SUMMARY

This filing is 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 approximately 1.4-mile long Mack Macungie #1 138/69 kV Transmission Tap Line. PPL Electric intends to convert the existing Mack Macungie 138/69 kV Tap from a single tap off the Wescosville – Trexlertown #1 138/69 kV Line to a double tap, single feed arrangement off both the Wescosville – Trexlertown #1 and #2 138/69 kV Lines through two load sectionalized air break (LSAB) switches. Presently, the Mack Macungie #1 138/69 kV Tap Line is supplied by the Wescosville Trexlertown #1 138/69 kV Line. Creating a double tap, single feed arrangement for the Mack Macungie 138/69 kV Tap will relieve excessive loading on the Wescosville – Trexlertown #1 Line by transferring the Mack Macungie Tap to the Wescosville – Trexlertown #2 Line. This entire Project will be contained within existing PPL Electric right-of-way (ROW). No additional ROW is required to construct this Project. The Project is located in Lower Macungie Township in Lehigh County, Pennsylvania.

The estimated cost of this Project is $1,525,200. Subject to Commission approval, construction will begin as soon as practical to support the Project's in-service date of May 2013.

This document, which describes the need for the Project and discusses the engineering and environmental analysis for the proposed construction, consists of the following attachments:

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

ATTACHMENT 1

MACK MACUNGIE #1 & #2 138/69 kV TAP RECONSTRUCTION

NECESSITY STATEMENT

TABLE OF CONTENTS

LIST OF FIGURES

ATTACHMENT 1

MACK MACUNGIE #1 & #2 138/69 kV TAP RECONSTRUCTION

NECESSITY STATEMENT

A. INTRODUCTION

PPL Electric is requesting PUC approval to reconstruct the 1.4-mile long Mack Macungie 138/69 kV Tap for double tap, single feed operation. As part of the reconstruction, the existing cellon-treated wood poles, which are deteriorating more quickly than expected, will be replaced with single-shaft steel poles.

The proposed transmission line will be designed and constructed for 138 kV operation, although initially both circuits will operate at 69 kV. They will be upgraded to 138 kV operation when the increasing demand for electricity makes this conversion appropriate. As further explained below, this Project is required to reduce loading on the Wescosville – Trexlertown #1 138/69 kV Transmission Line.

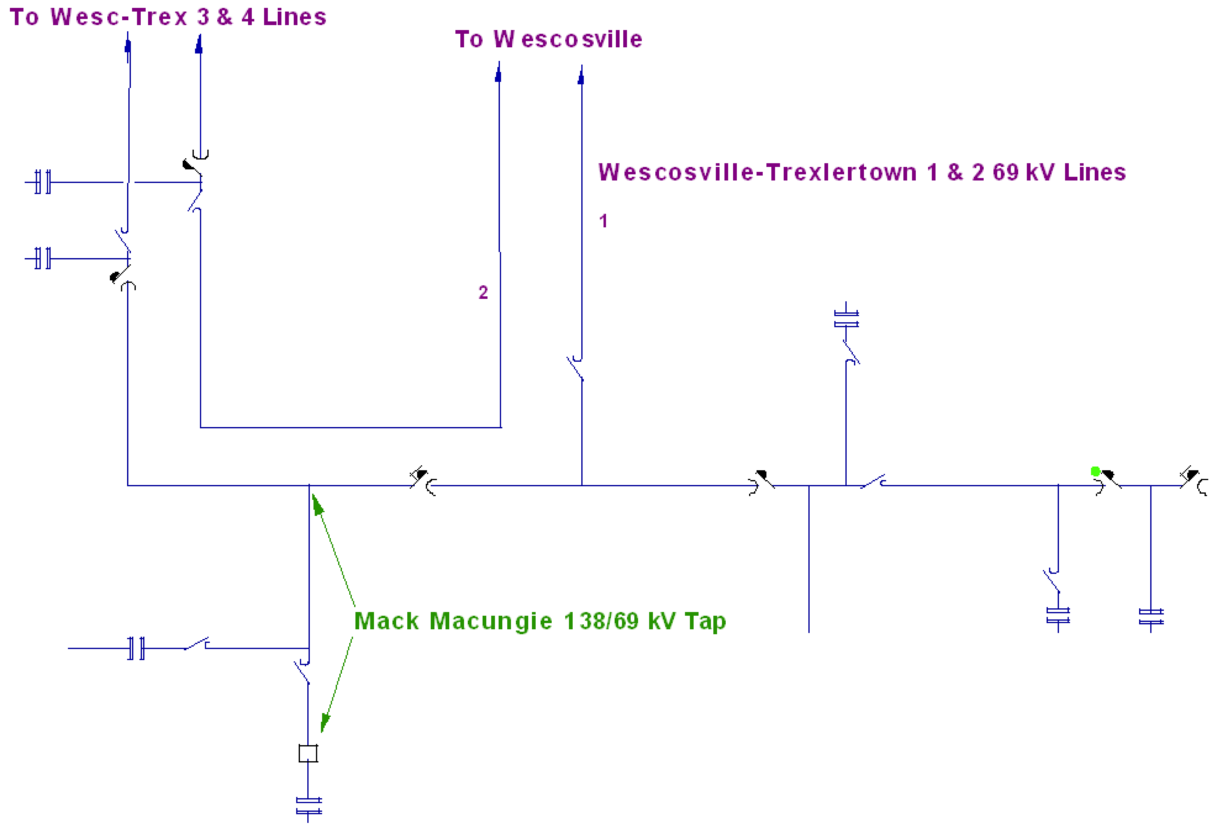
The estimated cost to site, design and reconstruct the transmission line is approximately $1,525,200. Construction is scheduled to begin as soon as practical following Commission approval to meet a required in-service date of May 2013. The required in-service date is defined as the date that the proposed facility must be placed in service to prevent overloads that could potentially damage equipment and result in service interruptions to customers.

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 Lehigh County.

B. EXISTING SYSTEM

Western Lehigh County is presently served from the Wescosville 500 – 230 – 138 – 69 kV Substation. The Wescosville – Trexlertown #1 and #2 138/69 kV Transmission Line, which supplies electricity to approximately 22,000 customers, is one of several 138/69 kV lines serving the area. The Mack Macungie 138/69 kV Tap Line is sourced from the Wescosville – Trexlertown #1 138/69 kV Transmission Line. Figure 1 below depicts the present system in the area.

Figure 1
Existing Mack Macungie Tap – One-Line Diagram



C. DEFINITION OF THE PROBLEM

PPL Electric plans its system in accordance with the guidelines found in the Reliability Principles and Practices (RP&P), so that PPL Electric can sustain probable contingencies and disturbances with only minimal customer service interruptions, and so that it can adequately serve each customer's needs with regard to capacity, voltage and reliability for all load levels throughout the daily load cycle. System Planning is the process which assures that PPL Electric's regional system can supply electricity to all customer load in a manner that is reliable and economic. In addition, the system is planned so that system reliability can be maintained to prevent large scale, long term, or frequent service interruptions in order to avoid adverse effects and hazards to the public.

The planning process begins with the development of a computer model of the future system. A specific study year is chosen. The future system model is then developed using the existing system plus any planned modifications to the transmission system scheduled to be in service prior to the study year. Load levels used in the system model are based on the latest forecast prepared annually by PPL Electric, which is based on recent summer peak load forecasts that 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. 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 and economic manner.

By the summer of 2013, the summer peak load on the Wescosville – Trexlertown #1 138/69 kV Line is projected to be approximately 90 MW. This exceeds the RP&P guideline for maximum allowable load drop for the loss of a single 69 kV circuit. The RP&P guidelines recommend that only 60 MW be exposed to a single line outage of up to 2 hours until manual switching can be completed. A single outage of the Wescosville – Trexlertown #1 Line would initially interrupt 90 MW, approximately 30 MW above the Transmission RP&P guidelines.

Transferring the 90 MW of load from the Wescosville – Trexlertown #1 138/69 kV Line to an alternate source is limited due to the emergency rating of the neighboring transmission lines, all of which are heavily loaded.

The Mack Macungie 138/69 kV Tap currently serves approximately 25 MW of load off the Wescosville-Trexlertown #1 138/69 kV Line. The tap's configuration currently does not allow a transfer from the Wescosville-Trexlertown #1 138/69 kV Line to the Wescosville-Trexlertown #2 138/69 kV Line to reduce loading on the Wescosville Trexlertown #1 138/69 kV Line. Transferring load from the Wescosville-Trexlertown #1 138/69 kV Line to the Wescosville-Trexlertown #2 138/69 kV Line would more evenly distribute the load between the lines which would improve the capability of restoring all load on the Wescosville-Trexlertown #1 138/69 kV Line following a single circuit loss.

D. PROPOSED SOLUTION

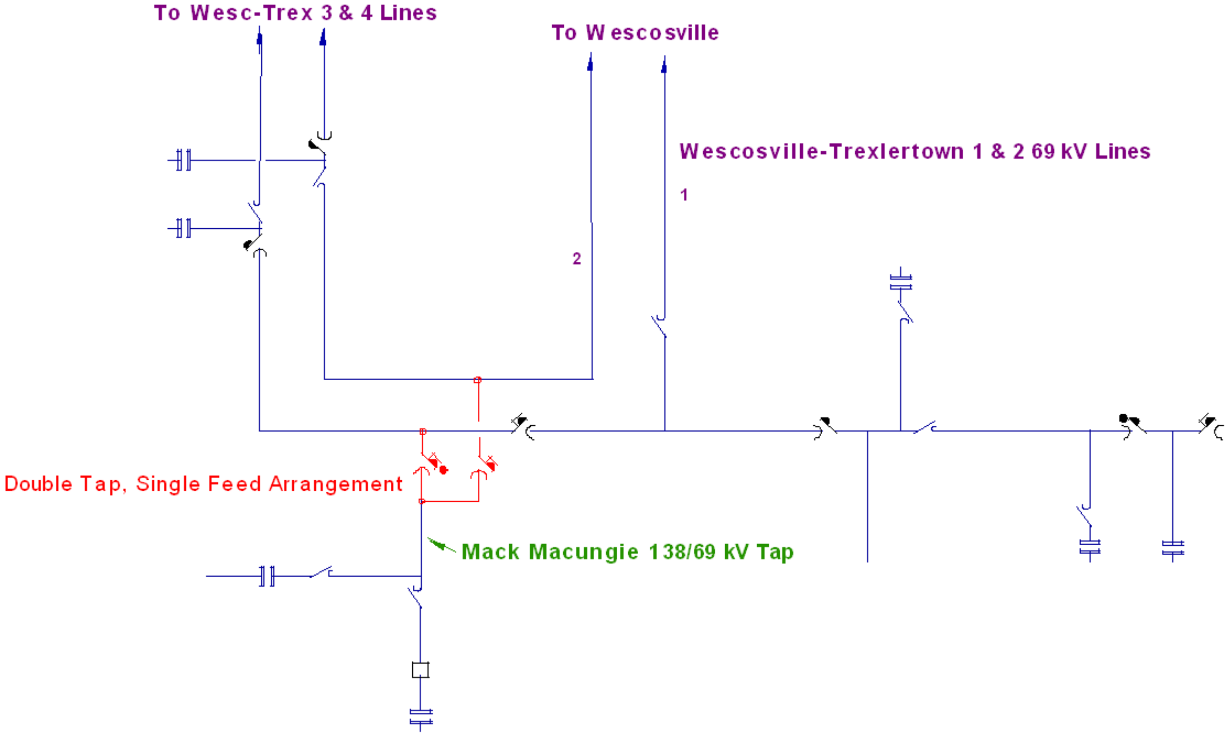
PPL Electric has identified two projects that will reduce the loading on the Wescosville-Trexlertown #1 138/69 kV Line to comply with the RP&P guidelines. The first, more immediate Project will transfer approximately 25 MW of load served from the Mack Macungie Tap to the Wescosville – Trexlertown #2 138/69 kV Line. This will be done by converting the Mack Macungie 138/69 kV Tap to a double tap- single feed connection off both the Wescosville-Trexlertown #1 & #2 138/69 kV Lines. This arrangement will allow the load on both lines to be more evenly distributed between them.

After the Project is completed, the projected loading on the Wescosville-Trexlertown #1 Line under peak summer conditions will be approximately 65 MW and the projected loading on the Wescosville-Trexlertown #2 Line will be approximately 60 MW. To reduce the load further to comply with the Transmission RP&P Guidelines of 60 MW for a single circuit 69 kV transmission line, PPL Electric has another future project planned to install a new Breinigsville 500-138-69 kV Substation and connecting lines by 2015 which will allow the transfer of some 138/69 kV load from the Wescosville 500-230-138-69 kV Substation to this new substation. After the new Breinigsville 500-138-69 kV Substation is installed, the expected loading on the Wescosville-Trexlertown #1 138/69 kV Line will be reduced down to approximately 20 MW which is well below the Transmission RP&P Guidelines.

The initial reconstruction is necessary to reduce loading on the Wescosville-Trexlertown #1 138/69 kV line in the near term which will improve transfer capability for unexpected outages. The double tap-single feed connection will also reduce extended outage times for customers served by the Mack Macungie 138/69 kV Tap and will provide Transmission Operations with the ability to transfer the Mack Macungie 138/69 kV Tap load between the Wescosville-Trexlertown #1 and #2 lines for ease of maintenance and operation.

Figure 2 below shows a one-line diagram of the proposed conversion of the Mack Macungie Tap.

Figure 2
Future Mack Macungie Tap– One-Line Diagram



E. FUNCTIONAL ALTERNATIVE

No other economically feasible alternatives were identified to relieve the heavy loading on the Wescosville – Trexlertown #1 138/69 kV Line before the installation of the new Breinigsville 500 – 138 – 69 kV Substation in 2015.

ATTACHMENT 2

MACK MACUNGIE #1 & #2 138/69 kV TAP RECONSTRUCTION

ENGINEERING DESCRIPTION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

MAP

ATTACHMENT 2

MACK MACUNGIE #1 & #2 138/69 kV TAP RECONSTRUCTION

ENGINEERING DESCRIPTION

A. DESCRIPTION OF THE PROPOSED LINE

PPL Electric proposes to reconstruct approximately 1.4 miles of the single-circuit Mack Macungie 138/69 kV Tap Line. The proposed reconstruction will replace 35 deteriorating cellon-treated wood poles with 34 single-shaft steel monopoles and will also add a second circuit to the tap. Five existing self-supporting steel poles will not be replaced (see Figure 1). Finally, two 138 kV Load Sectionalizing Air Break (LSAB) switches will be installed. The installation of the LSAB switches will result in the replacement of the remaining cellon-treated wood pole. The Mack Macungie Tap is located in Lower Macungie Township, Lehigh County. Refer to the aerial location map.

The existing cellon wood poles average 75 feet high. The replacement steel monopoles average 79 to 84 feet high. The steel monopoles will be direct-embedded, and they will be equipped with 7-foot-long steel upswept conductor support arms (see Figure 2). The replacement steel poles will be placed in the approximate same locations as the existing wood poles. The LSAB switches will be mounted on two 85-foot-tall direct embedded steel poles connected with an x-brace (see Figure 3). The existing conductors will remain. Three new power conductors will be installed for the additional circuit. The conductors will be 556.5 kcmil 24/7 stranding ACSR and the existing 3/8-inch-diameter high strength steel overhead ground wire will be retained.

The proposed line will be designed to, and generally exceed, minimum National Electrical Safety Code standards. Design specifications and safety rules practiced by PPL Electric Utilities are included in Attachment 4. The minimum conductor to ground clearance for the proposed line will be 30 feet which occurs at a maximum conductor temperature of 125°C. The designed minimum conductor clearances and conductor thermal ratings are as follow:

TABLE 1
DESIGN MINIMUM CONDUCTOR CLEARANCES
FOR 556.5 KCMIL 24/7 STRANDING ACSR*
Mack Macungie Tap #1 138/69 kV LINE

Condition	Double-Circuit Design Clearance to Ground
Normal load, average weather (16°C ambient temperature)	33.00 feet
Predicted extreme thermal load (125°C conductor temperature)	30.00 feet
Predicted NESC extreme wind load (16°C ambient temperature)	32.11 feet
Predicted extreme weather conditions (1-inch ice, 4 lbs. wind, -10°C)	32.21 feet

Clearances based on a maximum tension of 3,540 lbs. at 1 inch ice, 4 lbs. wind, -10°C and a ruling span of 290 feet. (NESC Rule 250D)

TABLE 2
CONDUCTOR THERMAL RATING
556.5 KCMIL 24/7 STRANDING ACSR
125ºC MAXIMUM CONDUCTOR TEMPERATURE

Ambient Temperature Condition	Wind Speed °C	Ampacity Knots	Amps
Summer Normal	35	0	815
Winter Normal	10	0	926
Summer Emergency	35	1.5	1041
Winter Emergency	10	1.5	1163

B. MAGNETIC FIELD MANAGEMENT

PPL Electric's Magnetic Field Management Program is included in Attachment 5 and applied to reconstruction and new line projects. In order to lower magnetic field exposures, the program generally prescribes the use of a line design that provides 5 feet higher ground clearances and reverse phasing 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.

For this Project, reverse phasing cannot be utilized to reduce magnetic field levels because we are installing a second circuit to an existing single circuit line. The phasing cannot be reversed without greatly increasing cost. However, some reduction of the magnetic field will be achieved through the use of taller poles.

C. RIGHT-OF-WAY STATUS

The proposed Project is being completed entirely within existing PPL Electric right-of-way. The Aerial Exhibit at the end of Attachment 2 shows existing property lines and current ownership along the right-of-way. Attachment 6 identifies owners of property within the right-of-way.

FIGURE 1

EXISTING 138/69 kV DOUBLE CIRCUIT CUSTOM STEEL POLE ON FOUNDATION STRUCTURE

Average Height – 80 Feet

Length of Arms – 7 Feet

FIGURE 2

PROPOSED 138/69 kV DOUBLE CIRCUIT UPSWEPT STEEL ARMS STRUCTURE

Average Height – 79 - 84 Feet

Length of Arms – 7 Feet

FIGURE 3

PROPOSED TWO POLE X-BRACED LSAB SWITCH STRUCTURE

Average Height – 85 Feet

Switch Spacing – 15 Feet

Width of Structure – 16 Feet

ATTACHMENT 3

MACK MACUNGIE #1 & #2 138/69 kV TAP RECONSTRUCTION

ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

ATTACHMENT 3

MACK MACUNGIE #1 & #2 138/69 kV TAP RECONSTRUCTION

ENVIRONMENTAL ASSESSMENT

A. INTRODUCTION

PPL Electric is requesting PUC approval to reconstruct the existing Mack Macungie 138/69 kV Tap Line. PPL Electric intends to convert the approximately 1.4-mile long existing Mack Macungie 138/69 kV Tap from a single tap off the Wescosville – Trexlertown #1 69 kV line to a double tap, single feed arrangement off both the Wescosville – Trexlertown #1 and #2 138/69 kV Lines through two LSAB switches. The proposed tap 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 rebuild begins with the first structure located adjacent to Willow Lane in Lower Macungie Township and continues south/southwest to a structure located along Alburtis Road adjacent to the Mack Truck plant.

The proposed Project was reviewed with representatives of Lower Macungie Township and Lehigh County, and neither the Township nor the County had any objection. A list of involved governmental agencies, municipalities, and other public entities is presented in Attachment 7.

B. LAND USE

The existing transmission line traverses adjacent to Mill Creek and Willow Roads through a primarily residential area in Lower Macungie Township. The Willow Lane Elementary School was recently constructed adjacent to the existing transmission line to the west of Willow Lane. Commercial and industrial properties, including the Mack Truck plant, are located at the southern terminus, south of Route 100. Agricultural land is located west of Mill Creek Road. The proposed rebuild will be constructed entirely within PPL Electric's existing ROW. The Mack Macungie Tap Line predates most of the residential development in the area. Visual impacts to existing and future homes in the area will be minimal because the transmission line is located along existing roadways and the new transmission structures will not significantly increase in height. Further, the rebuilt line will be supported by the same number of structures which will be, except for the structures supporting LSAB switches, monopole structures. In addition, the structures for the rebuilt line will be in substantially the same locations as the existing structures.

No communication towers, pipelines, or other utilities will be affected by the proposed Project. The closest airport is the Queen City Airport, located approximately 4.3 miles northeast of the Project. The proposed tap line reconstruction is not expected to impact airport operations. PPL Electric, however, will file the appropriate documentation with both the Federal Aviation Administration and the PennDOT Bureau of Aviation to ensure that the proposed tap line will not be a hazard to the airport's flight operations.

C. CULTURAL RESOURCES

The Project was reviewed by the Pennsylvania Historical and Museum Commission (PHMC). The PHMC has determined that there may be historic buildings, structures, and/or archaeological resources in the project area. However, correspondence from the PHMC, dated March 2, 2012[1], indicates that the proposed activities associated with this Project should have no effect on these resources. No further investigations are required. PPL Electric will notify the PHMC should any unidentified historic buildings, structures or archaeological resources be discovered during the course of this Project.

[1] File No. ER 2012-0186-077-B.

D. NATURAL FEATURES

The Project will not affect any recreational areas or natural landmarks. No recreational areas are traversed by the Project. A few local recreational areas are located within one mile of the Project. The closest recreational areas include the Brookside Country Club and the Brookside Farms Recreation Area, located approximately 530 feet and 1,200 feet to the east of the Project area, respectively.

The closest natural area, identified in the natural area inventory (NAI) by the Nature Conservancy, is the referred to as the Swabia, Indian, Hosensack Watershed. This NAI area encompasses the entire watershed and covers approximately 13,515 acres. According to the Nature Conservancy, the area supports a fair to good quality example of a Northern Appalachian Circumneutral Seeps Natural Community, one plant species of concern, the white-trout lily (*Erythronium albidum*) and two unidentified animal species of concern.[2],[3] This natural area is generally located to the east of the Project site. Approximately 735 feet of the southernmost portion of the route traverses this natural area. Based on the description of the NAI, the areas of sensitive habitat are not located in the vicinity of the existing route. In fact, the portion of the NAI area traversed by the Line is located within an industrial area. Because the rebuild will replace an existing line through this area, no significant impacts are expected. Only minimal earth disturbance is anticipated during construction. The Project will not traverse or affect any other unique geological, scenic or natural areas.

PPL Electric conducted a wetland delineation of the line on February 13, 2012. No wetlands or streams were observed within the Project ROW. PPL Electric will acquire all required environmental permits prior to the start of construction and adhere to all of their terms and conditions.

[2] The Nature Conservancy. (1999). *A Natural Areas Inventory of Lehigh and Northampton Counties*.
[3] The Conservancy has chosen not to identify the two animal species of concern in order to protect them and their habitat.

Some minimal tree clearing may be required, and if so, PPL Electric will apply its "Specification for Initial Clearing and Control of Vegetation On or Adjacent to Electric Line Right-of-Way Through Use of Herbicides, Mechanical and Hand Clearing Techniques" to mitigate any impacts.

PPL Electric anticipates that the earth disturbance activities associated with this reconstruction will not require a National Pollutant Discharge Elimination System (NPDES) permit or an erosion and sedimentation control (E&S) plan. However, if the earth disturbance exceeds the threshold for these permits, PPL Electric will obtain any required soil erosion and sedimentation control approvals and associated NPDES permits and will comply with any conditions placed on those permits. PPL Electric will employ its "Specification for Soil Erosion and Sedimentation Control on Transmission Line Rights-of-Way" as appropriate.

E. **THREATENED AND ENDANGERED SPECIES**

PPL Electric has coordinated with the relevant state and federal agencies, to obtain information regarding endangered and threatened species that could occur in the vicinity of the proposed Project. The Pennsylvania Game Commission (PGC), Pennsylvania Fish and Boat Commission (PFBC), and the Pennsylvania Department of Conservation and Natural Resources (DCNR) all report that, except for occasional transient species of wildlife, no threatened or endangered plant or animal life is known to exist in the project area.[4]

The U.S. Fish and Wildlife Service (USFWS) indicated that the federally threatened bog turtle (*Glyptemys muhlenbergii*) is known to exist within Lehigh County. The USFWS has requested Phase I bog turtle surveys for any wetlands located within the Project area or within 300 feet of the Project boundaries. As discussed previously, no wetlands were observed within the Project ROW. PPL Electric is currently consulting with the USFWS to obtain clearance for the bog turtle.

[4] Pennsylvania Natural Diversity Inventory (PNDI) Search ID: 20120216339535.

ATTACHMENT 4

MACK MACUNGIE #1 & #2 138/69 KV TAP RECONSTRUCTION

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 Corp. (PPL Electric) has developed design specifications and safety rules which meet or surpass all requirements 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 enhancements such 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

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

230 kV

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

500 kV

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

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:

Voltage-kV	Minimum Clearance
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

MACK MACUNGIE #1 & #2 138/69 KV TAP RECONSTRUCTION

PPL ELECTRIC MAGNETIC FIELD MANAGEMENT PROGRAM

MAGNETIC FIELD MANAGEMENT

PPL Electric Utilities Corporation

DECEMBER 2004

TABLE OF CONTENTS

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

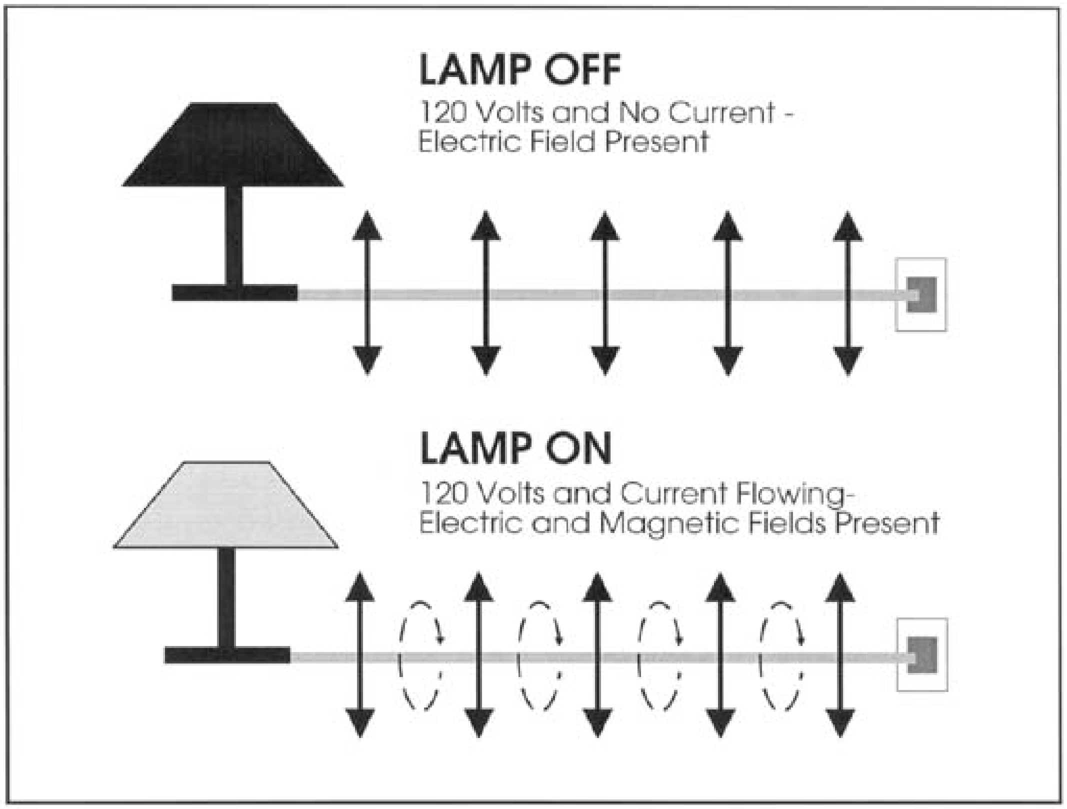

LAMP OFF
120 Volts and No Current -
Electric Field Present
LAMP ON
120 Volts and Current Flowing-
Electric and Magnetic Fields Present

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.

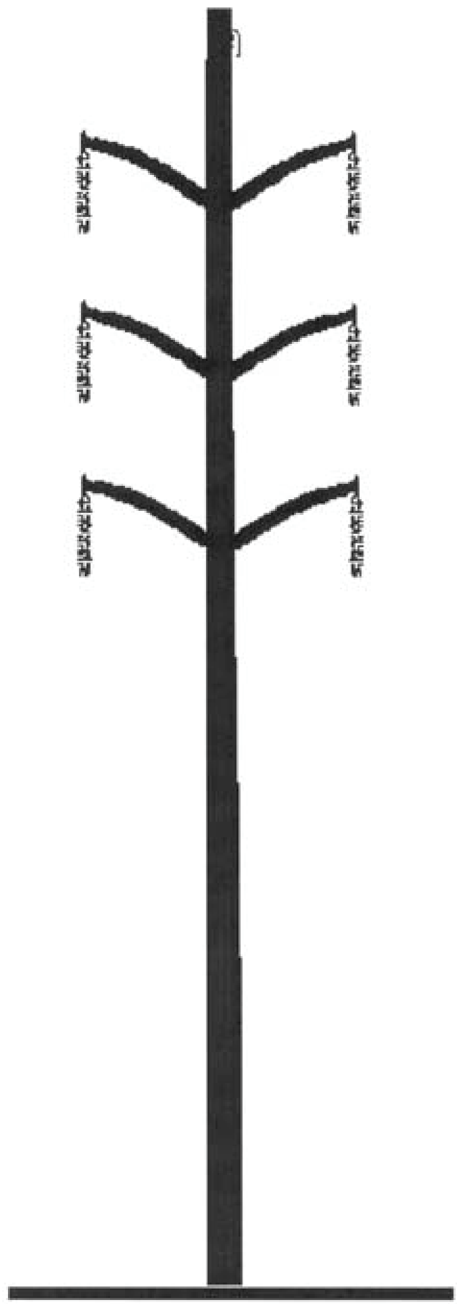
- Main lines are the most heavily loaded sections of a distribution line and therefore have the highest magnetic fields associated with them.
- Increasing the ground clearance by five feet reduces the magnetic field under the line from 14 mG to 11 mG using the standard eight-foot crossarm design. These 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.

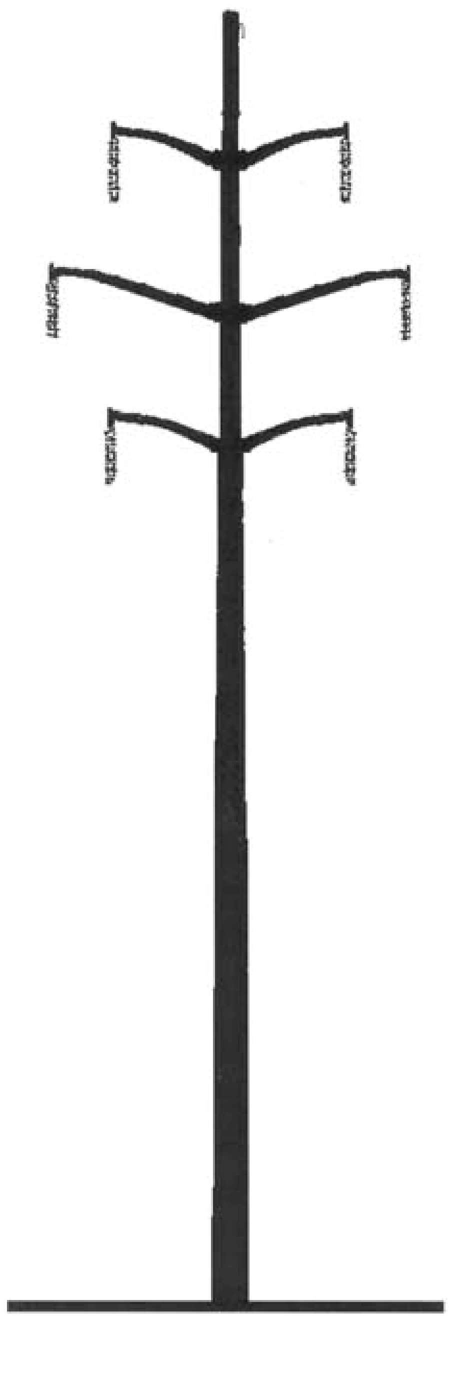
Short-Span Construction



- **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:**

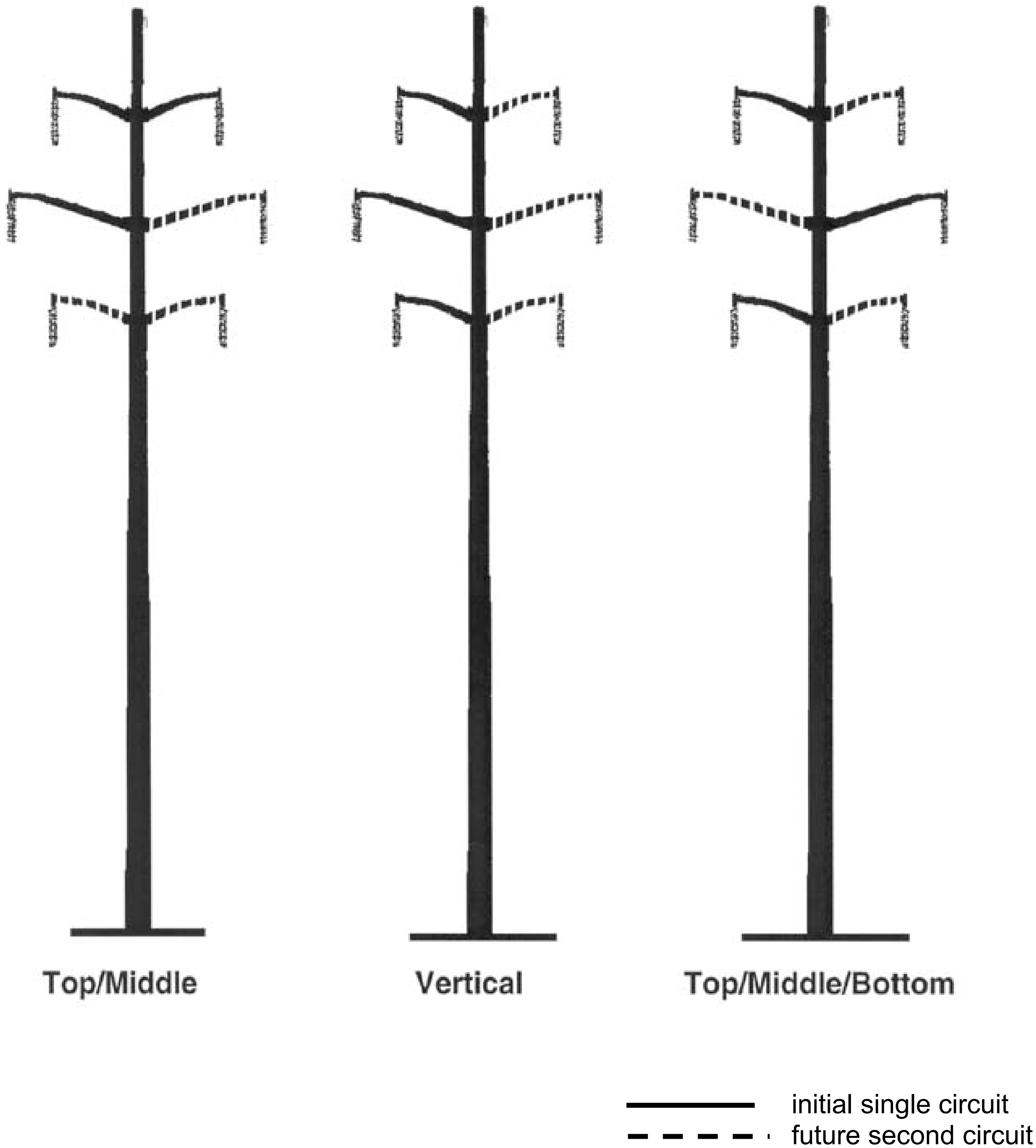
1 3/8" HS steel overhead ground wire - 17.3 feet sag
6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 23.0 feet sag
Average span - 600 feet

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

TYPE CONSTRUCTION	MAGNETIC FIELD IN MILLLIGAUSS 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

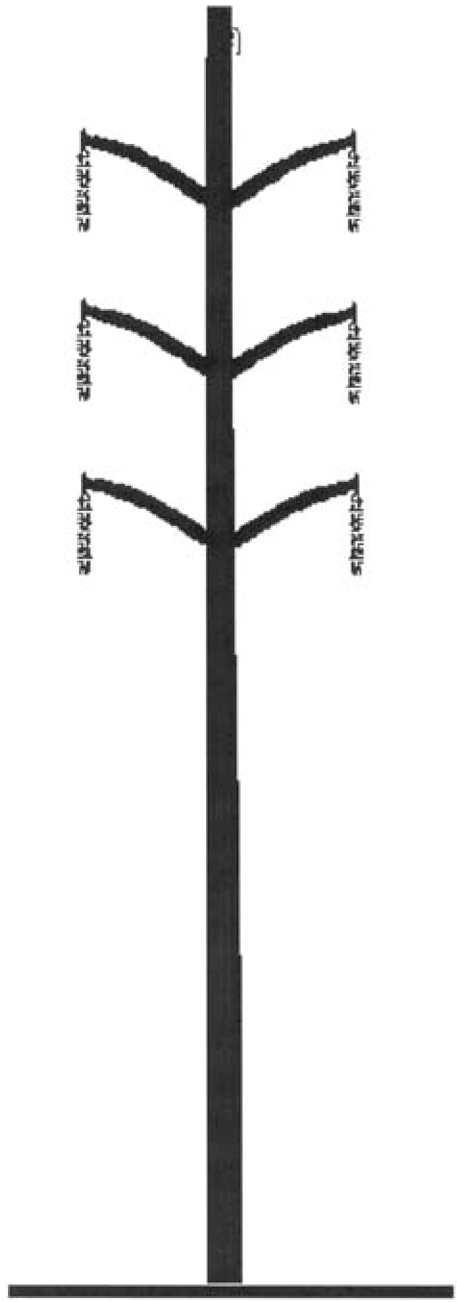


138/69 kV SINGLE CIRCUIT TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 400 AMPERES

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.

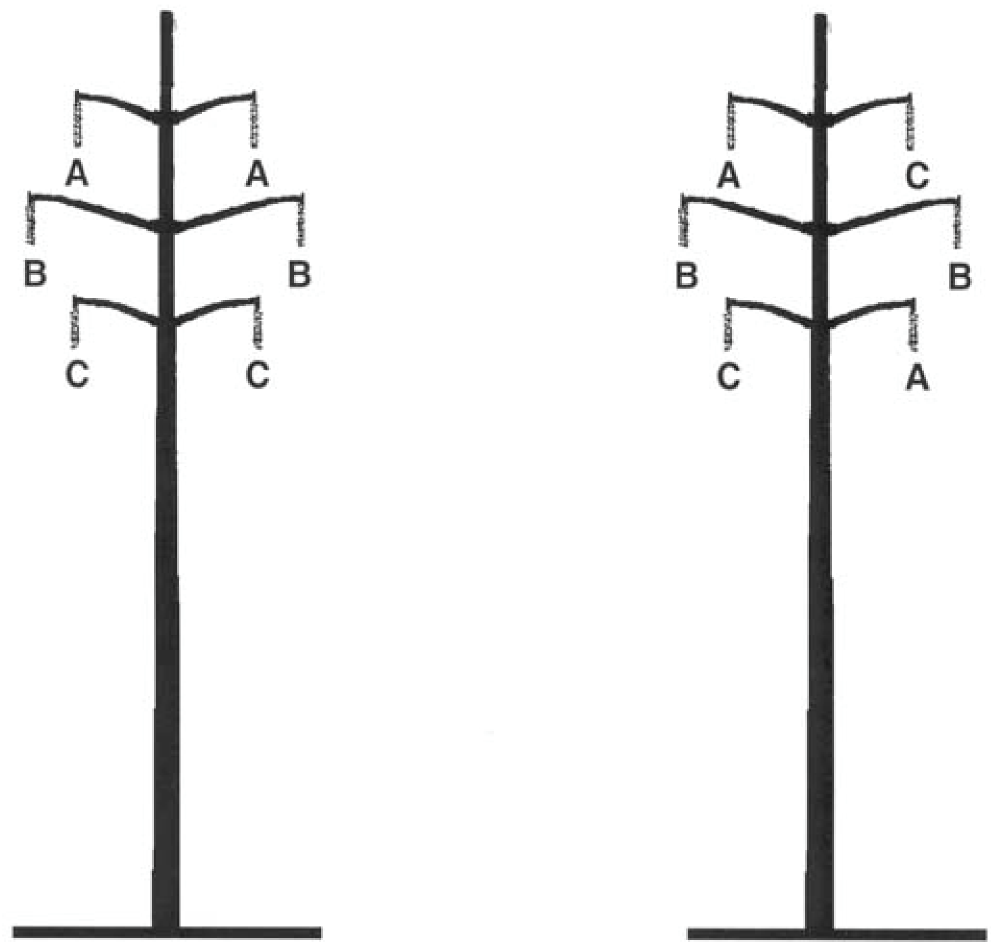
Compact Design Structure



- **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**

CHART VIII

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.

CHART IX

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.

CHART X

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.

CHART XI

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.

CHART XII

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.

Siting/Magnetic Field Management.doc/mlt

ATTACHMENT 6

MACK MACUNGIE #1 & #2 138/69 KV TAP RECONSTRUCTION

LIST OF OWNERS OF PROPERTY WITHIN THE RIGHT-OF-WAY

Property Owner/Address	Parcel Number
Lower Macungie Township 3400 Brookside Road Macungie, PA 18062-1428	1
Gabor & Monika Molnar 2671 Fieldview Drive Macungie, PA 18062-8417	2
David W & Laura A Stann 2669 Fieldview Drive Macungie, PA 18062-8417	3
Harry W & Anna Marie E Reichelderfer 2667 Fieldview Drive Macungie, PA 18062-8417	4
James P Toffy 2665 Fieldview Drive Macungie, PA 18062-8417	5
John R & Blanca A Rounds 6535 Rutherford Drive Macungie, PA 18062-8417	6
Eric & Anita Silberman Gopen 2661 Fieldview Drive Macungie, PA 18062-8417	7
Larry & Marsha Roth 2659 Fieldview Drive Macungie, PA 18062-8417	8
Karen L Schrantz 2657 Fieldview Drive Macungie, PA 18062-8417	9
Luis F & Bonnie J Goyzueta 2655 Fieldview Drive Macungie, PA 18062-8417	10
Chad D & Melissia A Baker 2651 Fieldview Drive Macungie, PA 18062-8411	11

Property Owner/Address	Parcel Number
Zhao Xuechan 8 Captains Parker Arms, Apt. #11 Lexington, MA 02421	12
Jose M & Jennifer Delgado 6644 Carmel Drive Macungie, PA 18062	13
K & M Associates Inc. PO Box 332 Trexlertown, PA 18087-0332	14, 17, 20, 21, 23
Nicholas & Victoria Romano 6632 Carmel Drive Macungie, PA 18062	15
Ronald W & Sally J Trexler 6624 Carmel Drive Macungie, PA 18062	16
Dineshkumar & Bharti Dalsania 6608 Carmel Drive Macungie, PA 18062	18
Bharath & A Barath Sundararaman 6600 Carmel Drive Macungie, PA 18062	19
Jeffrey R Jr & Audrey N David 6576 Carmel Drive Macungie, PA 18062	22
Brendon Michael & Heather M Bankos 6560 Carmel Drive Macungie, PA 18062	24
Joshua Spradley & R Miller-Spradley 6552 Carmel Drive Macungie, PA 18062-8768	25
Edward G & Gayle H Thear 6544 Carmel Drive Macungie, PA 18062-8768	26
David W Benner 6536 Carmel Drive Macungie, PA 18062-8768	27
Andrew M Tuma Sr & K Delvecchio-Tuma 6528 Carmel Drive Macungie, PA 18062-8768	28

Property Owner/Address	Parcel Number
Penn's West Planned Community Association 2858 Sequoia Drive Macungie, PA 18062-8430	29
Penn's West Inc. 1150 S Cedar Crest Boulevard Allentown, PA 18103-7909	30, 31, 32, 33
Jessica Treichler & J Treichler 2996 PA Route 100 Macungie, PA 18062	34
Pf1 Lehigh Valley 2 Lp 180 Raritan Center Parkway, Suite 103 Edison, NJ 08837	35
Ray A Leibensperger 3096 Route 100 Macungie, PA 18062-9326	36

ATTACHMENT 7

MACK MACUNGIE #1 & #2 138/69 KV TAP RECONSTRUCTION

LIST OF INVOLVED GOVERNMENTAL AGENCIES, MUNICIPALITIES AND OTHER PUBLIC ENTITIES RECEIVING APPLICATIONS

---

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

2. 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

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

4. Lehigh Valley Planning Commission
   961 Marcon Boulevard - Suite 310
   Allentown, PA 18109
   Attn: Mr. Michael Kaiser, AICP

5. Lehigh County Board of Commissioners
   17 South Seventh Street
   Allentown, PA 18101-2400
   Attn: Mr. Brad Osborne, Chairman

6. Lower Macungie Township Planning Commission
   3400 Brookside Rd
   Macungie, PA 18062
   Attn: Mr. Irvin Keister, Chairman

7. Lower Macungie Township
   3400 Brookside Rd
   Macungie, PA 18062
   Attn: Mr. Bruce Fosselman, Township Manager