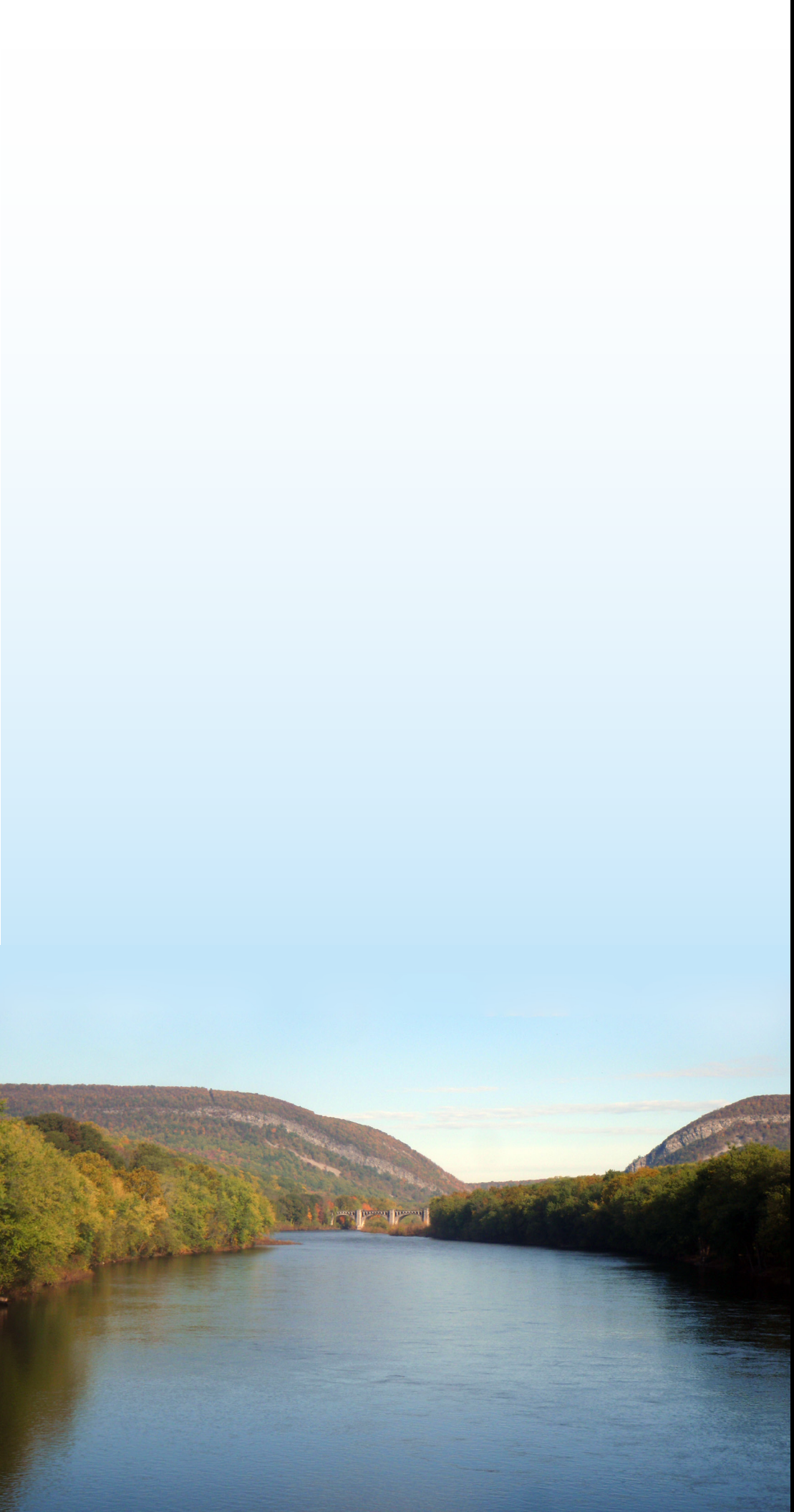
Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Michael Cemetery		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions
Millbrook Schoolhouse		National Register of Historic Places as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Millbrook Village Historic District		National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Miller House Amos van Campen House (outbuildings)		National Register of Historic Places as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Minard-Hamilton Farmstead		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Munch-Cyr Farm		Eligible for the National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Myers Farmstead		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
New York and Delaware River Slate Company Quarry		Eligible for the National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Newcomb House (Larch Hollow)	Visual impact	Eligible for the National Register of Historic Places	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Otto Nehland House		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Overfield Cemetery		*Recommended Eligible / No SHPO concurrence*	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Owens/Stone Spring Farm springhouse		Eligible for the National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Pennsylvania Subdistrict		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Peter's House		National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Ralph G. Turn, Jr. Farmstead		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
River Road (PA) Shawnee to Decker's Ferry	Physical and visual impacts	*Undetermined: Needs further study*	**Moderate Impact**	**Not Applicable**	**Alternative crosses the resource** Eligibility criteria threatened: location, setting, feel, design

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Rosenkrans House		National Register of Historic Places as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Sadie Van Campen Farm		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any seasonal visual intrusions
Salamovka		National Register of Historic Places as part of Old Mine Road Historic District and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Schoonover Farm (also called Schoonover Mountain House		National Register of Historic Places as part of Old Mine Road Historic District and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Slateford Farm		Eligible for the National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Smithfield Beach		*Undetermined*	**Negligible Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Sylvester Hill House		National Register of Historic Places as part of Old Mine Road Historic District	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Totts Gap Farm		Eligible for the National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Totts Gap Road		Eligible for the National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Trieble-Rouch House	Visual impact	*Undetermined*	**Minor Impact**	**Not Applicable**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Van Auken Cemetery		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Van Campen Sawmill site		Eligible for the National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Watergate Recreation Site		*Recommended Ineligible:* Awaiting SHPO concurrence	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Zion Lutheran Church		National Register of Historic Places and CLI	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions

TABLE J-4: SUMMARY OF CULTURAL LANDSCAPE IMPACTS (NEPA) AND EFFECTS (NHPA) UNDER ALTERNATIVES 4 AND 5

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Appalachian Trail (Appalachian National Scenic Trail)	Physical and visual impacts	Eligible for the National Register of Historic Places	**Moderate Impact**	**Adverse Effect**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, design
Camp Weygadt		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions No integrity issues
Camp Pahaquarra		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions
Delaware Water Gap Slate Company Quarry and Building Sites Historic District	Visual impact	Eligible for the National Register of Historic Places	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
Emory Pipher Quarry		*Ineligible*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions No integrity issues
John Michael Farm		National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Laurel Falls Schoolhouse		CLI /*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions
McManus House		Eligible for the National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Munch-Cyr Farm	Visual	Eligible for the National Register of Historic Places and CLI	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource
New York & Delaware River Slate Company		Eligible for the National Register	**Negligible Impact**	**No Adverse Effect**	Distance/topography/vegetation precludes any visual intrusions
Newcomb House (Larch Hollow)		Eligible for the National Register of Historic Places	**Negligible Impact**	**No Adverse Effect**	Distance/topography precludes any visual intrusions
River Road (PA) Shawnee to Decker's Ferry		*Undetermined: Needs further study*	**Negligible Impact**	**Not Applicable**	Distance/topography precludes any visual intrusions
Slateford Farm	Visual impact	Eligible for the National Register of Historic Places and CLI	**Minor Impact**	**Adverse Effect**	Seasonal visual intrusion possible, topography and vegetation screen the resource

Cultural Landscape Resource	Type of Impact	Documentation	Impact	Effect	Summary
Smithfield Beach		*Undetermined*	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions
Totts Gap Farm	Visual impact	CLI / *Undetermined*	**Moderate Impact**	**Not Applicable**	Physical proximity to the alternative corridor Eligibility criteria threatened: setting, location, design, feeling
Totts Gap Road	Physical and visual impacts	Retains landscape character defining features, views, integrity of location and setting, former Indian trail *Undetermined*	**Moderate Impact**	**Not Applicable**	Alternative crosses the resource Eligibility criteria threatened: location, setting, feel, views
Trieble-Rouch House		*Undetermined* / HABS	**Negligible Impact**	**Not Applicable**	Distance/topography/vegetation precludes any visual intrusions



Appendix K

Visual Simulations

APPENDIX K:
VISUAL SIMULATIONS

Visual Simulations

FIGURE 2-1, EXISTING: FERNWOOD RESORT, PA HWY 209

FIGURE 2-1, PROPOSED

FIGURE 2-2, EXISTING: JOSEPH M. MCDADE RECREATIONAL TRAIL, NEAR SCHOONOVER HOUSE

FIGURE 2-2, PROPOSED

FIGURE 2-3, EXISTING: MDSR AT ALTERNATIVE 2 CROSSING

FIGURE 2-3, PROPOSED

FIGURE 2-4, EXISTING: HAMILTON RIVER CAMPSITES

FIGURE 2-4, PROPOSED

FIGURE 2-5, EXISTING: PIONEER TRAIL

FIGURE 2-5, PROPOSED

FIGURE 2-6, EXISTING: HAMILTON RIDGE TRAIL

FIGURE 2-6, PROPOSED

FIGURE 2-7, EXISTING: OLD MINE ROAD AT ALTERNATIVE 2 CROSSING

FIGURE 2-7, PROPOSED

FIGURE 2-8, EXISTING: WATERGATE RECREATION SITE

Figure 2-8, PROPOSED

FIGURE 2-8, MITIGATION: CONCEPTUAL MITIGATION MEASURES AT WATERGATE RECREATION SITE

FIGURE 2-9, EXISTING: VAN CAMPEN GLEN TRAIL

FIGURE 2-9, PROPOSED

FIGURE 2-10, EXISTING: MILLBROOK VILLAGE

FIGURE 2-10, PROPOSED

FIGURE 2-11, EXISTING: APPA AT ALTERNATIVE 2 CROSSING

FIGURE 2-11, PROPOSED

FIGURE 2B-1, EXISTING: FERNWOOD RESORT, PA HWY 209

FIGURE 2B-1, PROPOSED: FERNWOOD RESORT, PA HWY 209

FIGURE 2B-2, EXISTING: JOSEPH M. MCDADE RECREATIONAL TRAIL, NEAR SCHOONOVER HOUSE

FIGURE 2B-2, PROPOSED

FIGURE 2B-3, EXISTING: MDSR AT ALTERNATIVE 2B CROSSING

FIGURE 2B-3, PROPOSED

FIGURE 2B-4, EXISTING: HAMILTON RIVER CAMPSITES

FIGURE 2B-4, PROPOSED

FIGURE 2B-5, EXISTING: PIONEER TRAIL

FIGURE 2B-5, PROPOSED

FIGURE 2B-6, EXISTING: HAMILTON RIDGE TRAIL

FIGURE 2B-6, PROPOSED

FIGURE 2B-7, EXISTING: OLD MINE ROAD AT ALTERNATIVE 2 CROSSING

FIGURE 2B-7, PROPOSED

FIGURE 2B-8, EXISTING: WATERGATE RECREATION SITE

FIGURE 2B-8, PROPOSED

FIGURE 2B-9, EXISTING: VAN CAMPEN GLEN TRAIL

FIGURE 2B-9, PROPOSED

FIGURE 2B-10, EXISTING: MILLBROOK VILLAGE

FIGURE 2B-10, PROPOSED

FIGURE 2B-11, EXISTING: APPA AT ALTERNATIVE 2 CROSSING

FIGURE 2B-11, PROPOSED

FIGURE 3-1, EXISTING: HIDDEN LAKE DAM

FIGURE 3-1, PROPOSED

FIGURE 3-2, EXISTING: SMITHFIELD BEACH

FIGURE 3-2, PROPOSED

FIGURE 3-3, EXISTING: RIVER ROAD, NEAR ALTERNATIVE 3

FIGURE 3-3, PROPOSED

FIGURE 3-4, EXISTING: MCDADE TRAIL

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FIGURE 3-4A, PROPOSED, REPRESENTATIVE OF MIGRATORY BIRD DIVERTER DEVICES (SPIRAL WIRE) ON THE 500-KV CONDUCTORS. APLIC-APPROVED BIRD DIVERTER DEVICES OF SOME TYPE WOULD BE REQUIRED WHERE ANY ALTERNATIVE ALIGNMENT CROSSES MDSR AND KITTATINNY RIDGE.

FIGURE 3-4B, PROPOSED. REPRESENTATIVE OF MIGRATORY BIRD DIVERTER DEVICES (MARKER BALLS) ON THE 500-KV CONDUCTORS. APLIC-APPROVED BIRD DIVERTER DEVICES OF SOME TYPE WOULD BE REQUIRED WHERE AN ALIGNMENT CROSSES MDSR AND KITTATINNY RIDGE.

FIGURE 3-5, EXISTING: OLD MINE ROAD, AT ALTERNATIVE 3 CROSSING

FIGURE 3-5, PROPOSED

FIGURE 3-6, EXISTING: WALTER'S TRACT RIVER CAMPSITES

FIGURE 3-6, PROPOSED

FIGURE 3-7, EXISTING: HIALEAH PICNIC AREA (FROM THE EXIT ROAD)

FIGURE 3-7, PROPOSED

FIGURE 3-8, EXISTING: HIALEAH AIR PARK

FIGURE 3-8, PROPOSED

FIGURE 3-9, EXISTING: MDSR AT ALTERNATIVE 3 CROSSING

FIGURE 3-9, PROPOSED

FIGURE 3-10, EXISTING: SHAWNEE RESORT BEACH

FIGURE 3-10, PROPOSED

FIGURE 3-11, EXISTING: TURTLE BEACH

FIGURE 3-11, PROPOSED

FIGURE 3-12, EXISTING: APPA, FUTURE RELOCATION SECTION

FIGURE 3-12, PROPOSED

FIGURE 3-13, EXISTING: APPA AT ALTERNATIVE 3 CROSSING

FIGURE 3-13A, PROPOSED: REPRESENTATIVE OF MIGRATORY BIRD DIVERTER DEVICES (SPIRAL WIRE) ON THE 500-KV CONDUCTORS. APLIC-APPROVED BIRD DIVERTER DEVICES OF SOME TYPE WOULD BE REQUIRED WHERE ANY ALTERNATIVE ALIGNMENT CROSSES MDSR AND KITTATINNY RIDGE.

FIGURE 3-13B, PROPOSED: REPRESENTATIVE OF MIGRATORY BIRD DIVERTER DEVICES (MARKER BALLS) ON THE STATIC WIRE. APLIC-APPROVED BIRD DIVERTER DEVICES OF SOME TYPE WOULD BE REQUIRED WHERE ANY ALTERNATIVE ALIGNMENT CROSSES MDSR AND KITTATINNY RIDGE.

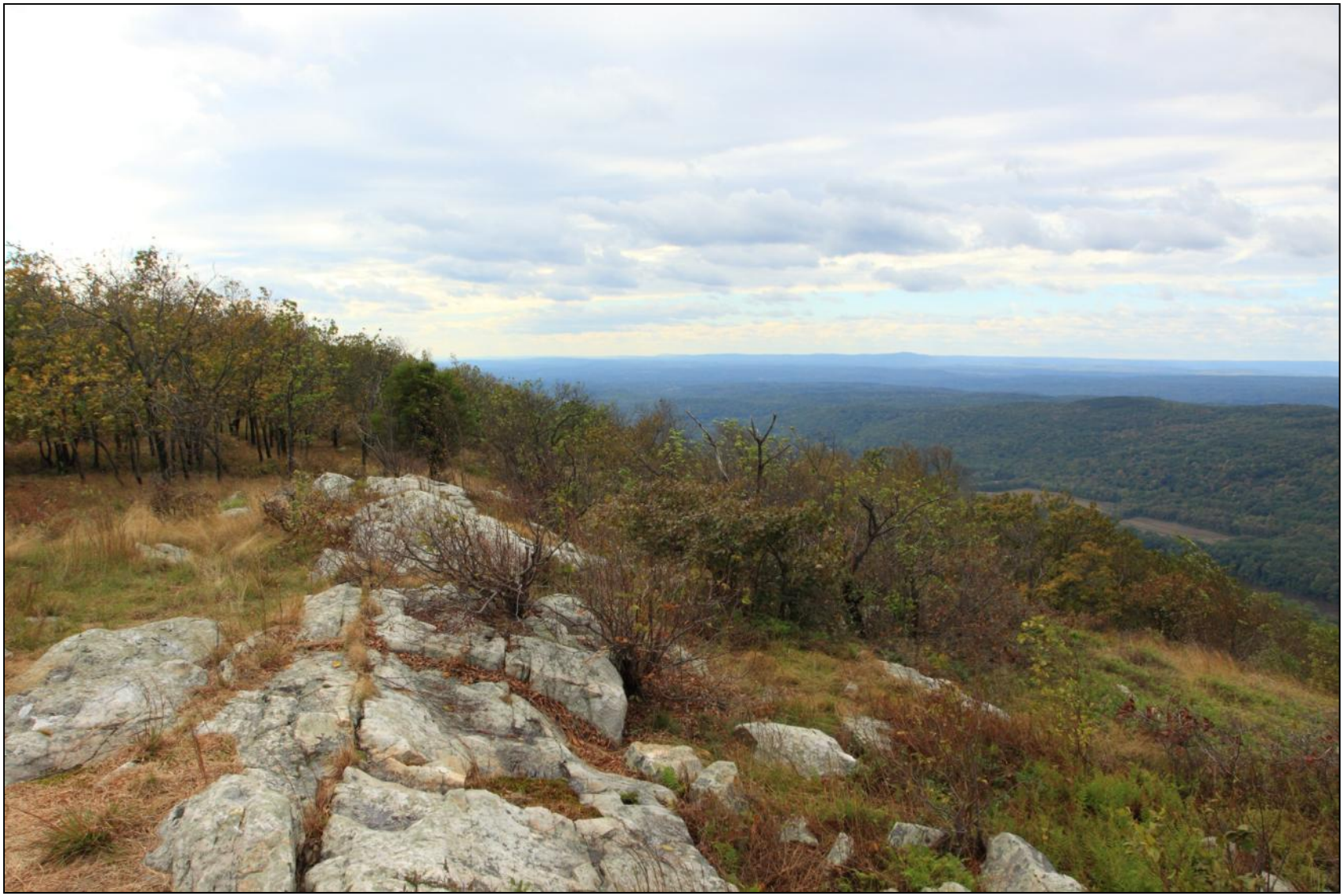

FIGURE 3-14, EXISTING: APPA AT RACCOON RIDGE

FIGURE 3-14, PROPOSED

FIGURE 3-15, EXISTING: APPA, VIEW OVERLOOKING LOWER YARDS CREEK RESERVOIR

FIGURE 3-15, PROPOSED

FIGURE 3-16, EXISTING: VISTA FROM RIDGE NEAR RATTLESNAKE SWAMP, NO. 1

FIGURE 3-16, PROPOSED

FIGURE 3-17, EXISTING: VISTA FROM RIDGE NEAR RATTLESNAKE SWAMP, NO. 2

FIGURE 3-17, PROPOSED

FIGURE 3-18, EXISTING: CATFISH FIRE TOWER

FIGURE 3-18, PROPOSED

FIGURE 4-1, EXISTING: MT. TAMMANY SUMMIT

FIGURE 4-1, PROPOSED

FIGURE 4-2, EXISTING: DELAWARE RIVER AT ALTERNATIVE 4/5 CROSSING

FIGURE 4-2, PROPOSED

FIGURE 4-3, EXISTING: KARAMAC TRAIL

FIGURE 4-3, PROPOSED

FIGURE 4-4, EXISTING: APPA AT ALTERNATIVE 4/5 CROSSING

FIGURE 4-4, PROPOSED

FIGURE 4-5, EXISTING: APPA AT LUNCH ROCKS

FIGURE 4-5, PROPOSED

FIGURE 4-6, EXISTING: APPA AT NELSON OVERLOOK

FIGURE 4-6, PROPOSED