

SUMMARY

This Letter of Notification is being submitted by PPL Electric Utilities Corporation (“PPL Electric”) pursuant to the Pennsylvania Public Utility Commission’s (“PUC” or the “Commission”) regulations at 52 Pa. Code §§ 57.71 through 57.77 for PUC approval to rebuild the single-circuit Blooming Grove – Hemlock 69 kV Transmission Line. This transmission line is being rebuilt to improve electric service reliability in the region by adding a second transmission source to the existing Hemlock Farms Substation. The transmission line will be designed and constructed for two 138 kV circuits. However, the two circuits will initially be operated at 69 kV, until load growth in the area makes an increase in the operating voltage appropriate.

The Blooming Grove – Hemlock #1 and #2 138/69 kV Project described herein will rebuild approximately 9.9 miles of existing transmission line. The transmission line begins at the PPL Electric Blooming Grove Substation located on Christopher Way in Blooming Grove Township and terminates at the Hemlock Farms Substation located on Belgian Way in Blooming Grove Township. The Project will be contained within the existing PPL Electric rights-of-way that traverse Blooming Grove Township, Pike County, Pennsylvania. No new rights-of-way are required for this Project.

As part of this Project, the existing wooden pole structures and conductors will be removed. New single shaft steel poles, conductors, insulators and overhead ground wire will be installed.

The total estimated cost of the proposed transmission work is \$15,300,000. Subject to the Commission’s approval, this Project has a scheduled construction start date of October 2012, in order to meet an in-service date of November 2013.

This document, which describes the need for the project and explains the engineering and siting analysis for the proposed rebuild, consists of the following attachments:

Attachment "1"	Necessity Statement
Attachment "2"	Engineering Description
Attachment "3"	Siting Analysis and Environmental Assessment
Attachment "4"	PPL Electric Design Criteria and Safety Practices
Attachment "5"	PPL Electric Magnetic Field Management Program
Attachment "6"	List of Involved Governmental Agencies, Municipalities, and Other Public Entities
Attachment "7"	List of Owners of Property within the Existing Right-of-Way

PPL ELECTRIC UTILITIES SERVICE TERRITORY



ATTACHMENT “1”
BLOOMING GROVE – HEMLOCK #1 & #2 138/69 kV LINE REBUILD
NECESSITY STATEMENT

TABLE OF CONTENTS

<u>SECTION</u>	<u>TOPIC</u>	<u>PAGE</u>
A.	INTRODUCTION.....	1-1
B.	SYSTEM PLANINNG PROCESS.....	1-2
C.	EXISTING SYSTEM.....	1-4
D.	DEFINITION OF THE PROBLEM.....	1-4
E.	PROPOSED SOLUTION.....	1-5
F.	ALTERNATIVES CONSIDERED.....	1-6

LIST OF FIGURES

FIGURE 1	ONE LINE DIAGRAM EXISTING TRANSMISSION FACILITIES.....	1-8
FIGURE 2	ONE LINE DIAGRAM PROPOSED TRANSMISSION FACILITIES.....	1-9
FIGURE 3	ELECTIRCAL SYSTEM MAP	End of Attachment

A. INTRODUCTION

PPL Electric Utilities (PPL Electric) proposes to rebuild an existing single-circuit 69 kilovolt (kV) transmission line to a double-circuit 138/69 kV transmission line between the existing Blooming Grove 230-69 kV Substation and the existing Hemlock 69-12 kV Substation. The new Line will be designed and constructed for future 138 kV operation, but will initially operate at 69 kV until load growth in the area makes it appropriate to increase the operating voltage.

The proposed new Project will reduce the electrical loading on the existing Blooming Grove – Hemlock 69 kV circuit. This reduction will be accomplished by transferring load supplied from Transformer #2 at Hemlock onto a new transmission circuit. The load reduction is needed during peak winter conditions. This Project will also provide operating flexibility and improved reliability for customers in Blooming Grove Township in Pike County.

This Project is required to prevent the interruption of load at a magnitude that would exceed PPL Electric’s “Reliability Principles & Practices” (RP&P) guidelines if the existing Blooming Grove – Hemlock 69 kV Line were unexpectedly removed from service by a contingency (unplanned outage).

The estimated cost to site, design, and construct this Project is approximately \$15,300,000. This cost includes the proposed transmission Line and substation modifications at Blooming Grove and Hemlock Substations. The required in-service date for this Project, which is defined as the date that the proposed facility must be placed in service to prevent overloads that could potentially damage equipment and result in service interruptions to customers, is November 2013. In order to meet that in-service date, subject to the Commission’s approval, construction is presently scheduled to commence in the fall of 2012.

A PPL Electric system map showing existing transmission facilities with a design voltage of 35 kV or greater is included in the **Attachment “1”** map pocket. This filing addresses only the existing and proposed transmission system in this portion of Pike County.

B. SYSTEM PLANNING PROCESS

System Planning is the process which assures that PPL Electric's non-bulk electric system (non-BES) transmission system can supply electricity to all customer load in a manner that is reliable and economic. This process assures that PPL Electric's non-BES transmission system is planned and constructed so that:

- It can sustain probable contingencies and disturbances with minimal customer service interruption;
- It can adequately serve each customer's needs with regard to capacity, voltage and reliability for all load levels throughout the daily load cycle; and
- It is in conformance with PPL Electric's RP&P.

The reliable and economical operation of PPL Electric's 138/69 kV transmission system requires planning guidelines for system expansion and reinforcement. The principles upon which these planning guidelines are based recognize that:

- The system expansion should be coordinated to achieve the most economical balance of construction and operating expenditures;
- It should maintain a proper balance between the degree of risk, amount and type of load interrupted, and the cost of providing the needed expansion; and
- System reliability should be maintained to prevent large scale, long term, or frequent service interruptions to avoid adverse effects and hazards to the public.

In accordance with these guidelines and PPL Electric's Reliability Criteria, PPL Electric's non-BES transmission system is planned so that:

1. Normal operation of the system will not load any electric facility beyond its normal continuous rating;.
2. The loss of any single transmission line, generating unit connected to the non-BES transmission system, power transformer, substation bus, circuit breaker, or double-

- circuit line due to the outage of a single tower or pole, does not result in any system electric facility being operated beyond its applicable emergency rating.
3. No customer load should remain interrupted for routine maintenance of non-BES transmission facilities.
 4. The loss of any single facility should not result in a voltage deviation of more than 5% on the 138/69 kV transmission system.
 5. Stability of the electric system should be maintained from a permanent three-phase transmission line fault cleared by normal primary relay action. In addition to this, system stability should also be maintained for a permanent single phase to ground line fault and the failure of the protective devices to operate properly resulting in a failed circuit breaker.
 6. No large-scale, long-term or frequent interruption may cause excessive load loss due to the adverse effects on, and hazard to, the public.
 7. Excessive load is not interrupted for the loss of a single-circuit 69 kV line or double-circuit 69 kV line.

These principles are incorporated in the PPL Electric Transmission Planning RP&P document.

The planning process begins with the development of a computer model of the future system. A specific study year is chosen, and the future system model is developed using the existing system plus any planned modifications to the transmission system scheduled to be completed prior to the study year. Load levels used in the system model are based on the latest forecast prepared annually by PPL Electric, based on recent summer and winter peak load forecasts which take into account ambient temperatures and humidity indices.

Once the system model is complete, comprehensive power flow simulations are performed to determine the ability of the system to comply with the PPL Electric transmission planning reliability criteria. This is accomplished by simulating an outage of each non-BES transmission and bulk electric facility. All conditions where the system is not in conformance with the reliability criteria are identified, and system reinforcements are added to bring the system into conformance. Also identified are estimated costs and lead-times to implement the required

reinforcements. Computer simulations of the system with the identified reinforcement alternatives are completed to identify the best overall reinforcement that will meet the needs of the region in a reliable, economic and environmentally acceptable manner.

C. EXISTING SYSTEM

From the Blooming Grove Substation to the Hemlock Substation, the Blooming Grove – Hemlock 69 kV Line is built on single-circuit 69 kV structures. The Line was not constructed for future 138 kV operation and currently operates at 69 kV. After the Hemlock Substation, the Line continues southeast to the end of the PPL Electric certificated territory and serves the Walker and Twin Lakes 69-12 kV distribution substations. The Walker and Twin Lakes substations are located near the end of the Line, approximately 9 miles southeast of Hemlock. The Twin Lakes distribution substation is owned by PPL Electric and serves PPL Electric customer load. The Walker distribution substation, owned by MetEd, is not an alternate source of 69 kV electric power to PPL Electric. The Walker substation is tied into PPL Electric’s transmission system only to supply MetEd customer load in the neighboring region. **Figure 1** (Attachment “1” Map Pocket) illustrates the functional arrangement of the existing transmission facilities in the area.

D. DEFINITION OF THE PROBLEM

By the winter of 2013-2014, an outage of the Blooming Grove – Hemlock 69 kV Line would interrupt 30.5 Mega-Volt Amperes (MVA) of load during peak winter conditions. The 30.5 MVA does not include MetEd customer load from the Walker distribution substation. The RP&P guideline for maximum allowable load loss is 30 MW for a single-circuit line outage. The Blooming Grove – Hemlock 69 kV circuit is a radial line with no ties with other circuits. In such an outage, the Power Dispatcher would not be able to transfer load to another source because no alternate source exists.

In its current configuration, if an outage were to occur on the Blooming Grove – Hemlock 69 kV Line between the Blooming Grove and Hemlock substations, approximately 30.5 MW would

remain interrupted for an extended period of time until the problem could be located and repaired. There are no transmission switching moves that could be made to re-sectionalize the Line. This outage exceeds the RP&P guideline for maximum allowable load loss for a single-circuit line outage. An outage of this circuit would result in approximately 6,400 customers experiencing a service interruption.

E. PROPOSED SOLUTION

To resolve the issues described above, PPL Electric, with approval from the PUC, will undertake the following:

- Rebuild the existing Blooming Grove – Hemlock 69 kV single-circuit Line to a double-circuit 138/69 kV Line from the Blooming Grove Substation to the Hemlock Substation, a distance of approximately 9.9 miles. PPL Electric will design the new Line to current 138 kV standards, but will operate the Line (both circuits) at 69 kV initially.
- Install a new line terminal, breaker bay, and circuit breaker in the 69 kV yard at the Blooming Grove Substation.
- Convert Hemlock Substation from “Modified Type A” operation to “Full Twin A” operation, which will increase the reliability to the local area because each of the two 69 - 12 kV distribution transformers at that substation will be supplied by a separate 69 kV line.

After completion of the Project, Transformer #2 at the Hemlock Substation will be served off the new Blooming Grove-Hemlock #2 138/69 kV circuit. Transformer #1 at Hemlock will be served off the Blooming Grove-Hemlock #1 138/69 kV circuit along with the Twin Lakes and Walker substations.

After completion of the Project, if an outage were to occur near Blooming Grove on the future Blooming Grove – Hemlock #1 138/69 kV circuit, approximately 18 MW of load would remain interrupted for an extended period of time until the problem is located and repaired. The

magnitude of load interrupted as a result of such an outage would be within the RP&P guideline for maximum allowable load loss for a single-circuit line outage.

After completion of the Project, if an outage were to occur near Blooming Grove on the future Blooming Grove – Hemlock #2 138/69 kV circuit, approximately 12 MW would remain interrupted for an extended period of time until the problem is located and repaired. The magnitude of load interrupted as a result of such an outage would be within the RP&P guideline for maximum allowable load loss for a single-circuit line outage.

If an outage were to occur near Blooming Grove on the future Blooming Grove – Hemlock #1 & #2 138/69 kV double-circuit Line, approximately 30.5 MW would remain interrupted for an extended period of time until the problem is located and repaired. The magnitude of load interrupted as a result of the outage would be within the RP&P guideline for maximum allowable load loss for a double-circuit line outage. The RP&P guideline for maximum allowable load loss is 45 MW for a double-circuit line outage. The RP&P guidelines for maximum allowable load loss (interrupted for an extended period of time until the problem is located and repaired) for single-circuit and double-circuit line outages do not change if the lines were operated at 138 kV.

Figure 1 details the functional arrangement of the existing transmission facilities in the area. **Figure 2** shows the functional arrangement of the proposed transmission facilities in the area. The total estimated cost for the proposed work is approximately \$15,300,000, which includes transmission line and substation work. The transmission line work is expected to cost \$14,100,000.

F. ALTERNATIVES CONSIDERED

In addition to the proposed solution described above, PPL Electric evaluated another functional alternative. The Functional Alternative included construction of approximately 13 miles of new double-circuit transmission line between the Bohemia Tap and Twin Lakes Tap and installation of a 10.8 MVAR capacitor bank near the Bohemia Substation. This Functional Alternative would provide increased operating flexibility in restoring service not only to the Hemlock Farms

Substation but also to the Walker and Twin Lakes substations. In addition, this “tie” line could be used to supply Bohemia by way of the Hemlock Farms Substation. The capacitor bank at Bohemia would provide voltage and reactive power support to the Bohemia and West Damascus area. During abnormal sectionalizing, the capacitor bank would provide the same support to Walker and Twin Lakes distribution substations.

This alternative was not selected because it had substantially higher social, environmental, and economic costs compared to the proposed solution. This alternative would require the acquisition of new rights-of-way through populated areas and clearing of new right-of-way in undeveloped areas at a cost of approximately \$17.2 million.

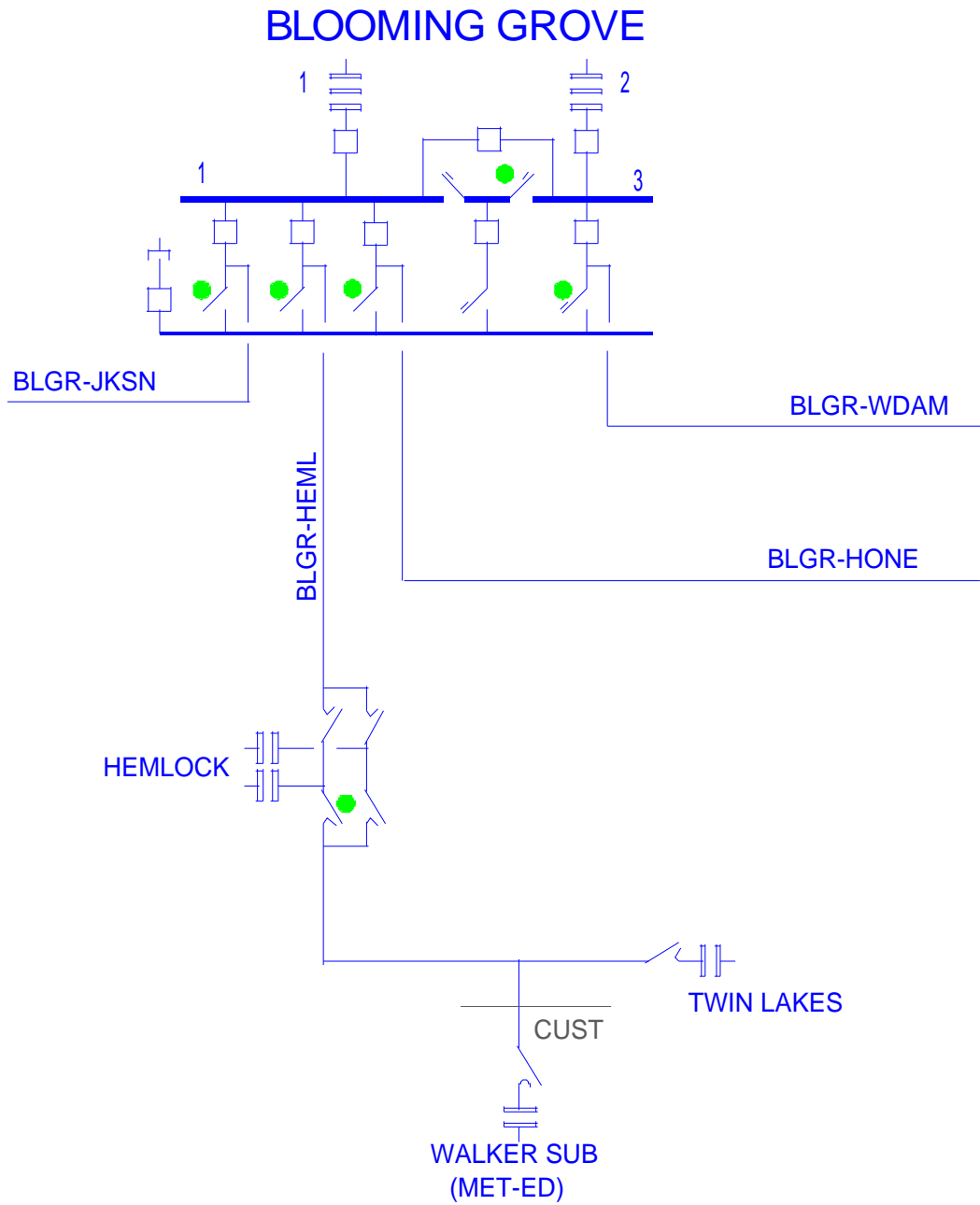


FIGURE 1 – ONE LINE DIAGRAM EXISTING TRANSMISSION FACILITIES

BLOOMING GROVE

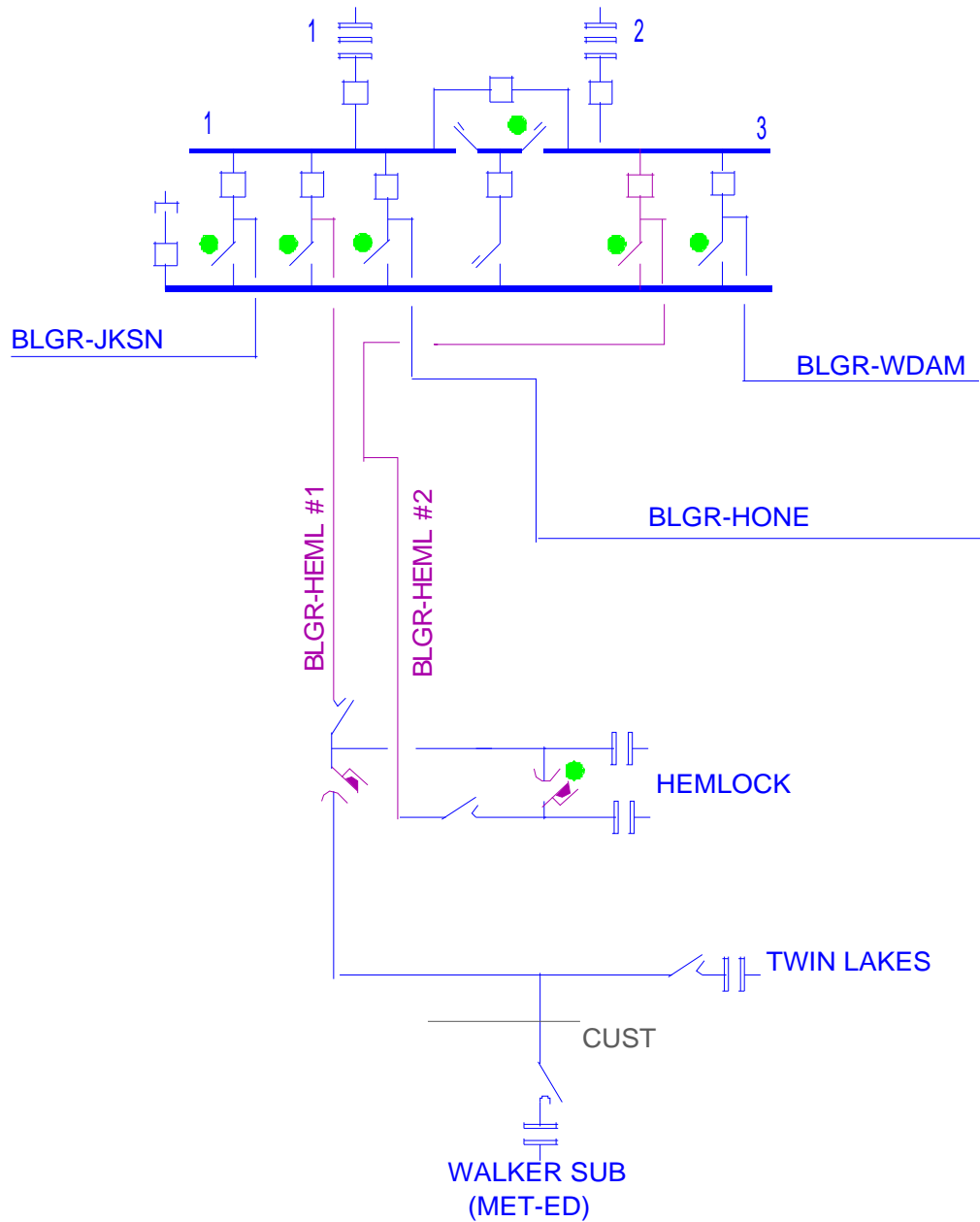


FIGURE 2 – ONE LINE DIAGRAM PROPOSED TRANSMISSION FACILITIES

ATTACHMENT “2”
BLOOMING GROVE – HEMLOCK #1 & #2 138/69 kV LINE REBUILD
ENGINEERING DESCRIPTION

TABLE OF CONTENTS

<u>SECTION</u>	<u>TOPIC</u>	<u>PAGE</u>
A.	DESCRIPTION OF THE PROPOSED LINE.....	2-1
B.	MAGNETIC FIELD MANAGMENT.....	2-5
C.	RIGHT-OF-WAY STATUS.....	2-5

LIST OF TABLES

TABLE 1	DESIGN MINIMUM CONDUCTOR CLEARANCES FOR 556.5 KCMIL 24/7 STRANDING ACSR	2-4
TABLE 2	CONDUCTOR THERMAL RATING 556.5 KCMIL 24/7 STRANDING ACSR.....	2-4

LIST OF FIGURES

FIGURE 1	TYPICAL DOUBLE CIRCUIT 138/69 KV TANGENT STRUCTURE.....	2-6
FIGURE 2	TYPICAL DOUBLE CIRCUIT 138/69 KV SINGLE POLE ANGLE STRUCTURE.....	2-7
FIGURE 3	TYPICAL DOUBLE CIRCUIT 138/69 KV DOUBLE POLE TANGENT STRUCTURE.....	2-8

AERIAL EXHIBIT DRAWINGS

END OF
ATTACHMENT

ATTACHMENT “2”
BLOOMING GROVE – HEMLOCK #1 & #2 138/69 kV LINE REBUILD
ENGINEERING DESCRIPTION

A. DESCRIPTION OF THE PROPOSED LINE

PPL Electric proposes to rebuild the existing Blooming Grove – Hemlock 69 kV Transmission Line. This transmission Line begins at the Blooming Grove Substation, located along Christopher Way, Blooming Grove Township, and extends approximately 9.9 miles to the Hemlock Farms Substation, located on Belgian Way, Hemlock Farms, PA. The existing transmission Line is presently a single 69 kV circuit. The rebuilt transmission Line will be designed for double-circuit 138 kV operation, however it will initially be operated at 69 kV until load growth in the area makes an increase in operating voltage appropriate.

This Project involves the removal of the entire existing transmission Line. The existing transmission Line is supported by 251 poles with an average height of approximately 65 feet and an average span of 220 feet. The existing Line is primarily supported by wood poles, however, there are a few steel poles along the line route. The proposed transmission Line will consist of approximately 92 single-shaft steel pole tangent structures equipped with upswept arms (Figure 1). There will be approximately 8 angle structures which may consist of single, two or three-pole structures depending on the severity of the angle (Figure 2).

All poles will be installed on concrete foundations. Additionally, some angle structures may be guyed. Altogether, this Project requires the installation of approximately 100 poles, which reflects a 60 percent decrease in the total number of poles. The proposed single-shaft steel poles will average approximately 96 feet tall and the average span length will be approximately 550 feet.

Since this Line can not be taken out of service, PPL Electric will install the new poles and one circuit prior to removing the existing Line. As a result, the new transmission Line will be constructed approximately 5 feet off the center line of the right-of-way. It is PPL Electric's intention to place new poles near the existing wood pole locations in areas adjacent to residential development. However, to reduce environmental impacts, comply with property owner requests, optimize design and reduce construction costs, some pole locations may be shifted or adjusted. Overall there will be a substantial reduction in the total number of poles within the right-of-way. Properties that do not presently have poles will not have poles added.

The proposed Line will consist of six power conductors. The power conductors will be 556.5 KCMIL¹, 24/7 strand ASCR.² The optical ground wire (OPGW) will be 0.567-inch diameter OPGW with 48 single mode fibers. Additionally, the existing switches at the Hemlock Farms Substation will be replaced with two Load Sectionalizing Air Breaks (LSABs). Refer to the Aerial Exhibit at the end of the Attachment 2 which depicts the location of these facilities. Current and proposed transmission structure locations are identified in the Aerial Exhibit. These locations are based on preliminary engineering and are subject to change.

The rebuilt transmission Line will be designed to meet, and generally exceed, National Electric Safety Code ("NESC") minimum standards. Additional design criteria and safety rules practiced by PPL Electric are included in Attachment 4.

The minimum conductor to ground clearance will be 30 feet, which occurs at a maximum conductor temperature of 257° F. The design minimum conductor ground clearances and conductor thermal ratings are as follow:

¹ A circular mil is the cross-sectional area of a wire one mil in diameter, where 1 kcmil = 0.5067 mm².

² Aluminum Conductor Steel Reinforced

TABLE 1

**DESIGN MINIMUM CONDUCTOR CLEARANCES
FOR 556.5 KCMIL, 24/7 STRANDING ASCR**

<u>Condition</u>	<u>Double-Circuit Design Clearance to Ground</u>
Normal load, average weather (60°F ambient temperature)	34.97 ft
Predicted extreme thermal load (257°F conductor temperature)	30.00 ft
Predicted NESC extreme wind load (60°F ambient temperature)	32.77 ft
Predicted extreme weather conditions (1.04-inch ice, 4 lbs. wind, 15°C)	32.44 ft

Clearances based on a maximum tension of 8500 lbs. at .75 inch ice, 4 lbs. wind, 0°F and a ruling span of 600 feet.

TABLE 2

**CONDUCTOR THERMAL RATING
556.5 KCMIL 24/7 STRANDING ASCR
(257°F) 125°C MAXIMUM CONDUCTOR TEMPERATURE**

<u>Condition</u>	<u>Ambient Temperature °F</u>	<u>Wind Speed Knots</u>	<u>Ampacity Amps</u>
Summer Normal	95	0	815
Winter Normal	50	0	926
Summer Emergency	95	1.5	1041
Winter Emergency	50	1.5	1163

B. MAGNETIC FIELD MANAGEMENT

PPL Electric Utilities' Magnetic Field Management Program is summarized in Attachment 5 and will be applied to reconstructions and new line projects. In order to reduce magnetic field exposures, the program generally prescribes the use of line design that provides five feet higher ground clearances than those required under the NESC and reverse phasing of new double-circuit lines where it is feasible to do so at low or no cost. The implementation of additional modifications will be considered, provided those modifications can be made at low or no cost and will not interfere with the operation of the line.

For this Project, PPL Electric will implement both elements of its Magnetic Field Management Program. Increased structure height and reverse phasing will both be used to reduce magnetic field exposures.

C. RIGHT-OF-WAY STATUS

The Blooming Grove – Hemlock 138/69 kV Transmission Line will be constructed entirely in existing rights-of-way or on property owned in fee by PPL Electric. No additional rights-of-way are required for the construction of the transmission Line because there is sufficient property to contain the transmission Line and meet all required NESC clearances.

FIGURE 1
PROPOSED 138/69 kV TANGENT STRUCTURE
APPROXIMATE HEIGHT – 75' to 140'

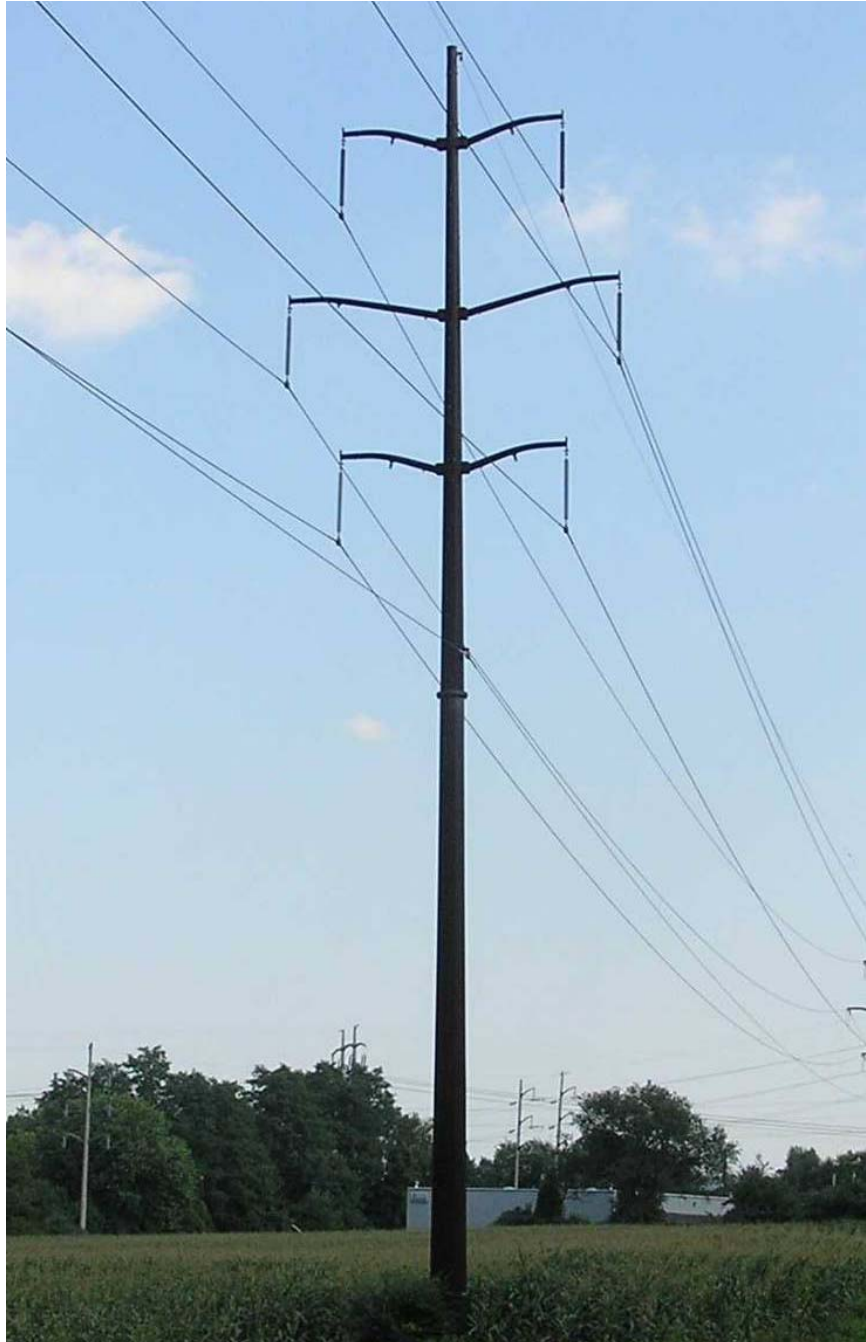


FIGURE 2
PROPOSED 138/69 kV SINGLE POLE ANGLE STRUCTURE
APPROXIMATE HEIGHT – 80' to 110'



FIGURE 3
PROPOSED 138/69 kV TWO POLE ANGLE STRUCTURE
APPROXIMATE HEIGHT – 80' to 110'



ATTACHMENT “3”
BLOOMING GROVE – HEMLOCK #1 & #2 138/69 kV LINE REBUILD
SITING ANALYSIS AND ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

<u>SECTION</u>	<u>TOPIC</u>	<u>PAGE</u>
A.	INTRODUCTION.....	3-1
B.	GENERAL LOCATION.....	3-2
C.	EXISTING LAND USE.....	3-2
D.	CULTURAL RESOURCES.....	3-6
E.	NATURAL FEATURES.....	3-7
F.	HABITATS AND SPECIES OF CONCERN.....	3-11
G.	SOURCES.....	3-16

LIST OF TABLES

TABLE 1	PERCENT EXISTING LAND USE ALONG RIGHT-OF-WAY.....	3-3
TABLE 2	PERCENT ZONING ALONG RIGHT-OF-WAY.....	3-4
TABLE 3	POPULATION DATA AND FORECASTS.....	3-5
TABLE 4	SURFACE WATER CLASSIFICATION.....	3-8
TABLE 5	WETLANDS CROSSED BY THE PROPOSED PROJECT.....	3-9
TABLE 6	NATURAL AREA INVENTORY DATA.....	3-11
TABLE 7	DCNR SPECIES AND COMMUNITIES OF CONCERN.....	3-13

LIST OF FIGURES

AERIAL FIGURES.....	End of Attachment
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ATTACHMENT “3”
BLOOMING GROVE – HEMLOCK #1 & #2 138/69 kV LINE REBUILD
SITING ANALYSIS AND ENVIRONMENTAL ASSESSMENT

A. INTRODUCTION

PPL Electric Utilities (PPL Electric) plans to rebuild the approximately 9.9-mile long existing single-circuit Blooming Grove – Hemlock 69 kV Transmission Line for double-circuit 138 kV operation in order to improve electric reliability in the project area. The Project involves removing the existing transmission line and wood pole structures and replacing them with single-shaft steel poles carrying two circuits capable of accommodating 138 kV operation. There will be approximately 8 angle structures which may consist of single, two or three-pole structures depending on the severity of the angle. The two circuits will initially be operated at 69 kV, until load growth in the area makes an increase in the operating voltage appropriate.

The existing Blooming Grove – Hemlock 69 kV right-of-way traverses primarily forestland, including approximately 2.1 miles of the Delaware State Forest. PPL Electric determined that any alternative route outside of the existing right-of-way would result in new impacts to both the social and natural environments. The line rebuild can be conducted entirely within the existing right-of-way.¹ Therefore, constructing within the existing Blooming Grove – Hemlock 69 kV right-of-way was selected as the best option for rebuilding the transmission line (**Figure 1**). PPL Electric held a public meeting on September 27, 2011 to inform residents of the proposed Project.

¹ The existing ROW is generally 100 feet wide. The ROW for the last approximately 2.5 miles of the route is 70 feet wide with additional 15-foot tree clearing rights on both sides of the 70' ROW. For the last 2.5 mile of the route, PPL Electric can construct within the 70 feet of existing ROW while meeting all NESC Clearance Requirements.

B. GENERAL LOCATION

The Blooming Grove – Hemlock 69 kV Line generally runs in a west to east direction through the central section of Pike County (**Figure 1**). The western terminus is the Blooming Grove Substation located in Blooming Grove Township along Christopher Way. The eastern terminus is the Hemlock Farms Substation located adjacent to the Hemlock Farm residential community in Blooming Grove. Project activities will occur entirely within Blooming Grove Township.

Specific linear features in the project area include roadways and transmission line rights-of-way. I-84 is the only major roadway crossed by the existing transmission line. A few state or local roads, including State Route 402, are traversed by the existing line. The Blooming Grove – Hemlock right-of-way is parallel to the Bushkill – Blooming Grove 230 kV Transmission Line right-of-way for the first 4.4 miles exiting the Blooming Grove Substation. A few other transmission lines are located near the existing line route that exit or tap into the Blooming Grove Substation or the Hemlock Farms Substation. Aside from possible traffic controls employed during construction, the proposed Project is not anticipated to result in impacts to any of these linear features.

C. EXISTING LAND USE

According to the Blooming Grove Township Comprehensive Plan, forest land constitutes the largest land use in the Township and includes 13,500 acres owned by the PA Bureau of Forestry, 8,120 acres owned by the PA Game Commission, and 12,960 acres owned by the Blooming Grove Hunting and Fishing Club (BGHFC). The existing right-of-way is presently maintained in accordance with PPL Electric's Vegetation Management Program. Tree clearing will be limited to the existing right-of-way (including the area adjacent to the right-of-way where PPL Electric has tree clearing rights) and the access roads.

Other land uses in the vicinity of the existing line consist of low and medium density residential and commercial uses. There are no heavily developed areas located in the vicinity of the existing line route. The largest residential area is the Hemlock Farms subdivision located directly south

and east of the Hemlock Farms Substation. The Hemlock Farms community, which would directly benefit from the proposed Project, consists of approximately 3,500 lots located in Blooming Grove Township, with a small number of lots located in Dingman and Porter Townships. Other developed areas are located along Route 402, Skytop Ranch Road, Blooming Grove Road, Hatchery Road, and a few other dispersed locations. Most commercial businesses in the Township are located along Route 739 on either side of I-84, which is located just north or east of the existing line route. **Table 1** summarizes the general land use types and the percent of each type identified along the Blooming Grove – Hemlock right-of-way.

TABLE 1: Percent Existing Land Use Along Right-of-Way

Land Use Classification	Percent Land Use Type Along Right-of-Way
Water/wetlands	2.2%
Developed (Low, Medium, High)	8.0%
Barren Land	0.0%
Forest Cover	86.7%
Grassland/Pasture	3.0%
Cultivated Crops	0.1%

Source: National Land Use Cover Dataset, 2001

The closest airport is the Flying Dollar Airport, located 9 miles southwest of the Blooming Grove – Hemlock right-of-way. Due to the distance from the proposed project site, the presence of other taller transmission equipment in the area, and the proposed structure height, PPL Electric does not anticipate that the proposed structures will be a hazard to the airport’s flight operations. Nonetheless, PPL Electric will contact the PennDOT Bureau of Aviation and the Federal Aviation Administration to confirm that the proposed rebuild will not be a hazard to flight operations.

Comprehensive Land Use Plans and Zoning

Planning in the vicinity of the existing line is guided by the *Pike County Comprehensive Plan...Growing Naturally* (2006) (PCCP) and the *Blooming Grove Township Comprehensive*

Plan (2008). Both of these plans strive to prepare for the projected growth while protecting forestland and other important natural features. In addition, Blooming Grove Township and Pike County have developed zoning districts that define allowable uses within each district. Both the county and the municipal zoning districts reflect the historical nature of Blooming Grove Township as a forested and rural residential area. Blooming Grove Township adopted a new zoning ordinance and map in June 2011. The only significant change in the new zoning map is that the multiple use district has been divided into multiple use and open space. The intent of the open space district is to identify the State Forest and State Game Lands property within the Township. **Table 2** summarizes the type and percent of each general zoning classification that the Blooming Grove – Hemlock Transmission Line Rebuild project right-of-way crosses through. As identified in Table 2, most of the right-of-way is designated as Multiple Use. The last approximately 0.75 mile portion of the route traverses land designated as Residential Planned Community. Based on the new zoning ordinance, the area through the Delaware State Forest was re-designated as Open Space.

TABLE 2: Percent Zoning Along Right-of-Way

Municipality	PCCP Zoning	Municipal Zoning	Percent Zoning District*
Blooming Grove Township	Mixed Commercial/Residential	Multiple Use/Open Space	92%
Blooming Grove Township	Mixed Commercial/Residential	Residential Planned Community	8%

* Percentage is approximate.

In general, zoning requirements within Blooming Grove Township seek to preserve forested land and other natural areas and concentrate growth in previously developed areas. Rebuilding the Blooming Grove – Hemlock Project within the existing right-of-way is consistent with local efforts to preserve forested land and other natural areas.

Population

According to the PCCP, development in the region continues to surge, making Pike County one of the fastest growing counties in the Commonwealth. According to the 2010 census, Pike County was the second fastest growing county in the Commonwealth over the past decade.

Blooming Grove Township has historically been seen as a second home community or vacation destination; however, the number of permanent residences has grown in recent years. According to the Blooming Grove Township Comprehensive Plan, population growth was generally slow and steady between 1950 and 1970, but has been growing rapidly since the 1970s. Population growth within the Township is primarily dependent on immigration from New York and New Jersey. Due to the volatility in immigration from these areas over the past 30 years, accurate growth projections are difficult. Therefore, forecasts were completed by the Township in 2008 for 40 percent, 50 percent, and 70 percent growth projections. In all cases, population growth is expected to increase development pressure in the general vicinity of the existing line route.

Near the existing line route, population growth is expected to increase along I-84, along State Route 402 adjacent to the Delaware State Forest, and within the Hemlock Farms subdivision. **Table 3** provides a summary of previous US Census data and population forecasts for Blooming Grove Township (US Census 2010 and PCCP).

TABLE 3: Population Data and Forecasts

Municipality	1950 Census	2000 Census	2010 Census*	2020 Forecast	2000-2020 Change
Blooming Grove Township	358	3,621	4,819	6,083 (40%) 6,789 (50%) 8,310 (70%)	2,462 3,168 4,689

*Based on US Census 2010 redistricting data. The PCCP predicted a population of 5,425 by 2010.

Agricultural Areas

According to the Blooming Grove Township Comprehensive Plan, only two agricultural properties are located within the Township. These properties include a one 300-acre beef cattle operation, Martin Farm, located on Egypt Meadow Road and the Ivy Guild, located in Lords Valley. Neither of these properties is traversed by the existing right-of-way.

Presently, there are no agricultural easements or agricultural security areas located in Blooming Grove Township. The Project would not have any negative impacts on agricultural lands.

C. CULTURAL RESOURCES

Historic Architectural Assessment

A desktop survey of historic architectural resources within the Blooming Grove – Hemlock project area was completed. The survey consisted of accessing the Pennsylvania Historical and Museum Commission’s (PHMC’s) Bureau for Historic Preservation (BHP) Cultural Resources Geographic Information System (CRGIS) to review available information on previously-recorded historic architectural sites on and near the transmission line alignment.

There are no previously recorded National Register of Historic Places (NRHP)-listed or eligible historic architectural resources located within 1 mile of the proposed Blooming Grove – Hemlock Transmission Line Rebuild Project. Five previously identified sites located within 1 mile of the right-of-way have been evaluated as ineligible for inclusion in the NRHP by the PHMC/BHP.

Archaeological Assessment

Review of the PHMC CRGIS reveals that four recorded archaeological sites are within 1 mile of the proposed Blooming Grove – Hemlock Transmission Line Rebuild Project. One of these sites, a historic domestic site identified as 36PI0251, is located within the transmission corridor in Blooming Grove Township; however, the site has been considered ineligible by the submitter. The remaining three sites are also located within Blooming Grove Township are recorded as rock shelter/cave sites and are 0.2 miles, 0.4 miles, and 1.0 mile from the right-of-way, respectively. The eligibility of all three sites is undetermined due to insufficient data.

PPL Electric consulted with the PHMC to determine whether surveys are required given the limited earth disturbance involved. A response letter from the PHMC dated January 12, 2012² indicates that the activities associated with this Project should have no effect on potential historic buildings, structures, and/or archaeological resources located within the project area. PPL

² PHMC File No. ER 2012-0424-103-A

Electric will notify the PHMC should any unidentified historic buildings, structures or archaeological resources be discovered during the course of the Project.

D. NATURAL FEATURES

The existing line route crosses several physiographic regions, geologic formations, soil associations, streams, and wetlands as it runs from west to east. These features are described in detail within the following sections.

Physiographic Regions and Bedrock Geology

The existing line route traverses two physiographic sections. The majority of the Project traverses the rounded hills and valleys of the Glaciated Low Plateau Section and, to a lesser extent, the broad upland of the Glaciated Pocono Plateau Section. Bedrock geology found within and near the existing line route consists of the Long Run and Walcksville Members of the Catskill Formation, undivided.

Soils

According to the Natural Resources Conservation Service (NRCS) State Soil Geographic (STATSGO) database, the project area contains five primary soil associations:

- Laidig-Hazleton-Dekalb-Buchanan (s6558) – very to moderately deep, somewhat poorly to excessively drained soils
- Pope-Monongahela-Holly-Chenango (s6563) – very deep, very poorly to somewhat excessively drained soil
- Volusia-Mardin-Histosols (s6567) – very deep, somewhat poorly to moderately well drained soils
- Wellsboro-Oquaga-Morris-Lackawanna (s6560) – very to moderately deep, somewhat poorly to somewhat excessively drained soils

- Wurtsboro-Worth-Volusia-Swartswood-Mardin (s6566) – very deep to shallow, somewhat poorly to somewhat excessively drained soils.

The Wurtsboro-Worth-Volusia-Swartswood Association comprises the majority of the eastern and central portions of the existing line route. The Pope-Monongahela-Holly-Chenango Association comprises the majority of the northern and western portions of the project area. The remaining soil associations are found throughout the project area.

Surface Water Resources

Wetland delineation activities were conducted within the Blooming Grove – Hemlock right-of-way in May 2011. Based on review of the National Hydrology Dataset (NHD) and the results of the wetland delineation, the Blooming Grove – Hemlock Line intersects eight streams as it runs from Blooming Grove in the west to Hemlock Farms in the east. Four of these streams are named streams and four streams are unnamed tributaries of a named stream. All eight of these streams have been classified by the PADEP under Title 25 Chapter 93 as High Quality Cold Water Fisheries (PADEP (a) 2010). **Table 4** provides a summary of all streams that the existing line crosses and their classifications. Definitions for each of these classifications are located below the table.

TABLE 4: Surface Water Classification

STREAMS	
Name	Designated Use
Blooming Grove Creek	HQ-CWF, MF
Notch Brook	HQ-CWF
Unnamed Tributary to Notch Brook	HQ-CWF
York Creek	HQ-CWF
Adjacent to Unnamed Tributary of York Creek	HQ-CWF
Shohola Creek	HQ-CWF, MF
Unnamed Tributary to Shohola Creek	HQ-CWF

- CWF - *Cold Water Fishes*—Maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat.
- HQ - *High Quality Waters*—Designation indicates that surface waters have quality which exceeds the level necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water as determined by §93.4b(a).
- MF - *Migratory Fishes*—Passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which move to or from flowing waters to complete their life cycle in other waters.

Wetlands

Based on review of the U.S. Fish and Wildlife Service’s (USFWS) National Wetland Inventory (NWI), the Blooming Grove – Hemlock Line crosses several wetland systems as it runs from west to east (USFWS 2010). As mentioned in the previous section, wetland delineation activities were conducted within the Blooming Grove – Hemlock right-of-way in May 2011, and January and February 2012. Based on the wetland delineation, the Blooming Grove – Hemlock Line Replacement Project intersects seventeen wetlands. This does not include the stream crossings discussed in the previous section, which are also regulated by the U.S. Army Corps of Engineers (USACE) and the Pennsylvania Department of Environmental Protection (PADEP).

The Blooming Grove – Hemlock Line Rebuild Project traverses approximately 4.9 acres of wetlands. These wetland systems are located throughout the route, but are more concentrated along the first few miles exiting the Blooming Grove Substation. Most of these wetlands are palustrine emergent wetland systems (PEM). Three of the wetlands are palustrine scrub-shrub wetland systems (PSS), one is classified as a PSS/PEM wetland, and one is classified as a palustrine, unconsolidated bottom wetland (PUB). **Table 5** provides a summary of the type and acreage of all wetlands found within the existing right-of-way.

TABLE 5: Wetlands Crossed by the Proposed Project

WETLANDS	
Wetland Type	Acres Crossed*
PEM	2.1
PSS	2.7

WETLANDS	
Wetland Type	Acres Crossed*
PSS/PEM	0.2
PUB	<0.1
Total	5.1

*Rounded to the nearest 0.1

PPL Electric will avoid placing structures and access roads in wetlands and streams to the maximum extent practical. Where impacts cannot be avoided, PPL Electric will obtain and adhere to the terms and conditions of all required USACE and PADEP permits.

Floodplains

A review of Federal Emergency Management Agency (FEMA 2010) floodplain data for the Blooming Grove – Hemlock Rebuild Project indicates the existing line route intersects one area mapped as within a 100-year floodplain. This area is associated with Blooming Grove Creek and is located immediately south of the Blooming Grove Substation. Presently, this floodplain is spanned by the transmission lines and no new impacts are anticipated as a result of the proposed rebuild.

Vegetation

Vegetative cover near the existing line route consists primarily of mixed oak forest. According to the Pike County Natural Areas Inventory (NAI), white, red, and black oaks (*Quercus sp.*) are the dominant forest species. The area has been logged in the past and, therefore, most of the forest today consists of timber approximately 40 to 80 years old. The primary association species include red and sugar maple (*Acer sp.*), black cherry (*Prunus serotina*), black gum (*Nyssa sylvatica*), white pine (*Pinus strobus*), blueberry (*Vaccinium sp.*), shadbush (*Amelanchier sp.*), *Viburnums*, and witch hazel (*Hamamelis*). Lowland areas along streams and wetlands may be dominated by red maple, yellow birch (*Betula alleghaniensis*), black gum, eastern hemlock (*Tsuga canadensis*), red and black spruce (*Picea sp.*), and tamarack (*Larix laricina*) (Pike

County Open Space and Greenways Plan, 2008). Wetlands are abundant in the project area. As a result of conservation efforts in the County, including the Delaware State Forest and BGHFC, the majority of the project area outside of the right-of-way remains forested today. PPL Electric will rebuild the Blooming Grove – Hemlock Transmission Line Project within an existing cleared right-of-way that is currently maintained in accordance with PPL Electric’s Vegetation Management Plan. Therefore, the rebuild will result in little change to the existing vegetation within the right-of-way. The improvement and/or construction of access roads could require the cutting of some trees and shrubs outside of the right-of-way. The locations and extent of any such clearing is unknown at this time, but is expected to be minimal because PPL Electric will use existing access roads to the maximum extent practical.

G. HABITATS AND SPECIES OF CONCERN

Natural Areas Inventory

The Nature Conservancy’s Pike County NAI (Nature Conservancy, 1995 and updated NAI GIS layer, 2011) identified two sites within 500 feet of the existing line route of special concern. **Table 6** identifies the NAI areas within 500 feet of the right-of-way.

TABLE 6: Natural Area Inventory Data

Site Name	Special Species /Community Type	Last Seen*
Low/High Knob	Small ridgetop dwarf-tree forest community	N/A
	One plant species of concern (unidentified)	N/A
	One additional species of concern (unidentified)	N/A
Pecks Pond	Largest glacial bog in northeastern Pennsylvania	N/A
	Two state-threatened plant species of concern and one state-rare plant species of concern (unidentified)	9/27/89
	One dragonfly species of concern (unidentified)	7/1/88

Modified from the Pike County NAI.

*Last seen as of NAI publication date, 1995.

The Low Knob/High Knob Natural Area is located west of State Route 402 within the Delaware State Forest and encompasses High Knob, Low Knob and the area immediately surrounding these two geologic features. Low Knob is located approximately one half mile from the existing right-of-way and High Knob is located over a mile from the existing right-of way. The existing Blooming Grove – Hemlock Transmission Line traverses approximately 0.1 miles of the Low Knob/High Knob Natural Area. This Natural Area is of importance as a small ridgetop dwarf-tree forest community and supports one plant species of special concern and one additional, unidentified species of concern. The existing line crosses this Natural Area at an elevation of approximately 400 feet below the peak of the ridgetops and is currently maintained in accordance with PPL Electric’s Vegetation Management Plan.

Pecks Pond is located to the south of the project area within the Delaware State Forest. The existing route does not traverse Pecks Pond, but is located within 100 feet of this natural area. PPL Electric will avoid impacts to the Pecks Pond NAI to the maximum extent practical.

The rebuilt line will have no new impacts to existing NAI areas since the line is being constructed within the existing right-of-way. PPL Electric will avoid impacts to these natural areas during construction to the maximum extent practical. Several additional NAI areas are located within a 2-mile radius of the existing route, primarily within the Delaware State Forest. The proposed Blooming Grove – Hemlock 138/69 kV Line is not expected to impact any of these natural areas.

Pennsylvania Natural Diversity Inventory Review

On March 1, 2011, PPL Electric conducted a large project review of the Pennsylvania Natural Diversity Inventory (PNDI) database for the project area by consulting with the United States Fish and Wildlife Service (USFWS)³, Pennsylvania Game Commission (PGC)⁴, Pennsylvania Fish and Boat Commission (PFBC)⁵, and the Pennsylvania Department of Conservation and

³ USFWS tracking number 2010-1113

⁴ PGC did not assign a tracking number for this Project

⁵ PFBC SIR number 35971

Natural Resources (DCNR)⁶. The USFWS indicated that no adverse impacts to federally listed species are anticipated. PGC noted that no impacts to birds or mammal species are anticipated.

PFBC indicated that the proposed Project could potentially impact the timber rattlesnake (*Crotalus horridus*), a PA candidate species, if construction is conducted between April 15th and October 15th. PFBC would then ask PPL Electric to take several measures to protect rattlesnakes and workers, including having a qualified biologist on site prior to and during construction to “clear” the area of rattlesnakes between Hemlock Farms up to a point where the transmission line turns NNW near Low Knob. If work is to be conducted outside of the active season for the timber rattlesnake, no adverse impacts are expected.

DCNR indicated the potential presence of eleven plant species of concern and eight communities of special concern known within one mile of the Project. The majority of these species are wetland species found in bogs and glacial lakes in the vicinity of the project area. DCNR requests surveys in these areas if construction will require tree clearing, right-of-way widening, access road construction, or staging areas. **Table 7** lists the species and communities identified by DCNR. Species followed by an asterisk (*) are currently unlisted in Pennsylvania and are not a target species for the required survey, but due to their ecological significance, DCNR is recommending that they be voluntarily added to the survey to avoid potential impacts. PPL Electric will assess all of the species identified by DCNR, including surveys where appropriate as determined through consultation with DCNR.

TABLE 7: DCNR Species and Communities of Concern

Species/Community	Scientific Name	Status	Habitat	Flowering Season
Bog-rosemary	<i>Andromeda polifolia</i>	PA Rare	Bogs and peaty wetlands	May
Dwarf Mistletoe	<i>Arceuthobium pusillum</i>	PA Threatened	Sphagnum bogs where host <i>Picea mariana</i> is found (two known occurrences nearby)	June - July
Slender Sedge	<i>Carex lasiocarpa</i>	PA Rare	Sphagnum bogs (two known occurrences nearby)	
Mud Sedge*	<i>Carex limosa</i>	Currently Unlisted	Sphagnum bogs, mats and hummocks (two known occurrences nearby)	

⁶ DCNR tracking number 21201

Species/Community	Scientific Name	Status	Habitat	Flowering Season
Bog Sedge	<i>Carex paupercula</i>	PA Threatened	Sphagnum bogs and boggy woods	
Slender Wheatgrass*	<i>Elymus trachycaulu</i>	Currently Unlisted	Open woods, barrens and banks	June - July
Marsh Bedstraw*	<i>Galium trifidum</i>	Currently Unlisted	Moist woods, thickets and swales	June
Yellow Cowlily	<i>Nuphar microphylla</i>	Currently Unlisted	Lakes and ponds	June - September
Floating-heart	<i>Nymphoides cordata</i>	PA Threatened	Lakes and ponds	July - August
White Fringed-orchid*	<i>Platanthera blephariglottis</i>	Currently Unlisted	Sphagnum bogs and swamps	June - August
Horned Bladderwort*	<i>Utricularia cornuta</i>	Currently Unlisted	Shallow water of marshes, ponds and ditches (two known occurrences nearby)	July - August
Communities of Concern				
Black Spruce – Tamarack Palustrine Woodland	NA	NA	This is a peatland community type with tree cover totals between 10 and 60 percent. Black spruce (<i>Picea mariana</i>) and tamarack (<i>Larix laricina</i>) are usually both present in some amount, at least one dominating or co-dominating the tree stratum.	NA
Leatherleaf – Bog Rosemary Peatland	NA	NA	Leatherleaf (<i>Chamaedaphne calyculata</i>) is the dominant shrub. This community type often occurs between a woodland or tall-shrub type and the “Leatherleaf-cranberry Peatland” type. There is typically a sphagnum (moss) layer on organic soil, sometimes on a floating mat.	NA
Leatherleaf – Cranberry Peatland	NA	NA	In glacial bogs, this community often occupies the central zone or one of the final zones of the rooted vegetation surrounding an aquatic interior. The dominant species are leatherleaf, cranberry (<i>Vaccinium oxycoccos</i> and/or <i>macrocarpon</i>), and sphagnum	NA
Pitch Pine – Scrub Oak Woodland	NA	NA	This is a woodland community type that occurs on rocky ridge-tops, on sandy soils, or both. Soils for this community are acidic and conditions are dry. Trees are drought-stressed and of small stature.	NA
Red Spruce – Mixed Hardwood Palustrine Forest	NA	NA	This community type occurs on shallow organic soils or mineral soils with a substantial accumulation of organic matter. Red spruce (<i>Picea rubens</i>) is always present, usually dominant or co-dominant.	NA
Scrub Oak Shrubland	NA	NA	This community type occurs either on sandy soils or on thin soils over bedrock. Soils for this community	NA

Species/Community	Scientific Name	Status	Habitat	Flowering Season
			are acidic and conditions are dry. This community most commonly occurs on rocky ridgetops.	
Sphagnum – Beaked Rush Peatland	NA	NA	This community type occurs in the open areas of many acidic peatlands. The substrate is sphagnum peat, often on a floating mat.	NA
Water-Willow (<i>Decodon verticillatus</i>) Shrub Wetland	NA	NA	Water-willow has the ability to extend itself laterally over open water and thus forms a fringe along the aquatic edge of lakeside, creekside, or bog-lake-side wetlands.	NA

PPL Electric will continue to consult with PFBC and DCNR to resolve potential impacts to timber rattlesnake and rare plants in order to receive PNDI clearances from these agencies. Using the existing right-of-way reduces the potential for impacts to rare species and habitat because it reduces the need for tree clearing and new wetland and stream crossings. Because the majority of the rare plants in the project area occur only in specific wetland habitats, such as bogs and glacial lakes, the Project is unlikely to affect these species. However, once final project construction needs are known, PPL Electric will consult with DCNR to determine if rare plant surveys are required.

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ATTACHMENT “4”

BLOOMING GROVE – HEMLOCK #1 & #2 138/69 kV LINE REBUILD PPL ELECTRIC DESIGN CRITERIA AND SAFETY PRACTICES

The National Electrical Safety Code (“NESC”) is a set of rules to safeguard people during the installation, operation, and maintenance of electric power lines. The NESC contains the basic provisions considered necessary for the safety of employees and the public. Although it is not intended as a design specification, its provisions establish minimum design requirements. PPL Electric Utilities Corporation (“PPL Electric”) has developed design specifications and safety rules which meet or surpass all provisions specified by the NESC.

Engineering Design Criteria and Parameters

The NESC includes loading requirements and clearances for the design, construction, and operation of power lines. The "loads" on conductors and supporting structures are the mechanical forces that develop from the weight of the conductors, the weight of ice on the conductors, plus wind pressure on the conductors and supporting structures. Loading requirements are the loads on the conductors and structures that are anticipated assuming certain ice and wind conditions. Loading requirements always contain "safety factors" to allow for unknown or unanticipated contingencies. The clearances and loading requirements contained in the NESC were developed to ensure public safety and welfare.

PPL Electric transmission line design standards meet or surpass the NESC standards. For example, the relative order of grades of construction for conductors and supporting structures is B, C, and N; Grade B being the highest. According to the NESC standards, construction Grades B, C, or N may be used for transmission lines (except at crossings of railroad tracks and limited access highways where Grade B construction is specified). However, PPL Electric designs all of its transmission lines for Grade B construction. The use of Grade B design and construction specifies such things as larger-minimum crossarm dimensions, larger-minimum conductor size, and increased safety factors.

Another example is the design parameters utilized to account for ice and wind loadings on the overhead ground wire (“OHGW”) and power conductors. The NESC standard ice and wind design magnitudes for the PPL Electric territory are 0.5 inch thickness of radial ice combined with four pounds per square foot horizontal wind pressure (equivalent to 40-mile per hour wind velocity). The conductor sags and tensions used in line designs are the result of various ice and wind combinations, depending on the elevation at the line location and line design voltage. The conductor sags and tensions used in the design of all PPL Electric transmission lines are at least 0.5-inch ice combined with eight pounds wind pressure (equivalent to 57 miles per hour wind velocity). This means that PPL Electric lines are designed to operate safely and reliably during inclement weather even more severe than assumed by the NESC. In addition, PPL Electric transmission lines are designed with more clearance to the ground than required by the NESC. The tables below compare PPL Electric and NESC ground clearances for lines of various voltages.

138 kV

<u>Surface Underneath Conductors</u>	<u>Vertical Clearance to Ground</u>	
	<u>NESC Standard</u> (feet)	<u>PPL Electric</u> <u>Design (feet)</u>
Roads, streets, alleys	21	30
Other land traversed by vehicles (such as cultivated field, forest, etc.)	21	30
Spaces accessible to pedestrians only	17	30
Railroad tracks	31	35

230 kV

<u>Surface Underneath Conductors</u>	<u>Vertical Clearance to Ground</u>	
	<u>NESC Standard</u> <u>(feet)</u>	<u>PPL Electric</u> <u>Design (feet)</u>
Roads, streets, alleys	23	32
Other land traversed by vehicles (such as cultivated field, forest, etc.)	23	32
Spaces accessible to pedestrians only	19	32
Railroad tracks	31	36

500 kV

<u>Surface Underneath Conductors</u>	<u>Vertical Clearance to Ground</u>	
	<u>NESC Standard</u> <u>(feet)</u>	<u>PPL Electric</u> <u>Design (feet)</u>
Roads, streets, alleys	28	53
Other land traversed by vehicles (such as cultivated field, forest, etc.)	28	53
Spaces accessible to pedestrians only	24	53
Railroad tracks	38	53

A relay protection system is used to protect the public safety and welfare as well as equipment and the transmission system. Relay protection is installed for all transmission lines to automatically de-energize the line in the unlikely event that the line or supporting structure fails and the line contacts the ground.

Periodic Maintenance Program on All Transmission Lines

To ensure continued public safety and integrity of service, a periodic maintenance and inspection program is implemented for every transmission line. The program is administered through the use of helicopter patrols, with supplemental foot and structure climbing patrols. A number of helicopter patrols are performed on all lines annually. The two-man helicopter crew flies parallel, to the left, and above the line so that the observer can look for signs of line damage or deterioration and observe clearances between vegetation and conductors. The observations are included in a report that is forwarded to the appropriate department for corrective action.

Foot and structure climbing patrol programs for a transmission line begin approximately three to five years after the line is energized, unless a helicopter patrol reports a need for earlier action. The frequency of foot patrols varies from once every year to once every several years depending on line type and age.

An assigned foot patroller checks right-of-way conditions, including access roads, bridges, pole washouts, tower footers, vegetation height and clearance to conductors, pole and tower deterioration and, with the use of binoculars, insulators, and condition of hardware. Identified problems are included in a report that is forwarded to the appropriate department for corrective action.

A scheduled line outage is required to perform an overhead patrol because of "hands-on" inspection of hardware. Overhead patrols are conducted on a schedule determined by line age, operating record, and observed general condition. The necessary repairs are also done during the inspection outage.

Personnel Safety Rules

The following are a few of the PPL Electric safety rules that demonstrate the Company's concern for employee safety:

- Work procedures have been developed to allow work to be performed on energized facilities in a safe manner. When lines or apparatus are removed from service to be worked on, the Energy Control Process system is applied. This system provides that a red tag must be physically placed on the control handle of the de-energized equipment. The red tag may be removed only after proper authorization to energize the equipment. Various other tags are used for limited operations and informational purposes. Employees will not apply or remove a tag or change the status of tagged equipment unless authorized.
- Temporary safety grounds are used on de-energized facilities for employee safety during maintenance, construction, or reconstruction work. Safety grounds are wires connecting the de-energized facility to an electrical ground. If the facility should be energized, the safety grounds will divert the current directly to ground and reduce the likelihood of personal injury. The conductor size and attachment clamps of temporary safety grounds must be capable of conducting anticipated fault currents. Rubber gloves, rubber sleeves, and additional rubber protective equipment are used as required when applying or removing temporary safety grounds to or from the lines or apparatus to be grounded. An approved nonconductive working stick of sufficient length to allow workers to maintain the following required minimum clearances is used to test that the line has been de-energized and to apply temporary safety grounds:

<u>Voltage-kV</u>	<u>Minimum Clearance</u>
138	3'-7"
230	5'-3"
500	11'-3"

Before applying grounds, a test is done to confirm that the line is de-energized. The voltage test device is checked before and after use to assure reliability. When ground pins are used to establish proper ground points, they are driven to a depth of not less than four feet as near vertical as possible.

- Poles or structures are inspected and examined for structural integrity before climbing. If there is any reason to believe that a pole is unsafe, it is stabilized before work is performed. Appropriate safety gear in the form of body belts, safety straps, hard hats, gloves, etc., is worn by linemen during line work activity.

ATTACHMENT “5”
BLOOMING GROVE – HEMLOCK #1 & #2 138/69 kV LINE REBUILD
PPL ELECTRIC MAGNETIC FIELD MANAGEMENT PROGRAM



**MAGNETIC
FIELD
MANAGEMENT**
**PPL Electric Utilities
Corporation**

DECEMBER 2004

TABLE OF CONTENTS

INTRODUCTION	1
DEVELOPMENT OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM.....	6
VARIABLES THAT AFFECT MAGNETIC FIELDS	6
Effect of Phase Current on Magnetic Fields	6
Effect of Conductor Configuration on Magnetic Fields	7
Effect of Distance from the Magnetic Field Source	7
SUMMARY OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM.....	8
MAGNETIC FIELD MANAGEMENT PROGRAM GUIDELINES	9
Overhead Lines	9
New or Rebuilt Transmission Lines	9
Reconductoring or Adding Additional Circuits to Existing Transmission Lines	14
Distribution Lines	14
Underground Transmission Lines.....	15
CHARTS.....	16

INTRODUCTION

At PPL Electric Utilities Corp. (PPL EU), magnetic field management means investigating and implementing methods at low or no cost to reduce magnetic fields in new or rebuilt transmission and distribution lines. This document explains PPL EU's Magnetic Field Management Program, which is part of PPL EU's larger Electric and Magnetic Fields (EMF) policy.

PPL EU's View

Some people are worried that electric and magnetic fields are harming their health. Others think the scientific research does not show a problem at all, and still others believe there's just too much scientific uncertainty to draw any conclusions.

Here's what we do know now. Various panels of scientists that have reviewed the EMF research generally have drawn two main conclusions. First, the large body of evidence does not demonstrate that EMF are harmful. Second, additional research is recommended to explore questions raised in some studies.

Given these conclusions, PPL EU is taking a reasoned approach in responding to the EMF issue. PPL EU's approach to the EMF issue consists of five elements:

- Providing EMF information to customers and employees
- Providing magnetic field measurements
- Establishing and implementing a magnetic field management program to reduce magnetic fields in new or rebuilt facilities when it can be done at no, or low, cost
- Integrating EMF in the public involvement process that PPL EU undertakes in the siting of transmission lines
- Have supported additional research

EMF Are All Around Us

Electric and magnetic fields occur in nature and in all living things. The earth, for instance, has a magnetic field, which makes the needle on a compass point north.

Electric fields and magnetic fields of a different type also surround every wire that carries electricity. In everyday life, these EMF arise from several basic sources, including power lines, electrical appliances, home and building wiring, other utility lines and cables, and currents flowing on water pipes. Though they often occur together, EMF are made up of two separate components:

Electric Fields

Electric fields are produced by the voltage—or electrical pressure—on a wire. The higher the voltage, the higher the electric field. As long as a wire is energized—has voltage present—an electric field is present (see Figure 1). In other words, an appliance, or an electric power line, doesn't actually have to be turned on to create an electric field. It just has to be plugged in. Electric fields diminish with distance and can be blocked or partially shielded by objects such as trees and houses.

Magnetic Fields

Magnetic fields are created by the current or flow of electricity through a wire. Generally speaking, the higher the current, the higher the magnetic field. Because they only occur when current is flowing, magnetic fields are present only when the power is turned on (see Figure 1). Magnetic fields also diminish with distance, but—unlike electric fields—are not blocked by common objects. In recent years, public and scientific interest has turned toward the magnetic field component of EMF because of some scientific studies regarding these fields.

Figure 1

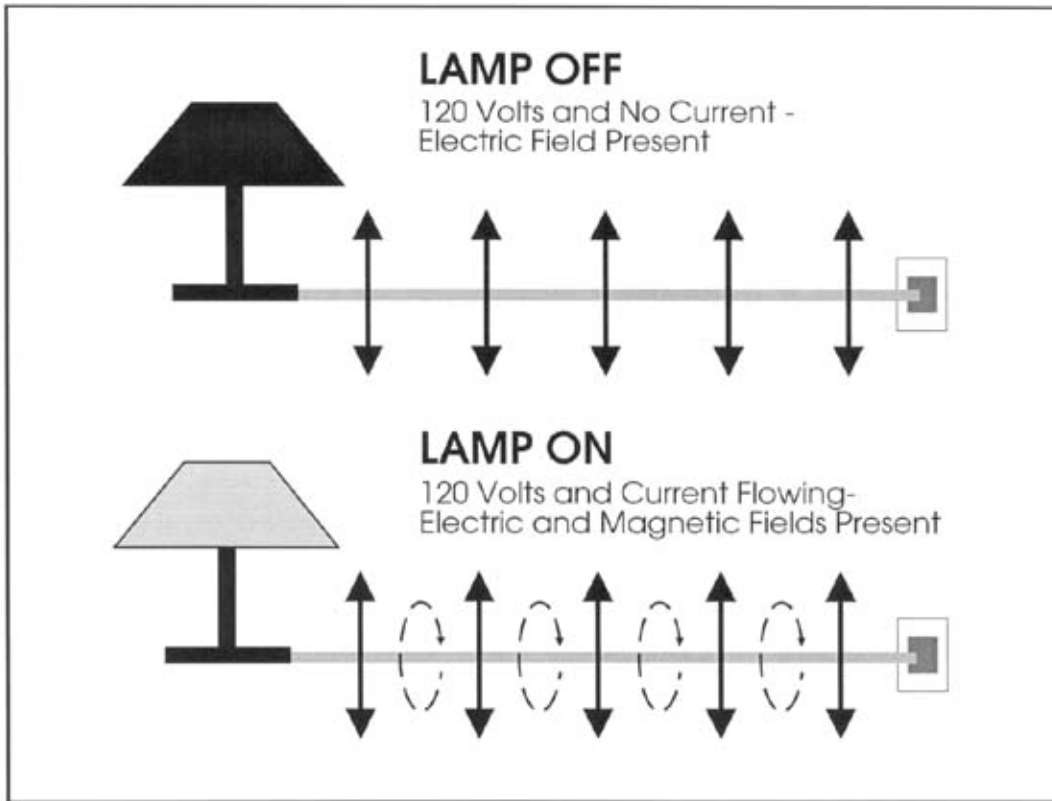


Figure 2









Magnetic field strengths decrease with distance Magnetic fields are measured in milligauss		Source: "EMF In Your Environment", U.S. Environmental Protection Agency 1992		
		At 6 inches	At 1 foot	At 2 feet
Clothes dryer		2 to 10	* to 3	*
Microwave oven		100 to 300	1 to 200	1 to 30
Toaster		5 to 20	* to 7	*
Power drill		100 to 200	20 to 40	3 to 6
Can opener		500 to 1500	40 to 300	3 to 30
Mixer		30 to 600	5 to 100	* to 10
Hair dryer		1 to 700	* to 70	* to 10
Color television		Data not available	* to 20	* to 8

FIGURE 2 * The magnetic field measurement at this distance from the operating appliance could not be distinguished from background measurements taken before the appliance had been turned on.

Measuring Magnetic Fields

Magnetic fields usually are measured in a unit called a milligauss. Magnetic field levels found in the living areas of homes typically range from less than 1 milligauss to about 4 milligauss according to the U.S. Environmental Protection Agency. They can be higher in some cases. The levels next to appliances can exceed 1,000 milligauss (1 gauss). Figures 2 and 3 show how the strength of the field falls off as you move away from the source, just as the heat of a campfire grows weaker as you walk away from it. For overhead power lines, the strength of the magnetic fields is dependent upon a number of factors that will be explained later. Those factors produce a magnetic field that drops off rapidly as you move away from the power line.

Figure 3

Sample Magnetic Field Levels in Milligauss				
Type of Overhead Power Line	Distance from the line			
	Under the line	50 ft.	100 ft.	200 ft.
220 kV and 500 kV	5-400	5-250	1-75	0.5-20
69 kV and 138 kV	3-80	0.5-2.5	0.1-10	0.1-3
12 kV and below	0.4-20	0.1-1	-	-

The magnetic field values provided in this table represent a general range of values associated with the types of overhead power lines listed and are provided for illustration. There will be circumstances in which there will be magnetic field levels above or below the range of values provided due to variations in such factors as height of the wires, current flow and so on.

DEVELOPMENT OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

One element of our response to EMF concerns expressed by some of our customers is PPL EU's Magnetic Field Management Program. The program was initiated in March 1991 because PPL EU believes it makes good sense, as a matter of policy, to respond to the concerns expressed by some of our customers and to reduce magnetic fields in new and rebuilt facilities where it can be done with either no-cost or low-cost design changes.

This document updates the original program which has been revised several times since 1991. These guidelines were developed by PPL EU's EMF Working Group.

VARIABLES THAT AFFECT MAGNETIC FIELDS

Magnetic fields from transmission and distribution lines are a function of a number of design variables. The following parameters affect the magnetic field levels produced by transmission and distribution lines:

- Current
- Height of conductors above ground
- Configuration of conductors
- Distance from the line

EFFECT OF PHASE CURRENT ON MAGNETIC FIELDS

At power frequencies (i.e., 60 hertz), the magnetic field level is a function of the current or flow of electricity through a wire. Keeping all other parameters the same, the magnetic field is proportional to the current. Hence, if the current increases by 25 percent, the resulting magnetic field level will increase by 25 percent.

The overall load current on any line varies with the demand for power. It's usually highest during daytime hours and lowest at night. There also are weekly, monthly, seasonal and yearly variations.

The difference in the currents between each phase in a multiphase line also can affect the magnetic field. This difference is called phase unbalance. For a constant load, a statistical analysis of this phase unbalance can be made to determine its effect on the magnetic field. Close to the line, there is very little effect. However, the phase unbalance slows the rate at which the magnetic field decreases with distance from the line.

EFFECT OF CONDUCTOR CONFIGURATION ON MAGNETIC FIELDS

In the transmission and distribution of power, utilities like PPL EU presently use both three-phase and single-phase lines. Each phase on a three-phase power line has either a single conductor or a bundle of two or more conductors. In a three-phase system, the ground-level magnetic field is a result of the fields produced by the currents in each of the phases. Placing the three phases as close together as possible (compaction) creates some field cancellation, and the ground-level magnetic field is reduced. However, appropriate phase separation is required for the reliable operation of the line. In addition, the arrangement of the phases can create some; field cancellation and reduction of the ground-level magnetic field.

EFFECT OF DISTANCE FROM THE MAGNETIC FIELD SOURCE

Magnetic field strength diminishes with the vertical and lateral distances from the magnetic field source. Increasing the height of the conductors above ground is useful for magnetic field reduction at ground level, but may result in increased structure costs and increased aesthetic impact of the structures. Another possible method of increasing the distance to the magnetic field source is to increase the right-of-way requirements. By keeping buildings off increased rights of way, thereby requiring the public to live and work further away from lines, exposure to magnetic fields produced by the lines can be reduced. Increases in right of way are not always practical and may increase costs significantly, however.

SUMMARY OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

Under its Magnetic Field Management Program, PPL EU has changed the way it builds and rebuilds some of its transmission and distribution lines. These design changes reduce magnetic field levels (assuming balanced circuit loadings and phase currents) by up to 69 percent in most of the company's new transmission lines. These guidelines now are being applied to new and reconstructed transmission facilities, based on this program.

The distribution component of the program focuses on 12 kV lines, the company's standard distribution voltage. It concentrates on the three-phase, primary 12 kV lines, since these are the most heavily loaded facilities and often are located in densely populated areas. The guidelines in this program are being applied to these three-phase, primary 12 kV lines.

A maximum 3-5 percent change in estimated cost was used as the limit for the guidelines since this value is consistent with low cost, is within estimating accuracy and is likely to have little impact on overall line costs.

The magnetic field calculations used in this document for the design of PPL EU's overall magnetic field management plan assume balanced load conditions among the phases and a fixed level of current, not necessarily representative of specific transmission or distribution lines. These levels were calculated using the Electric Power Research Institute's ENVIRO computer program. Under actual operating conditions, the magnetic field levels that result may vary due to such things as actual load per circuit, overall current on each phase conductor and the electrical configuration and operation of each line.

MAGNETIC FIELD MANAGEMENT PROGRAM GUIDELINES

The guidelines for magnetic field management are noted below, with discussion points for each.

OVERHEAD LINES

NEW OR REBUILT TRANSMISSION LINES

1. Balance transmission circuit loads and phase currents as much as possible.

- PPL EU should continue to make every effort to balance loadings between the two circuits of a double circuit line when planning new or rebuilt facilities to maximize the effects of reverse phasing.
- PPL EU should continue the practice of balancing single-phase loads across the three phases of the distribution system. (Unbalanced phase currents on the distribution system are reflected through to the transmission system.)
 - Unbalanced phase currents result in higher magnetic fields that do not drop off as quickly with distance as do the fields resulting from balanced phase currents.
 - For a 5 percent phase current unbalance, the magnetic field 50 feet from the centerline of a single circuit 138 kV line could be more than twice the value than if the same line had balanced phase circuits.
- Balanced phase currents on each three-phase distribution circuit also reduce magnetic fields from the distribution circuits themselves. In addition, they reduce magnetic fields on the transmission system from which the distribution system circuits are supplied and connected through substations.
- Apart from magnetic field considerations, balanced phase currents on each three-phase distribution circuit also reduce line losses and improve the system voltage.

2. Continue with the present practice of using long-span construction as the PPL EU 138/69 kV standard

- Structure designs for short-span and long-span construction are illustrated on Charts I and II, respectively.
 - Short-span design does not significantly reduce magnetic fields when compared to long-span design even though it is more compact than long-span design. Comparison of the magnetic field values from Chart III indicates essentially the same values. Therefore, short-span design should not be used solely to reduce magnetic fields.
 - PPL EU will continue to use long-span construction for 138/69 kV double-circuit lines and for single-circuit/future-double-circuit lines.
 - For single-circuit/future-double-circuit lines, PPL EU will continue to install two conductors on the top positions and one in the middle position as shown in Chart IV.
 - This arrangement minimizes magnetic fields as shown in Chart V by placing the three initial conductors higher on the structure, which increases the ground clearances, and by placing the conductors in a triangular configuration.

3. Compact design structures are not a low-cost alternative and should be used for magnetic field reduction only in special applications.

Chart VI illustrates the compact design structure.

- The compact design increases the initial installation costs by 79 percent when compared to the long-span design but reduces the magnetic field from 9 mG to 3 mG (about 67 percent) at the edge of the 100-foot-wide right of way as shown on Chart III.

4. Reverse phase new or rebuilt double-circuit transmission lines for all voltage levels.

- Reverse phasing was adopted by PPL EU in March 1991 for double-circuit 138/69 kV transmission lines and in April 1992 for all other double circuit transmission lines. Reverse phasing is shown in Chart VII. Reverse phasing will reduce the magnetic fields when the current flow on both circuits is in the same

direction. Calculated values contained here are based on balanced and equal phase currents on both circuits.

- Reverse phasing reduces the magnetic field of a double circuit 138 kV single pole transmission line from 29 mG to 9 mG (about 69 percent) at the edge of the 100-foot-wide right of way as shown on Chart III.
- Reverse phasing reduces the magnetic field of a double circuit 230 kV single pole transmission line from 49 mG to 16 mG (about 67 percent) at the edge of the 150-foot-wide right of way as shown on Chart VIII.
- Reverse phasing reduces the magnetic field of a double-circuit 500 kV single pole transmission line from 37 mG to 21 mG (about 43 percent) at the edge of the 200-foot-wide right of way as shown on Chart IX.
- When new or rebuilt double-circuit lines require tapping existing double-circuit lines, PPL EU will review the existing lines to determine if reverse phasing can be provided at low cost.
- Computer modeling is required to develop the optimum phasing and overall conductor arrangements for lines added to, or rebuilt in, multiple-line corridors.
 - Merely adding a reverse-phase double-circuit line to an existing transmission line corridor or reverse phasing a rebuilt line in the multiple-line corridor will not necessarily produce lower magnetic field levels at the edge of the corridor right of way.
 - The corridor must be computer modeled with all the lines, existing phase conductor locations and currents. Then, magnetic field calculations must be made varying the phase arrangements of the new or reconstructed line to determine the appropriate phasing arrangement.
 - Current flow direction on a line also must be considered. For example, a reverse-phased line should have the current flowing in the same direction on both circuits. If the current flow is in the opposite direction for one circuit, reverse phasing will not produce the lowest magnetic field and another phase arrangement that produces lower fields may need to be utilized.

5. **Increase the minimum ground clearance for all new transmission lines.**

138/69 kV Transmission Lines

- Increasing the minimum line design ground clearance from 25 feet to 30 feet may add up to about 5 percent to the installed cost of a new double-circuit single pole 138/69 kV line. For a given project, such cost may be substantially less, however. In fact, PPL EU frequently uses higher-than-minimum ground clearances due to such features as road crossings, line crossings and site-specific terrain. With long-span reverse-phase design, the magnetic field is reduced from 9 mG to 7 mG (about 22 percent) at the edge of a 100-foot-wide right of way as shown in Chart X.
 - In the actual design of transmission lines to include higher minimum ground clearances, there may be limited segments (such as highway crossings, severe slopes and transmission line crossing locations) where National Electrical Safety Code (NESC) minimum ground clearances may need to be used. The NESC minimum ground clearances are less than the increased ground clearance discussed previously.

230 kV Transmission Lines

- Increasing the minimum line design ground clearances from 27 feet to 32 feet may add up to about 5 percent to the cost of a single-circuit single-pole line (current standard). For a given project, such cost may be substantially less, however. In fact, PPL EU frequently uses higher-than-minimum ground clearances due to such features as road crossings, line crossings and site-specific terrain. By increasing the clearances, the magnetic field is reduced from 30 mG to 28 mG (about 7 percent) at the edge of a 150-foot-wide right of way.
- Increasing clearances from 27 feet to 32 feet could theoretically add up to about 2.8 percent to the cost of a double-circuit single-pole line (current standard) and reduce the magnetic field of a reverse-phase line from 16 mG to 15 mG (about 6 percent) at the edge of a 150-foot-wide right of way. Chart XI is a summary of this data.
- Studies are required for each new 230 kV line to determine optimum structure types, ground clearances, configurations and designs to reduce field levels. Such

studies could include analysis of reduction measures such as additional minimum ground clearances, increasing conductor tensions, using reduced phase spacing (a "Delta" configuration on a single-circuit line), installing the second circuit initially, and/or adding a second set of conductors that are reverse phased and operated in parallel with the first set (bundled/split phase).

500 kV Transmission Lines

- Increasing ground clearances from 33 feet to 53 feet may add up to about 4.5 percent to the cost of a single-circuit "H-frame" line (current standard). For a given project, such cost may be substantially less, however. In fact, PPL EU frequently uses higher-than-minimum ground clearances due to such features as road crossings, line crossings and site-specific terrain. By increasing the clearances, the magnetic field is reduced from 42 mG to 35 mG (about 17 percent) at the edge of a 200-foot-wide right of way.
- Increasing ground clearances from 33 feet to 53 feet could theoretically add up to 2.8 percent to the cost of a double-circuit "H-frame" line (current standard) and reduces the magnetic field of a reverse-phase line from 21 mG to 16 mG (about 24 percent) at the edge of a 200-foot-wide right of way. Chart XII is a summary of this data.
- Studies are required for each new 500 kV line to determine optimum structure types, ground clearances, configurations and designs to reduce field levels. Such studies could include analysis of reduction measures such as additional minimum ground clearances, increasing conductor tensions, using reduced-phase spacing (a "Delta" configuration on a single circuit line), installing the second circuit initially, and/or adding a second set of conductors that are reverse phased and operated in parallel with the first set (bundled/split phase).

RECONDUCTORING OR ADDING ADDITIONAL CIRCUITS TO EXISTING TRANSMISSION LINES

When reconductoring or adding additional circuits to existing transmission lines, PPL EU will evaluate low-cost or no-cost options for magnetic field management on a case-by-case basis.

When reconductoring existing transmission lines or adding additional circuits, low-cost alternatives may not exist; however, the following steps will be taken:

- For a single-circuit line, the use of a Delta arrangement or other modifications on the existing structure, with reduced-phase spacing, will be evaluated.
- For double-circuit lines, application of reverse phasing may reduce the magnetic field under the line and within the right of way and will be evaluated.
- For single- and double-circuit lines, evaluate using higher conductor tensions that can increase the minimum line design ground clearance.

DISTRIBUTION LINES

At the 12 kV distribution level, new main three-phase lines will continue to be constructed with five feet of additional ground clearance.

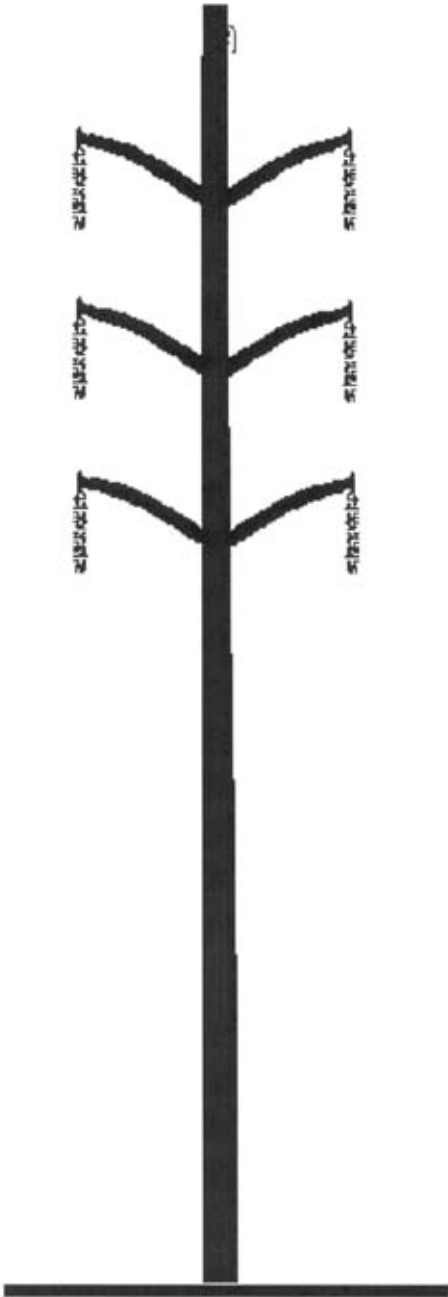
- Main lines are the most heavily loaded sections of a distribution line and therefore have the highest magnetic fields associated with them.
- Increasing the ground clearance by five feet reduces the magnetic field under the line from 14 mG to 11 mG using the standard eight-foot crossarm design. These values are based on increasing pole heights from 45 feet to 50 feet and a typical operating current of 300 amps per phase.
- Chart XIII is a summary of this data. Increasing ground clearance by five feet could theoretically add about 5 percent to the cost of a typical distribution line.

UNDERGROUND TRANSMISSION LINES

Underground transmission lines are required due to environmental or land use factors or restrictions on available clearances, PPL EU will evaluate options for magnetic field management techniques on a case-by-case basis.

- The phase arrangement that produces the lowest field will be determined.
- The depth of burial of the line will be determined considering the cost of excavation and the location of other buried utilities in the area.
- The use of steel pipe ferromagnetic shielding that reduces magnetic fields will be evaluated.

Short-Span Construction



- **More compact design**
- **Should not be used solely to reduce magnetic fields**
- **Typical conductor data:**
 - 1 3/8" HS steel overhead ground wire - 7.3 feet sag
 - 6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 10.0 feet sag
 - Average span - 400 feet

Long-Span Construction Remains PPL EU 138 kV Standard



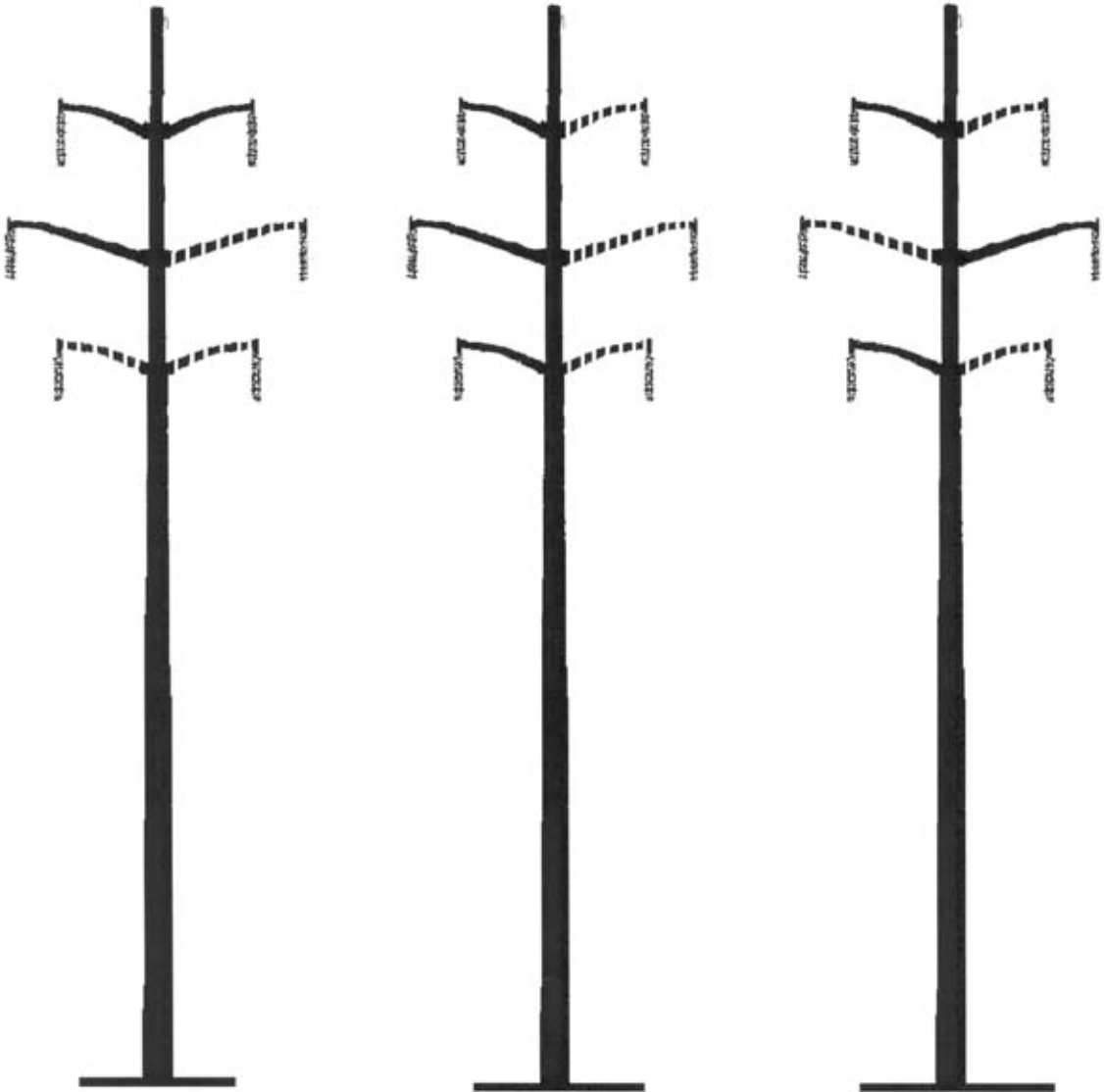
- Lower cost alternative
- Reduces magnetic fields due to higher structures
- Typical conductor data:
 - 1 3/8" HS steel overhead ground wire - 17.3 feet sag
 - 6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 23.0 feet sag
 - Average span - 600 feet

**138/69 kV REVERSE-PHASE TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 400 AMPERES**

TYPE CONSTRUCTION	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
SHORT SPAN (CHART I)	30
SHORT SPAN (REVERSE PHASE)	8
LONG SPAN (CHART II)	29
LONG SPAN (REVERSE PHASE)	9
COMPACT (CHART VI)	14
COMPACT (REVERSE PHASE)	3

The edge of right of way is 50 feet from the line centerline.
 The 400 ampere phase current is balanced between phases.
 Calculations are based on a minimum ground clearance of 25 feet.
 LONG SPAN, SHORT SPAN and COMPACT are double-circuit lines.

Typical Single-Circuit Structure Designs



Top/Middle

Vertical

Top/Middle/Bottom

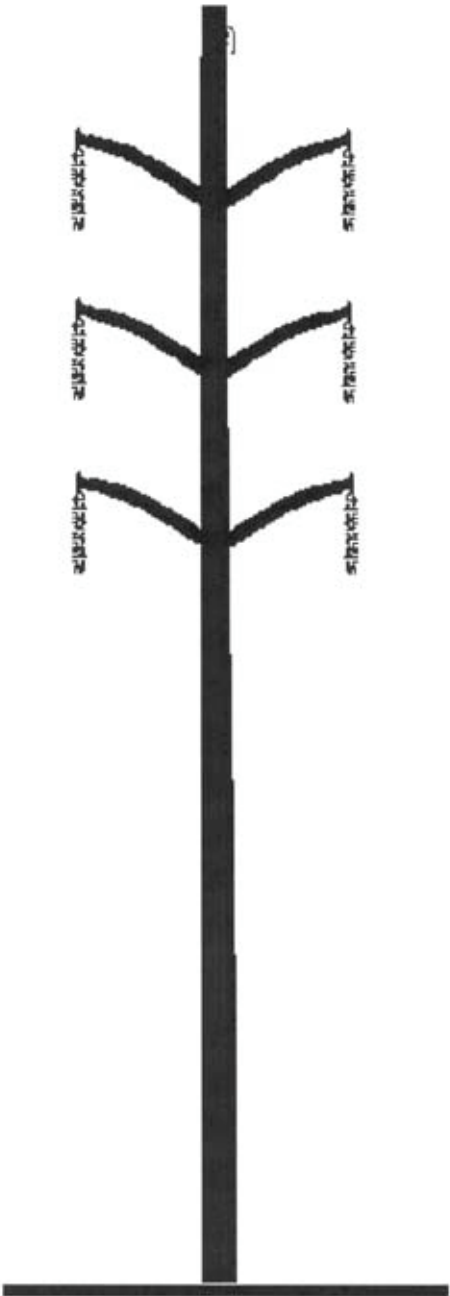
—— initial single circuit
- - - - future second circuit

**138/69 kV SINGLE CIRCUIT TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 400 AMPERES**

TYPE CONSTRUCTION	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
TOP/MIDDLE/BOTTOM	20
VERTICAL	17
TOP/MIDDLE	12

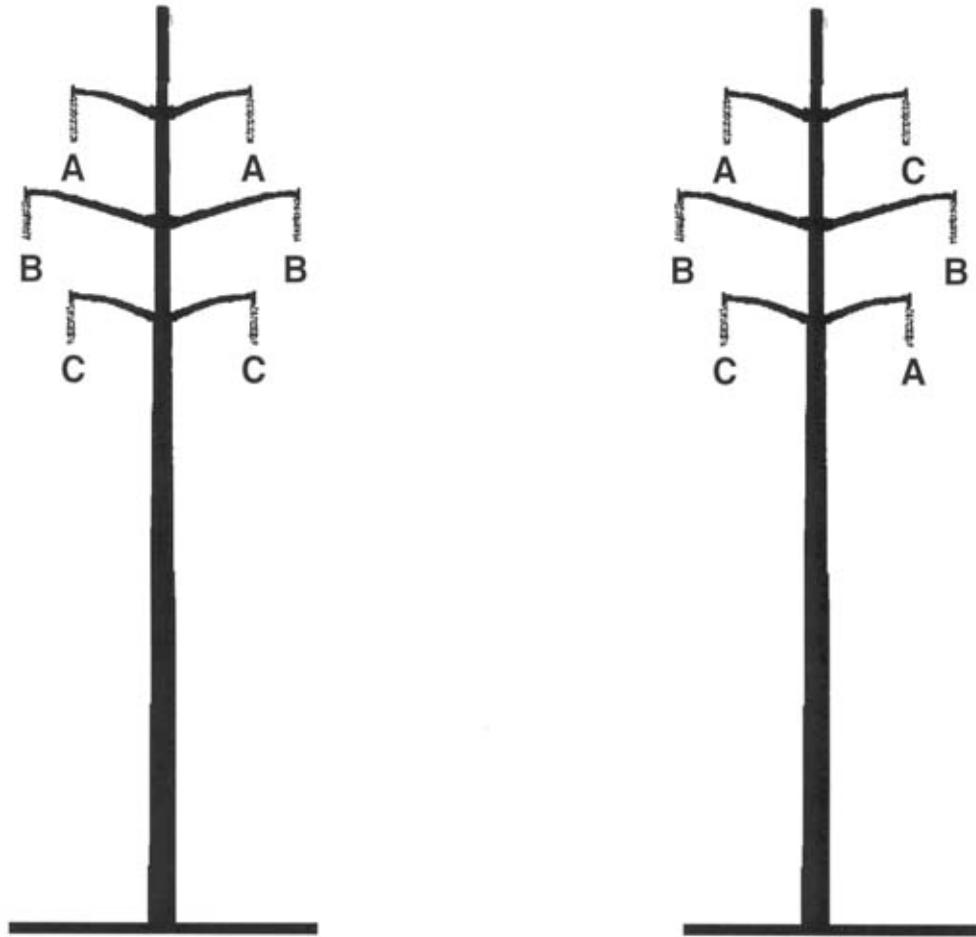
The edge of right of way is 50 feet from the line centerline.
The 400 ampere phase current is balanced between phases.
Calculations are based on a minimum ground clearance of 25 feet.

Compact Design Structure



- Minimize magnetic fields due to compact design
- Not a low-cost alternative
- Typical conductor data:
 - 1 3/8" HS steel overhead ground wire - 9.0 feet sag
 - 6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 9.0 feet sag
 - Average span - 300 feet

Reverse Phasing of Double-Circuit Transmission Lines



From: → → → → To:

Reverse phasing also can be one of the following phase arrangements:

A	B		B	A		B	C		C	A		C	B
C	C	or	C	C	or	A	A	or	B	B	or	A	A
B	A		A	B		C	B		A	C		B	C

**230 kV REVERSE-PHASE TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 800 AMPERES**

TYPE CONSTRUCTION	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
DOUBLE CIRCUIT POLE	49
DOUBLE CIRCUIT POLE (REVERSE-PHASE)	16

The edge of right of way is 75 feet from the line centerline.
The 800 ampere phase current is balanced between phases.
Calculations are based on a minimum ground clearance of 27 feet.

**500 kV REVERSE-PHASE TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 1100 AMPERES**

TYPE CONSTRUCTION	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
DOUBLE CIRCUIT POLE	37
DOUBLE CIRCUIT POLE (REVERSE PHASE)	21

The edge of right of way is 100 feet from the line centerline.
The 1,100 ampere phase current is balanced between phases.
Calculations are based on a minimum ground clearance of 33 feet.

**INCREASED 138/69 kV MINIMUM GROUND CLEARANCE
CALCULATED MAGNETIC FIELDS AT 400 AMPERES**

TYPE CONSTRUCTION	MINIMUM GROUND CLEARANCE FEET	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
SINGLE CIRCUIT TOP/MIDDLE	25	12
SINGLE CIRCUIT TOP/MIDDLE	30	10
LONG SPAN	25	29
LONG SPAN	30	26
LONG SPAN (REVERSE PHASE)	25	9
LONG SPAN (REVERSE PHASE)	30	7

The edge of right of way is 50 feet from the line centerline.
The 400 ampere phase current is balanced between phases.

**INCREASED 230 kV MINIMUM GROUND CLEARANCE
CALCULATED MAGNETIC FIELDS AT 800 AMPERES**

TYPE CONSTRUCTION	MINIMUM GROUND CLEARANCE FEET	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
SINGLE CIRCUIT TOP/MIDDLE	27	30
SINGLE CIRCUIT TOP/MIDDLE	32	28
DOUBLE CIRCUIT POLE	27	49
DOUBLE CIRCUIT POLE	32	46
DOUBLE CIRCUIT POLE (REVERSE PHASE)	27	16
DOUBLE CIRCUIT POLE (REVERSE PHASE)	32	15

The edge of right of way is 75 feet from the line centerline.
The 800 ampere phase current is balanced between phases.

**INCREASED 500 kV MINIMUM GROUND CLEARANCE
CALCULATED MAGNETIC FIELDS AT 1,100 AMPERES**

TYPE CONSTRUCTION	MINIMUM GROUND CLEARANCE FEET	MAGNETIC FIELD IN MILLIGAUSS AT THE EDGE OF THE RIGHT OF WAY
SINGLE CIRCUIT "H" STRUCTURE	33	42
SINGLE CIRCUIT "H" STRUCTURE	53	35
DOUBLE CIRCUIT POLE	33	37
DOUBLE CIRCUIT POLE	53	31
DOUBLE CIRCUIT POLE (REVERSE PHASE)	33	21
DOUBLE CIRCUIT POLE (REVERSE PHASE)	53	16

The edge of right of way is 100 feet from the line centerline.
The 1,100 ampere phase current is balanced between phases.

**12 kV DISTRIBUTION LINES
CALCULATED MAGNETIC FIELDS AT 300 AMPERES**

TYPE CONSTRUCTION	POLE HEIGHT FEET	MAGNETIC FIELD IN MILLIGAUSS*	
		AT CENTERLINE	AT 30 FEET FROM CENTERLINE
STANDARD CROSSARM	45	14	7
STANDARD CROSSARM	50	11	6

* Field level under the line at mid-span based on 300 amps, balanced loading, one meter above ground level.

ATTACHMENT "6"

**BLOOMING GROVE – HEMLOCK #1 & #2 138/69 kV LINE REBUILD
LIST OF INVOLVED GOVERNMENTAL AGENCIES, MUNICIPALITIES
AND OTHER PUBLIC ENTITIES**

Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Commonwealth Keystone Building, Second Floor
400 North Street
Harrisburg, Pennsylvania 17120-0053
Attn: Mr. Douglas C. McLearn, Chief

Pennsylvania Department of Transportation
Honorable Barry Schoch, P.E., Secretary
c/o Office of Chief Counsel
Commonwealth Keystone Building
400 North Street, 9th Floor
Harrisburg, PA 17120
Attn: Andrew Gordon

Pennsylvania Department of Environmental Protection
P.O. Box 2063
Market Street State Office Building
Harrisburg, Pennsylvania 17105-2063
Attn: Office of Field Operations

Pike County Board of Commissioners
506 Broad Street
Milford, PA 18337
Attn: Mr. Rich Caridi, Chairman

Pike County Planning Commission
837 Route 6, Unit 4
Shohola, PA 18458
Attn: Ms. Sally Corrigan, Planning Director

Blooming Grove Township
488 Route 739
Blooming Grove, PA 18428-9039
Attn: Ms. Jo-Anna Donahue, Secretary

Blooming Grove Township Planning Commission
488 Route 739
Blooming Grove, PA 18428-9039
Attn: Mr. Levi Travis, Sr., Chairman

ATTACHMENT "7"

**BLOOMING GROVE – HEMLOCK #1 & #2 138/69 KV LINE REBUILD
LIST OF PROPERTY OWNERS WITHIN THE PROPOSED RIGHT-OF-WAY**

<u>Property Owner/Address</u>	<u>Parcel Number</u>
Pennsylvania Power & Light Company 2 North Ninth St Allentown, PA 18101	1
Pennsylvania Power & Light Company 2 N Ninth St Allentown, PA 18101	2
Peter Daticuk 66 Porchtown Rd Pittsgrove, NJ 08318	3
Pennsylvania Power & Light Company 2 North Ninth St Allentown, PA 18101	4
Randy M. Fisher 620 Blooming Grove Rd Hawley, PA 18428	5
Drew B. & Charles H. Fetters Jr. 4 Harmony Lane Carbondale, CO 81623	6
Kleinhans Burial Grounds c/o Drew B. & Charles H. Fetters Jr. Carbondale, CO 81623	6B
Cheryl Glisson Hcr 6 Box 6451 Blooming Grove Hawley, PA 18428	7
Forrest Et Ux Glisson Hcr 6 Box 6451 Blooming Grove Hawley, PA 18428	8
Martin & Joann Netzer Hc 6 Box 6448 Hawley, PA 18428	9

Property Owner/Address

Parcel Number

John J. Sr. & Shirley J. Kleinhans
7028 Edna Ave
Bayonet Point, FL 34667

10

Craig Chapman
PA Department of Conservation and Natural Resources – Bureau of
Forestry
Rachel Carson State Office Building, 6th Floor
PO Box 8552
Harrisburg, PA 17105-8552

Timothy A. Balch
PA Department of Conservation and Natural Resources – Bureau of
Forestry
Delaware Forest
HC 1 Box 95A
Swiftwater, PA 18370

11

Laurin & Lois Kretzmer
Hc 8 Box 6502
Hawley, PA 18428

12

Stanley & Marion Orłowski,
104 Cherokee Circle
Hawley, PA 18428

13

Paul C. & Anne E. Fedorisin
Hc 6 Box 6511
Hawley, PA 18428

14

Walemar & Lynn Schultz
Po Box 56
Highland Lakes, NJ 07422

15

Richard P. Becker
500 Broadway
New York, NY 10012

16

Frank A. Et Ux Franzo
Hcr 6 Box 6512 Blooming Grove
Hawley, PA 18428

17

<u>Property Owner/Address</u>	<u>Parcel Number</u>
Blooming Grove Hunting & Fishing Club 123 Old Field Rd Hawley, PA 18428	18
Blooming Grove Hunting & Fishing Club 123 Old Field Rd Hawley, PA 18428	19
Blooming Grove Hunting & Fishing Club 123 Old Field Rd Hawley, PA 18428	20
Blooming Grove Hunting & Fishing Club 123 Old Field Rd Hawley, PA 18428	21
Blooming Grove Hunting & Fishing Club 123 Old Field Rd Hawley, PA 18428	22
Blooming Grove Hunting & Fishing Club 123 Old Field Rd Hawley, PA 18428	23
Blooming Grove Hunting & Fishing Club 123 Old Field Rd Hawley, PA 18428	24
Blooming Grove Hunting & Fishing Club 123 Old Field Rd Hawley, PA 18428	25
Charles B. Gilman 575 Constitution Ave Hellertown, PA 18055	26
Florence & Henderson, Betty & Drake, Carol S. Hazen PO Box 274 Tafton, PA 18464	27
Catherine Fortese Hc 8 Box 6625 Blooming Grove Hawley, PA 18428	28

Property Owner/Address

Parcel Number

Catherine Fortese
Hc 8 Box 6625 Blooming Grove
Hawley, PA 18428

29

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Hc 8 Box 6625 Blooming Grove
Hawley, PA 18428

30

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Hc 8 Box 6625 Blooming Grove
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Delaware Forest
HC 1 Box 95A
Swiftwater, PA 18370

33

Property Owner/Address

Parcel Number

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Hemlock Farms Community Association 1007 Hemlock Farms Hawley, PA 18428	37
Lenard S. & Marianne F. Hirshman 3662 Hemlock Farms Hawley, PA 18428	38
Anthony J. Miller 300 East 40th St Apt 31B New York, NY 10016	39
Cole B. III & James Lovell & Morgan B. Price Et al PO Box 620 Carlisle, PA 17013	40
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