Before the
Pennsylvania Public Utility Commission

TOBYHANNA #1 & #2 138/69 kV TAP

ATTACHMENTS IN SUPPORT OF THE

Letter of Notification

Application Docket No._____

Submitted by: PPL Electric Utilities Corporation

SUMMARY

On October 21, 2010, PPL Electric Utilities Corporation ("PPL Electric") petitioned the Pennsylvania Public Utility Commission ("Commission") for a waiver of certain provisions of the Commission's siting regulations, at 52 Pa. Code, Chapter 57, Subchapter G, in order to file a Letter of Notification in lieu of an Application. The petition was docketed at P-2010-2205755. In its petition, PPL Electric sought the Commission's permission to use a Letter of Notification instead of a full siting Application to obtain the Commission's approval for the siting and construction of the new double circuit 138/69 kV tap line to serve the United States Army Depot in Tobyhanna, Coolbaugh Township, Monroe County, Pennsylvania ("Tobyhanna Army Depot"). The Commission granted approval of the petition on February 10, 2011 enabling PPL Electric to file this Letter of Notification.

This Letter of Notification is being submitted by PPL Electric pursuant to the Commission's regulations at 52 Pa. Code §§ 57.71 through 57.77, for approval to site and construct a new double-circuit 138/69 kV tap line to replace the existing single-circuit 69 kV transmission tap line which is used for the sole purpose of supplying the Tobyhanna Army Depot. The proposed tap line to be constructed by PPL Electric, and a new substation to be constructed by the United States Army, are required to improve reliability of service at the Tobyhanna Army Depot. This project is located in Coolbaugh Township, Monroe County, as shown on the PPL Electric Utilities Service Territory figure located at the end of this section.

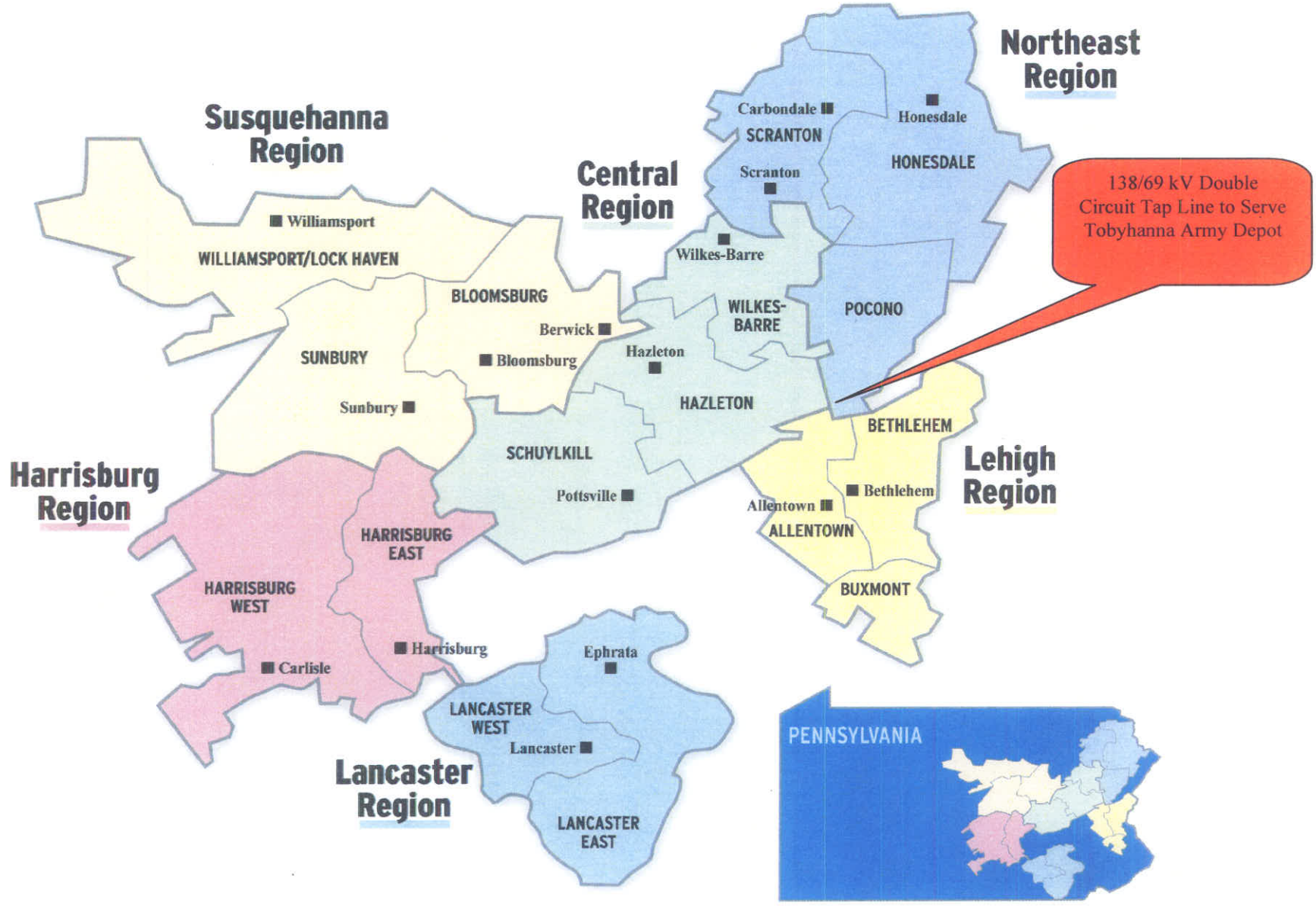
The proposed reconstructed tap line will be designed and constructed for two 138 kV circuits. Initially both circuits will be operated at 69 kV. The line will be converted to 138 kV operation when load growth makes it appropriate to do so. The reconstruction of the tap line will include the installation of new single shaft steel monopoles and new conductors, and the removal of the existing wood H-frame structures and conductors.

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

Attachment "1" Necessity Statement

Attachment "2"	Engineering Description
Attachment "3"	Environmental Assessment
Attachment "4"	PPL Electric 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

PPL ELECTRIC UTILITIES SERVICE TERRITORY



ATTACHMENT

1

ATTACHMENT "1"

TOBYHANNA #1 & #2 138/69 kV TAP

NECESSITY STATEMENT

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ATTACHMENT "1"

TOBYHANNA #1 & #2 138/69 kV TAP

NECESSITY STATEMENT

A. PROJECT NECESSITY

Tobyhanna Army Depot is an existing customer in Coolbaugh Township, Monroe County. Presently, PPL Electric provides service to the Tobyhanna Army Depot via a 2.08 mile single circuit 69 kV tap line served from the Blooming Grove-Jackson 138/69 kV Transmission Line to the customer substation (See Figure 1).

Due to growth in load at the Tobyhanna Army Depot over the years, the Army's electric facilities, including its substation, are no longer sufficient. Tobyhanna Army Depot has indicated that it regularly experiences brownouts due to its inadequate substation facilities. In order to address these problems, the United States Army has initiated on-premise electrical system improvements and upgrades, which include a new dual supply substation to improve the electrical service and station reliability.

In order to obtain a second source of supply for its new substation, and to adequately meet the Tobyhanna Army Depot's load, both now and into the foreseeable future, the existing single circuit 69 kV transmission tap presently supplying the customer will be replaced with a double circuit 138/69 kV tap ("Tobyhanna Tap"). This upgrade will improve service reliability by providing the customer with two 138/69 kV transmission circuits to supply its proposed substation. The upgrade allows the customer to achieve its goal for a dual supply substation design.

Under the proposed configuration, the loss of any single transmission facility (i.e., transmission line, tap line or transformer) will not result in the interruption of service to the Tobyhanna Army Depot. This is a significant improvement from the current configuration. Currently, the loss of the Blooming Grove-Jackson 138/69 kV line, the Tobyhanna single circuit 69 kV Tap, or the Army's transformer would completely interrupt Tobyhanna Army Depot's entire load.

PPL Electric proposes to supply one circuit from the existing Blooming Grove-Jackson 138/69 kV line, and the other circuit from the existing Peckville-Jackson 138/69 kV line (see Figure 2). The proposed double circuit tap line will be designed for future 138 kV operation. It will initially be operated at 69 kV.

The estimated cost to design and construct the proposed 138/69 kV tap line is $3.5 million, and will be paid by the United States Army. PPL Electric will construct, own, operate and maintain the tap line and associated switches. Tobyhanna Army Depot will construct, own, operate and maintain the new substation. In order to meet an in-service date of November 2012, line construction needs to begin in Spring of 2012.

A PPL Electric system map showing existing transmission facilities with a design voltage of 35 kV or greater is included in the Exhibit "A" map pocket. This filing addresses only the existing and proposed 69 kV regional transmission system in the Coolbaugh area.

FIGURE 1
Existing Tobyhanna 69 Tap – One Line Diagram

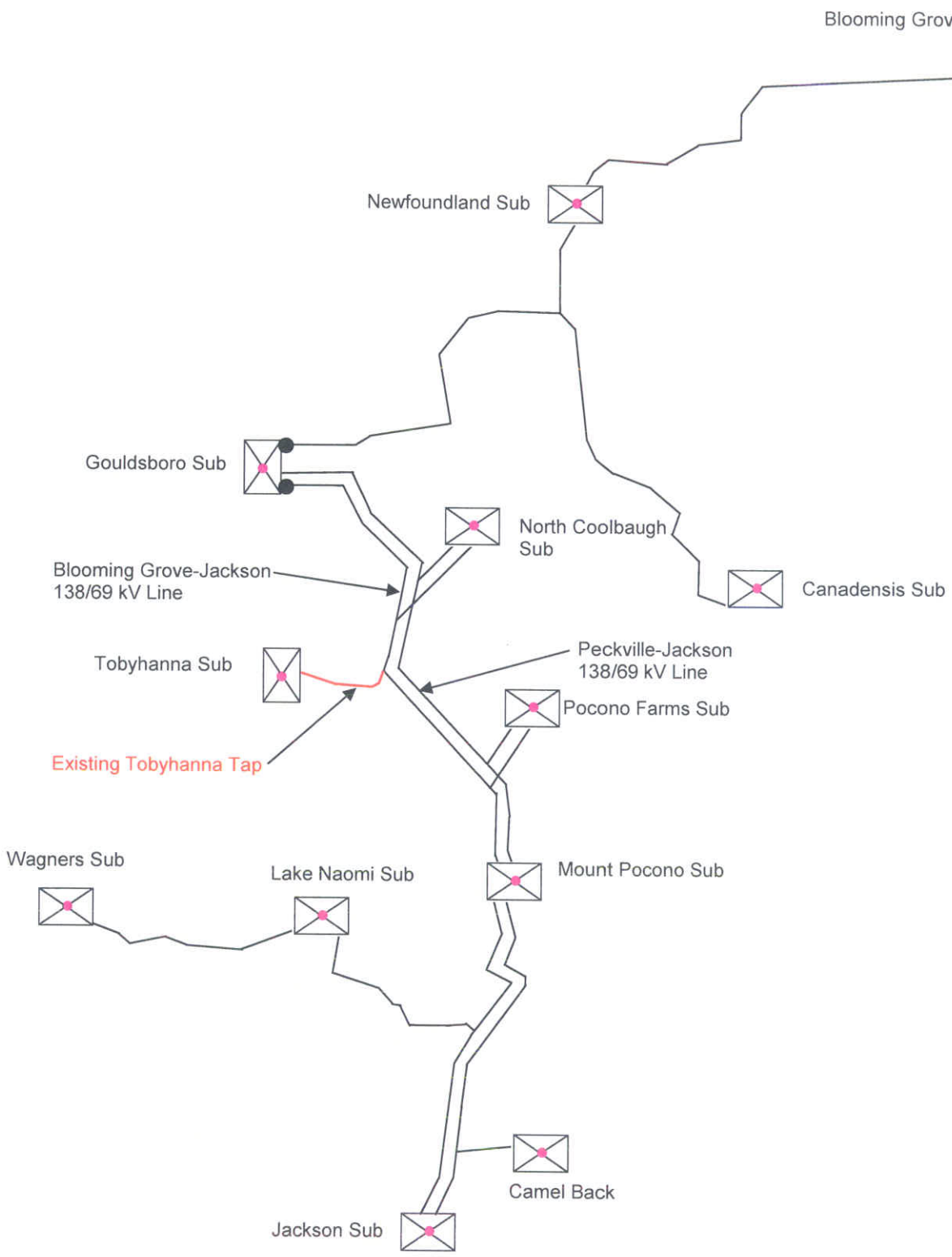
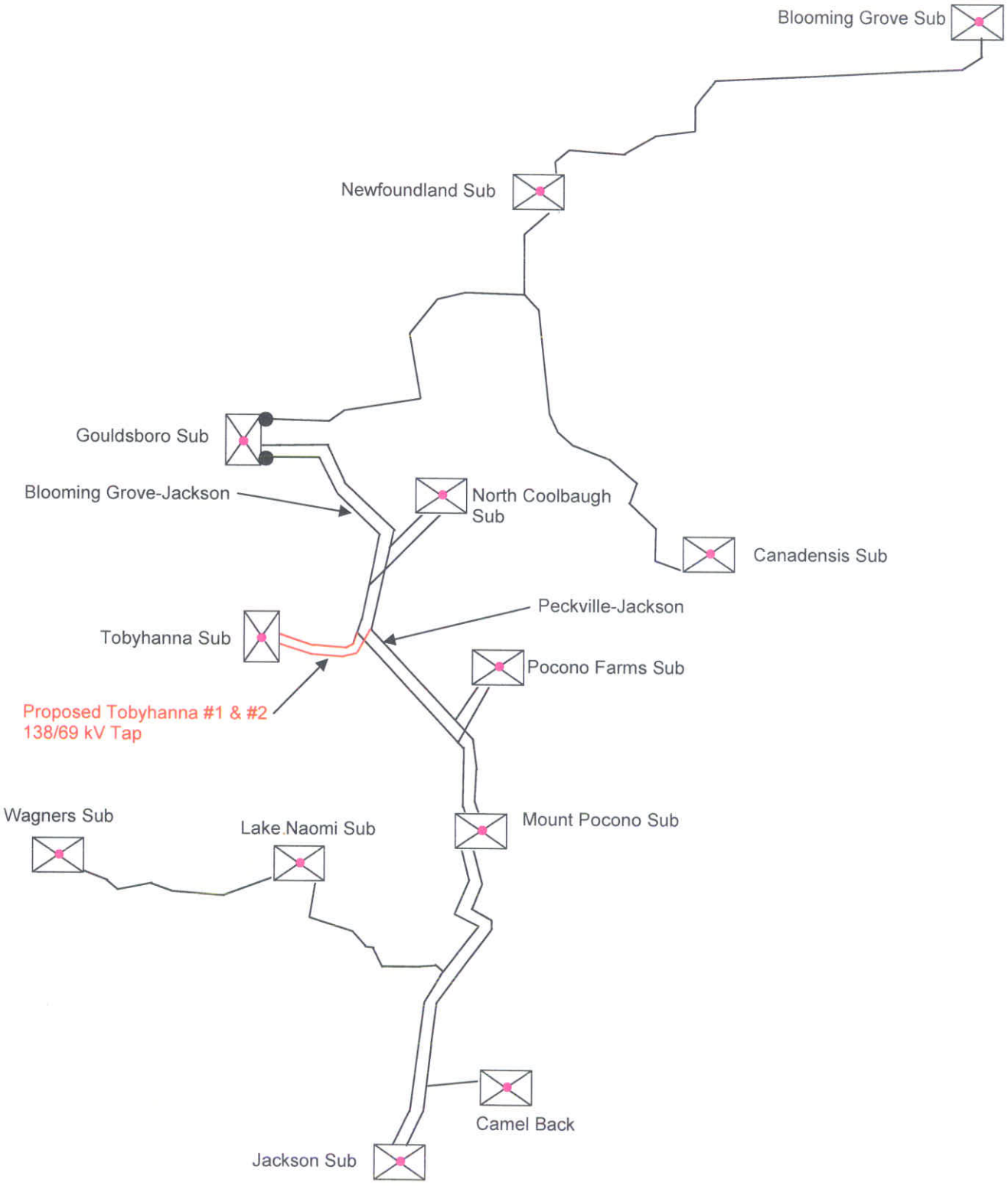


FIGURE 2
Proposed Tobyhanna 138/69 kV #1 & #2 Tap – One Line Diagram

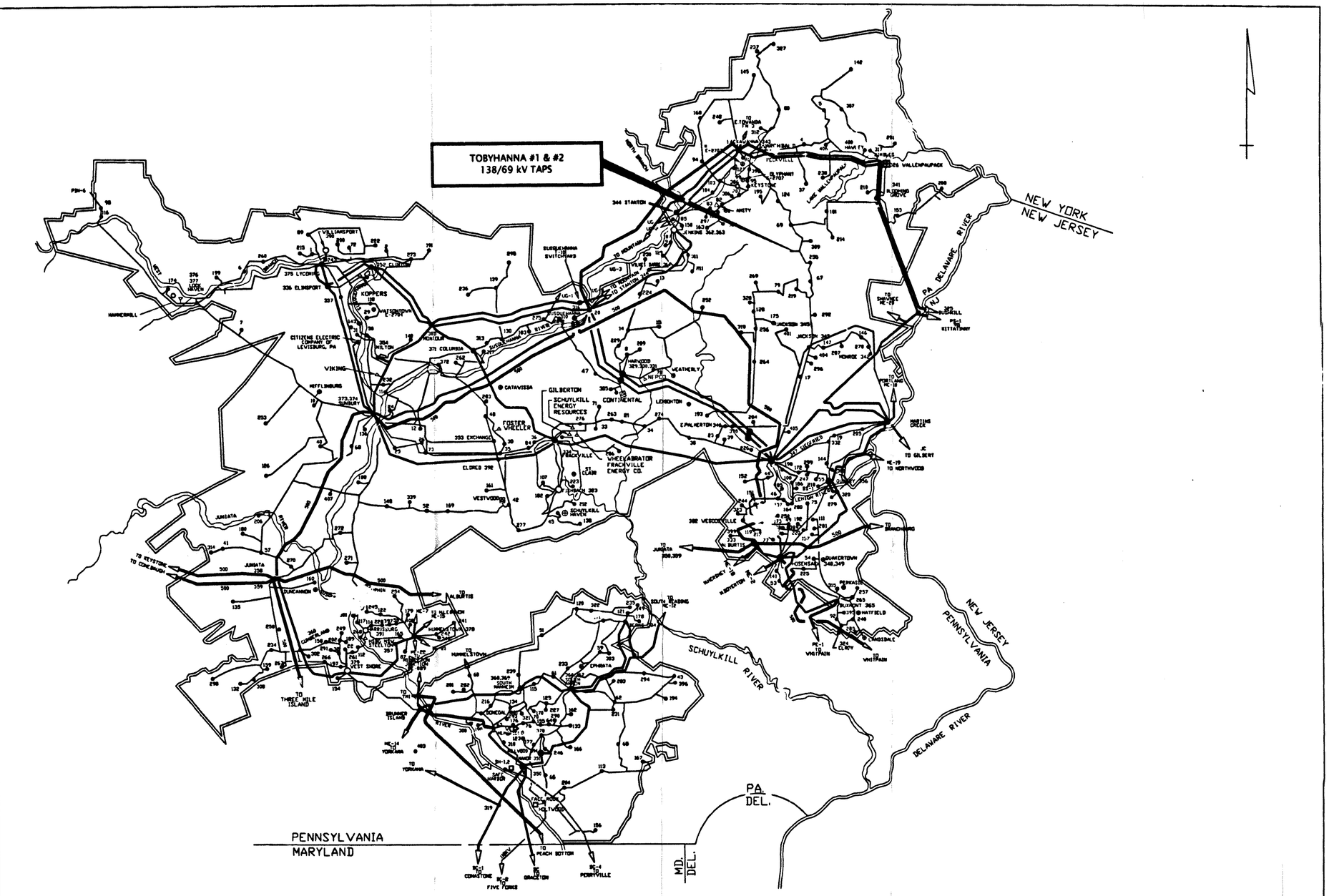


PROPRIETARY INFORMATION WHICH MUST NOT BE DISCLOSED WITHOUT PRIOR WRITTEN AUTHORIZATION FROM PPL ELECTRIC UTILITIES.

SUBSTATION LISTING

1 WEST WILLIAMSPORT	151 CRACKERSPORT	301 CENTER CITY
2 FAIRFIELD	152 SCHNECKSVILLE	302 NEW KINGSTOWN
3 MONTGOMERY	153 HEMLOCK	303 REAMSTOWN
4 VARDEN	154 MT. ALLEN	304 DUPONT
5 HONESDALE	155 PRINCE	305 HUMBOLDT
6 JERSEY SHORE	156 WAKEFIELD	306 CEDAR AVE.
7 LOGANTON	157 COOPERSBURG	307 INDIAN ORCHARD
8 VALMONT	158 WERTZVILLE	308 NOTTINGHAM
9 RIVER	159 WEST CARLISLE	309 NORTH COOLBAUGH
10 LIMESTONE	160 BENVENUE	310 CTORT
11 NORTHUMBERLAND	161 HEGINS	311 EAST MOUNTAIN
12 REED	162 LEDLA	312 JERMYN
13 WRIGHT	163 YATESVILLE	313 BLOOMSBURG
14 ST JOHNS	164 CENTRAL ALLENTOWN	314 MIFFLINTOWN
15 FREELAND	165 OBERLIN	315 RIDGE ROAD
16 *	166 STRASBURG	316 SUSQUEHANNA
17 GILBERT	167 ATGLEN	T-10 SW YD.
18 *	168 BROOKSIDE	317 KIMBLES
19 CHERRY HILL	169 WILLIAMSTOWN	318 CHRISTMANS
20 SUSQUEHANNA 230KV	170 E. PETERSBURG	319 OTTER CREEK
21 TAMANEND	171 WERNERSVILLE	320 STEEL CITY
22 WHITE HILL	172 N. BETHLEHEM	321 McGOVERNVILLE
23 PALMERTON	173 W. ALLENTOWN	322 ROBESONIA
24 HAMILTON	174 FLEMINGTON	323 SFOGELSVILLE
25 HUNTER	175 MECKESVILLE	324 ELROY
26 FAIRVIEW	176 DONERVILLE	325 BUSHKILL
27 *	177 MILLERSVILLE	326 WALLENPAUPACK
28 *	178 SHILLINGTON	327 ELK MOUNTAIN
29 MONTOUR PUMP	179 DUKE	328 JACK FROST
30 MT. CARMEL	180 MCALLISTERVILLE	329 HARWOOD 230/69KV
31 KELLY	181 NEWFOUNDLAND	330 HARWOOD CTG.
32 SPORTING HILL	182 MARLIN	331 HARWOOD 69/12KV
33 MAHANOY CITY	183 WEST BERWICK	332 NAZARETH
34 GREENWOOD	184 KEYSER AVENUE	333 ALBURTIS
35 MOYRY	185 MICKLEYS	334 FRACKVILLE
36 ALTAMONT	186 EAST ALLENTOWN	335 *
37 HAMLIN	187 PINE RIDGE	336 ELIMSPORT
38 ASHFIELD	188 DALMATIA	337 ALLENWOOD
39 SOUTH SLATINGTON	189 PENNSBORO	338 *
40 SOUTH MIDDLEBURG	190 NORTH COLUMBIA	339 GRATZ
41 WALKER	191 HUGHESVILLE	340 HOCKERSVILLE
42 FRAILEY	192 SOUTH ALLENTOWN	341 BLOOMING GROVE
43 MORGANTOWN	193 WEISSPORT	342 MONROE
44 EGYPT	194 HONEYBROOK	343 LACKAWANNA ##
45 POCESSONA	195 MOSCOW	344 STANTON
46 SOUTH WHITEHALL	196 *	345 JACKSON
47 EAST TOMHICKEN	197 ROSSMOYNE	346 EAST PALMERTON
48 BEAR GAP	198 NORTHAMPTON	347 SIEGFRIED
49 SALISBURY	199 WOOLRICH	348 HOSENSACK 230/69KV
50 SOUTH MILTON	200 FAXON	349 HOSENSACK 500KV
51 HEIDELBERG	201 ELIZABETHTOWN	350 CONESTOGA
52 LYKENS	202 ENOLA	351 MANOR
53 UPPER HANOVER	203 TERRE HILL	352 CLINTON
54 RICHLAND	204 BUCK	353 EXCHANGE
55 MACADA	205 MT. BETHEL	354 MILTON
56 ROCKVILLE	206 RICHFIELD	355 DAUPHIN
57 THOMPSONTOWN	207 SCRANTON	356 QUARRY SUB.
58 PAXTON	208 TWIN LAKES	357 STEELTON
59 COCALICO	209 HARLEIGH	358 JUNIATA 500/230KV
60 EAST ELIZABETHTOWN	210 TAFTON	359 JUNIATA 230/69KV
61 WARWICK	211 BEAR CREEK	360 CUMBERLAND
62 EARL	212 DRWIGSBURG	361 DONEGAL
63 HEMPFIELD	213 EAST TEXAS	362 JENKINS 230/69KV
64 EAST LANCASTER	214 CANDENSIS	363 JENKINS CTG
65 KINZER	215 LINDEN	364 WILKES-BARRE
66 MT. NEBO	216 MT. JOY	365 BUXMONT
67 MT. POCONO	217 WEST BLOOMSBURG	366 SOUTH AKRON 230/138/69KV
68 PENNS	218 MINSI TRAIL	367 SOUTH AKRON 69/12KV
69 COULDSBRO	219 LAKE NAOMI	368 SOUTH MANHEIM 69/12KV
70 DILLERVILLE	220 LANARK	369 SOUTH MANHEIM 230/69KV
71 GIRARD MANOR	221 *	370 ENGLESIDE
72 KENMAR	222 MONTOURSVILLE	371 COLUMBIA
73 GOWEN CITY	223 PORT CARBON	372 DANVILLE
74 *	224 BLYTHEBURN	373 SUNBURY
75 ELLIOT HEIGHTS	225 MILFORD	374 HUMMELS WHARF
76 ROHRERSTOWN	226 TREICHLERS	375 LYCOMING
77 MACUNGIE	227 ROSEVILLE	376 LOCK HAVEN CTG
78 EAST HAZLETON	228 RUTHERFORD	377 LOCK HAVEN 69/12KV
79 WAGNERS	229 HARTLAND	378 HUMMELSTOWN
80 EAST CARBONDALE	230 FARRISH	379 WEST SHORE
81 LYNDON	231 WEST NEW HOLLAND	380 MONTAGE
82 MINOOKA	232 POINT	381 SOUTH FARMERSVILLE
83 OLD FORGE	233 LINCOLN	382 WESCOSVILLE
84 FOUNTAIN SPRINGS	234 MIDDLETON	383 FISHBACH
85 SULLIVAN TRAIL	235 STATE HILL	384 BERKS
86 *	236 MILVILLE	385 MONTOUR
87 SVATARA	237 TINKER	386 SUBURBAN YARD
88 *	238 LAKEVILLE	387 *
89 HEPBURN	239 NORTH MANHEIM	388 *
90 *	240 HATFIELD	389 MACK
91 *	241 HERSHEY	390 WILLIAMSPORT
92 FRANCONIA	242 S. HERSHEY	391 HARRISBURG
93 EMMAUS	243 S. WILLIAMSPORT	392 ELDRED
94 MORGAN	244 FOGELSVILLE	393 *
95 THROOP	245 WINDSOR	394 MILLWOOD
96 *	246 W. WILLOW	395 TELFORD
97 *	WESTGATE	396 TWIN VALLEY
98 CHAPMAN	248 EDELA	397 DEVONSHIRE
99 SUBURBAN	249 SUMMERDALE	397 JESSUP
100 *	250 DORNEYVILLE	398 BELTZVILLE
101 *	251 BOHEMIA	399 SCHOENECK
102 *	252 WHITE HAVEN	400 HAWLEY
103 PROVIDENCE	253 LAURELTON	401 EFFORT MOUNTAIN
104 *	254 LINGLESTOWN	402 COPPERSTONE
105 AVOCA	255 POCONO FARMS	403 RED FRONT
106 *	256 HICKORY RUN	404 APPENZELL
107 CASS	257 BLOOMING GLEN	405 BLUE MOUNTAIN
108 CATASAQUA	258 SHERMANSDALE	406 DAPPERS 69-12KV
109 *	259 *	407 MEISERVILLE
110 SUSQUEHANNA 500KV	260 LARRYS CREEK	
111 SEIDERSVILLE	261 SPANGLER MILLS	
112 ROSEMONT	262 E. DANVILLE	
113 QUARRYVILLE	263 DELAND	
114 LAWNTON	264 CARBON	
115 LITITZ	265 SELLERSVILLE	
116 RENOVO	266 MECHANICSBURG	
117 WALNUT	267 CARLISLE	
118 WATSON	268 CEDAR	
119 TREXLERTOWN	269 ARROWHEAD	
120 LAVINO	270 NEWPORT	
121 SPRING	271 HALIFAX	
122 COLONIAL PARK	272 MILLERSURG	
123 WEST LANCASTER	273 MUNCY	
124 MADISONVILLE	274 HAUTO	
125 NEFFSVILLE	275 BERWICK	
126 BEAVERTOWN	276 SHENANDOAH	
127 BELMONT	277 PINE GROVE	
128 LAKE HARMONY	278 STROUDSBURG	
129 GEORGETOWN	279 FREEMANSBURG	
130 SCOTT	280 ALLENTOWN	
131 N. HARRISBURG	281 BINGEN	
132 MOUNT ROCK	282 RHEEMS	
133 GREENLAND	283 CLEVELAND	
134 LANDISVILLE	284 LITTLE GAP	
135 GREEN PARK	285 ORVILLA	
136 SELINSGROVE	286 TUSCARORA	
137 SUMNER	287 BARTONSVILLE	
138 AUBURN	288 ALTON PARK	
139 ROHRSBURG	289 SALEM	
140 DERRY	290 NORTH BRIDGEPORT	
141 EAST GREENVILLE	291 HAMPDEN	
142 WEST DAMASCUS	292 CAMELBACK	
143 NEW COLUMBIA	293 SILVER SPRING	
144 FARMERSVILLE	294 BRECKNOCK	
145 GREENFIELD	295 BENTON	
146 NORTH STROUDSBURG	296 MCMICHAELS	
147 TANNERSVILLE	297 HUGHESTOWN	
148 ELIZABETHVILLE	298 NEWVILLE	
149 WYOMISSING	299 POINTE NORTH	
150 EXETER	300 MARIETTA	

* - SUBSTATIONS THAT HAVE BEEN RETIRED.
** - SITE OF THE EXISTING 230KV SUBSTATION AND PROPOSED 500KV SUBSTATION



INTERCONNECTIONS

PS PUBLIC SERVICE ELECTRIC AND GAS CO. OF N.J.
ME METROPOLITAN EDISON CO. (FIRST ENERGY)
PE PHILADELPHIA ELECTRIC CO. (PECO ENERGY)
BC BALTIMORE GAS AND ELECTRIC CO.
SH SAFE HARBOR WATER POWER CORPORATION
UP THE UNITED GAS IMPROVEMENT CO. - LUZERNE ELECTRIC DIVISION
PN PENNSYLVANIA ELECTRIC CO. (FIRST ENERGY)
JC JERSEY CENTRAL POWER AND LIGHT CO. (FIRST ENERGY)

COMBUSTION TURBINE
HYDRO ELECTRIC
COMBINATION
FIRM SALES
SUBSTATION /SWITCHING STATION
STEAM ELECTRIC
NON-UTILITY GENERATION
INDEPENDENT POWER PRODUCERS

500KV OPERATION
230KV OPERATION
138KV OPERATION
69KV OPERATION

NO.	DATE	ACCT.		BY
76	11/30/10	100142uo	ADDED MANOR - GRACETON 230kV LINE RECONSTRUCTION	MG RWM DG
75	10/11/10	0015425	ADDED BUCKSHIRE SOLAR 138/69 kV TAP	MG RMW JW
74	11/4/10	0014645	ADDED FIRST QUALITY #4 138/69 kV TAP LINE PROJECT LOCATION	MG RWM KK
73	12/8/10	0014966	INDICATE TOBYHANNA #1 & #2 138/69 kV TAP.	RRC DG

REVIEWED APPROVED

ACCT- 805201
SCALE- NONE
BY- CDW
REVIEWED

ELECTRICAL SYSTEM MAP
TOBYHANNA #1 & #2
138/69kV TAPS

APPROVED G. HAKUN III
DATE 7/17/85
PPL ELECTRIC UTILITIES

PPL DRAWING NO. D191830
SHEET NO. 1
REV. 77

#6000 | LOCATION CODES | PLAN & PROFILE NO. | TRANSMISSION MAP NO. | C SORTS

D191830_5001.DWG

REFERENCE TITLE | NUMBER | REFERENCE TITLE | NUMBER

FRACTIONAL 0 1 2 DECIMAL 2 1 0

PPL EU FORM 4677 (7/90)

ATTACHMENT

2

ATTACHMENT "2"

TOBYHANNA #1 & #2 138/69 kV TAP

ENGINEERING DESCRIPTION

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MAP

MAP 1	AERIAL EXHIBIT – DRAWING.....	ATTACHMENT "2" MAP POCKET

ATTACHMENT "2"

TOBYHANNA #1 & #2 138/69 kV TAP

ENGINEERING DESCRIPTION

A. DESCRIPTION OF PROPOSED LINE

PPL Electric proposes to design and construct a double circuit 138/69 kV tap line to replace an existing single circuit 69 kV transmission tap which is presently used to serve the Tobyhanna Army Depot in Coolbaugh Township, Monroe County. The proposed tap line will be constructed within the right-of-way for the existing tap line except for a small section on the Army property to tie into the proposed substation. The proposed tap line will terminate at a new 138-69-12 kV substation located adjacent to the existing substation on the Army Depot property.

The tap line will be designed and constructed for double-circuit 138 kV operation, although it initially will be operated at 69 kV. The tap will be operated at 138 kV when future load increases make it appropriate to do so to maintain service reliability. The location of the existing transmission tap and the proposed facilities are depicted on the Aerial Exhibit included in the map pocket located at the end of Attachment "2".

The existing transmission tap is approximately 2.08 miles in length and is supported by wood H-frame structures with an average height of 52 feet. The proposed tap line will be approximately 2.08 miles in length and, with two exceptions, will be supported by steel monopoles with an average height of 80 feet (see Figures 1 and 2). The proposed poles located on either side of Hap Arnold Boulevard on the Army property will be approximately 100 feet tall to eliminate the need to place poles within wetlands, as discussed in Attachment 3. Subsequent to the submission of the Petition of Waiver, PPL Electric's planning department identified that the Blooming – Grove Jackson transmission line needs to be re-insulated to increase the basic insulation level (BIL) to improve the line's performance during periods of lightning. Since the proposed tap line is off the Blooming Grove – Jackson transmission line, it must be designed with the higher BIL. As a result, the proposed pole height of 80 feet is higher than the 70-foot pole height described within the petition.

The proposed steel monopoles will be direct embedded and guyed, or constructed on concrete foundations where necessary. The existing H-frame structures will be replaced on a one for one basis, to the extent practical. For example, the tower locations that are situated within wetlands will be shifted outside of the wetlands to reduce environmental impacts.

The proposed tap line will consist of six power conductors and one overhead ground wire. The power conductors will be 556.5 kcmil,[1] 24/7 strand ACSR.[2] One 3/8 inch steel overhead ground wire will provide lightning protection for the proposed tap line. In addition, one load sectionalizing air break ("LSAB") will be added to an existing pole on the Peckville – Jackson 138/69 kV Transmission Line.

The new 138/69 kV tap line will be designed according to, and will generally surpass, National Electrical Safety Code ("NESC") minimum standards. Additional design criteria and safety rules practiced by PPL Electric are explained in Attachment "4". With one exception, the minimum conductor-to-ground clearance will be 30.7 feet for the new 138/69 kV tap line. It should be noted that the first span from the Peckville – Jackson Transmission line will have a minimum ground clearance of 26 feet since it crosses beneath the Blooming Grove – Jackson transmission line. This 26-foot clearance meets the NESC design standards. This minimum clearance occurs at a maximum thermal conductor temperature of 125°C. The design minimum conductor clearances and conductor thermal rating are provided in Table 1 and Table 2 respectively.

[1] A kcmil is a thousand circular mils. 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 STRAND ACSR[3]

Condition	Double-Circuit Design Clearance-to-Ground
Normal load, average weather (16°C ambient, 60°F temperature)	36.8 feet
Predicted extreme thermal load (125°C conductor, 257°F temperature)	30.7 feet
Predicted NESC extreme wind load conditions (25 lbs., 16°C, 60°F temperature)	33.9 feet
Predicted extreme weather conditions (1-inch ice, 4 lbs. wind, -18°C, 0°F)	32.9 feet

TABLE 2

CONDUCTOR THERMAL RATING 556.5 KCMIL 24/7 ACSR 125°C MAXIMUM CONDUCTOR TEMPERATURES

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

[3] Clearances based on an initial maximum tension of 9,000 pounds and a ruling span of 450 feet.

B. MAGNETIC FIELD MANAGEMENT

PPL Electric's Magnetic Field Management Program is summarized in Attachment "5" and is applied to all reconstruction and new line projects. In order to lower magnetic field exposures, the program generally prescribes a line design that provides for ground clearances that are five feet higher 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 that those modifications can be made at low or no cost and will not interfere with the operation of the line.

For this project, increased structure height and existing phase transposition[4] will be utilized to reduce magnetic field exposures. Except at the under-crossing of the Blooming Grove – Jackson Transmission Line, the proposed tap line will be designed for at least 30 feet of ground clearance, and phasing will match the existing Blooming – Grove and Peckville – Jackson transmission lines. In addition, the proposed compact design being utilized to obtain the higher BIL will also decrease the magnetic field. Complete reverse phasing of the proposed tap line cannot be cost effectively implemented at this time, as it would require re-termination of the source lines at six substations or widening of the existing right-of-way to accommodate the addition of another structure to roll phases. Further, complete reverse phasing at this time would interfere with the operation of the source lines. PPL Electric will re-evaluate reverse phasing of the proposed tap line in the future if the phases on the Blooming Grove-Jackson and Peckville-Jackson Transmission Lines are modified.

C. RIGHT-OF-WAY STATUS

The majority of the proposed tap line situated on the Army property will be constructed within the existing right-of-way. For the portion of the transmission line located off the Army Property, the proposed tap line will be constructed adjacent to the 69 kV tap within the existing right-of-

[4] Phase transposition describes the present phasing on the existing Blooming Grove and Peckville - Jackson Transmission Lines which results in the partial cancellation of magnetic field on two phases of these lines. Phasing is B,A,C on Peckville-Jackson and A,B,C on Blooming Grove-Jackson.

way as shown on the Aerial Exhibit. No additional right-of-way will be required for this section of the line.

In order to tie the new tap line into the new substation, additional right-of-way will be required for the property adjacent to the new substation. In addition, in order to meet design parameters and clearance requirements the existing right-of-way will need to be widened where the tap spans the wetlands adjacent to Hap Arnold Boulevard. Figure 3 shows the proposed typical cross section of the right-of-way. The approximate aerial extent of the right-of-way is shown on the Aerial Exhibit included in Attachment "2". The owner of the property, the United States Army, has agreed to grant the additional rights-of-way.

FIGURE 1
PROPOSED 138/69 kV TANGENT STRUCTURE
APPROXIMATE HEIGHT – 80'

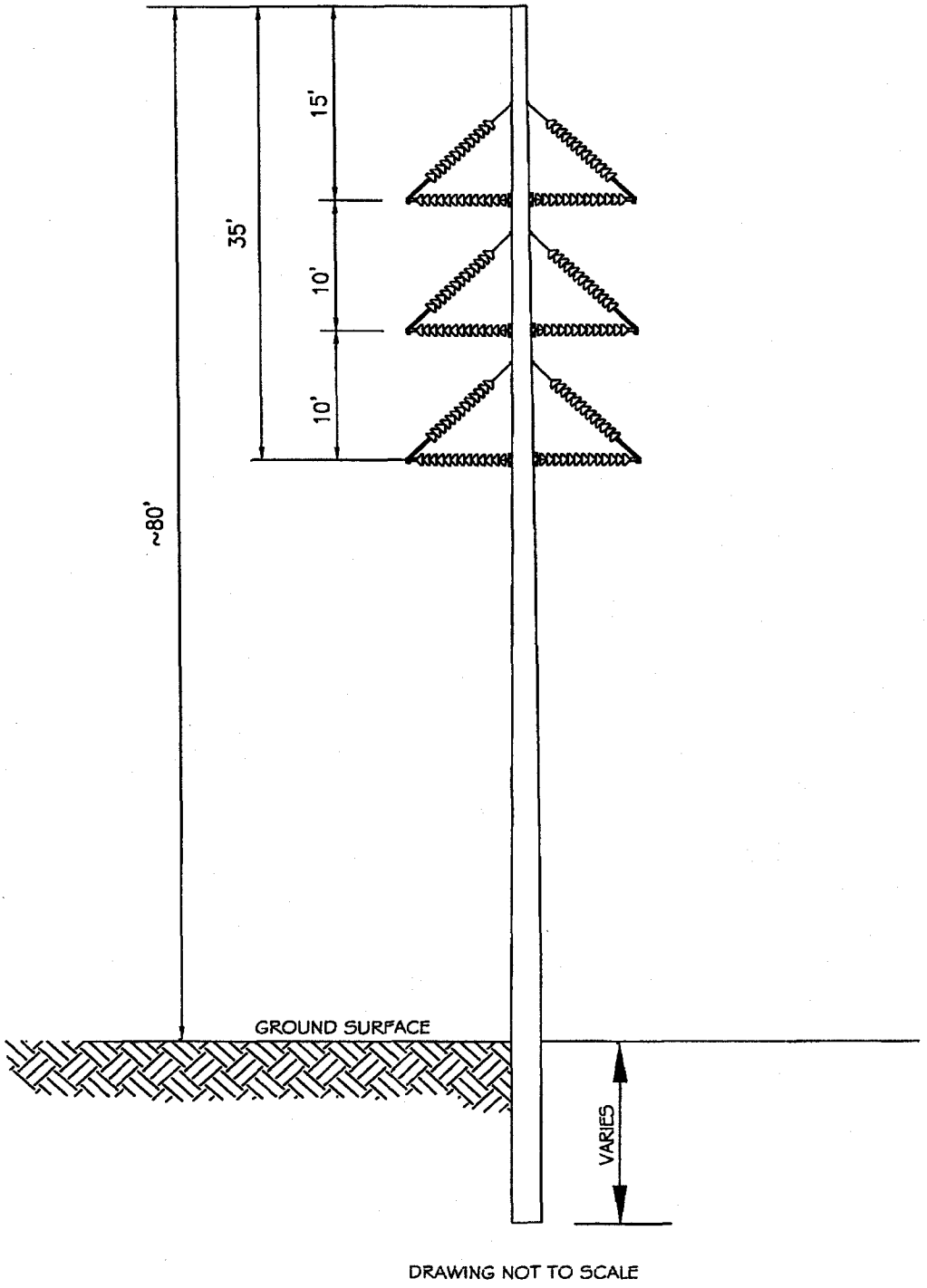
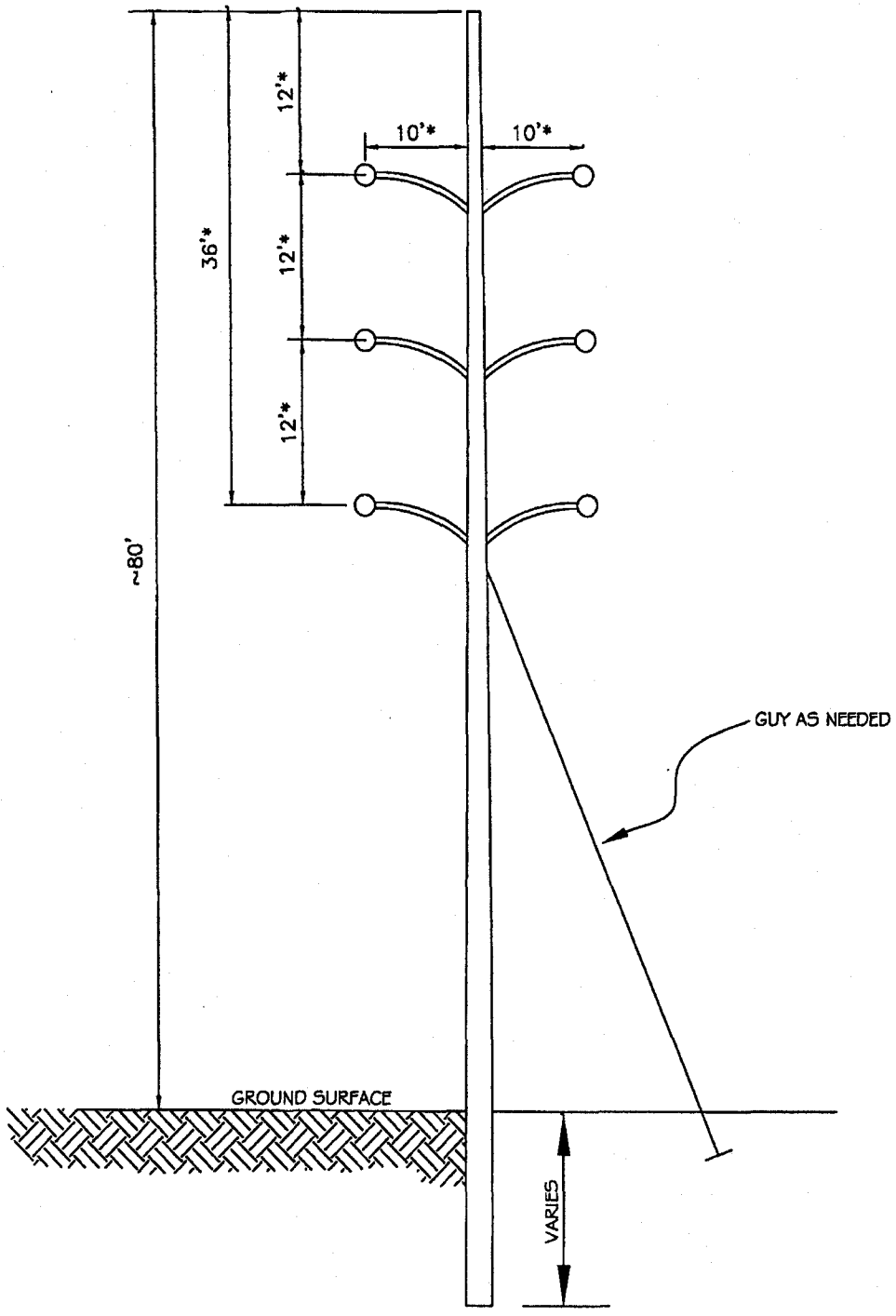


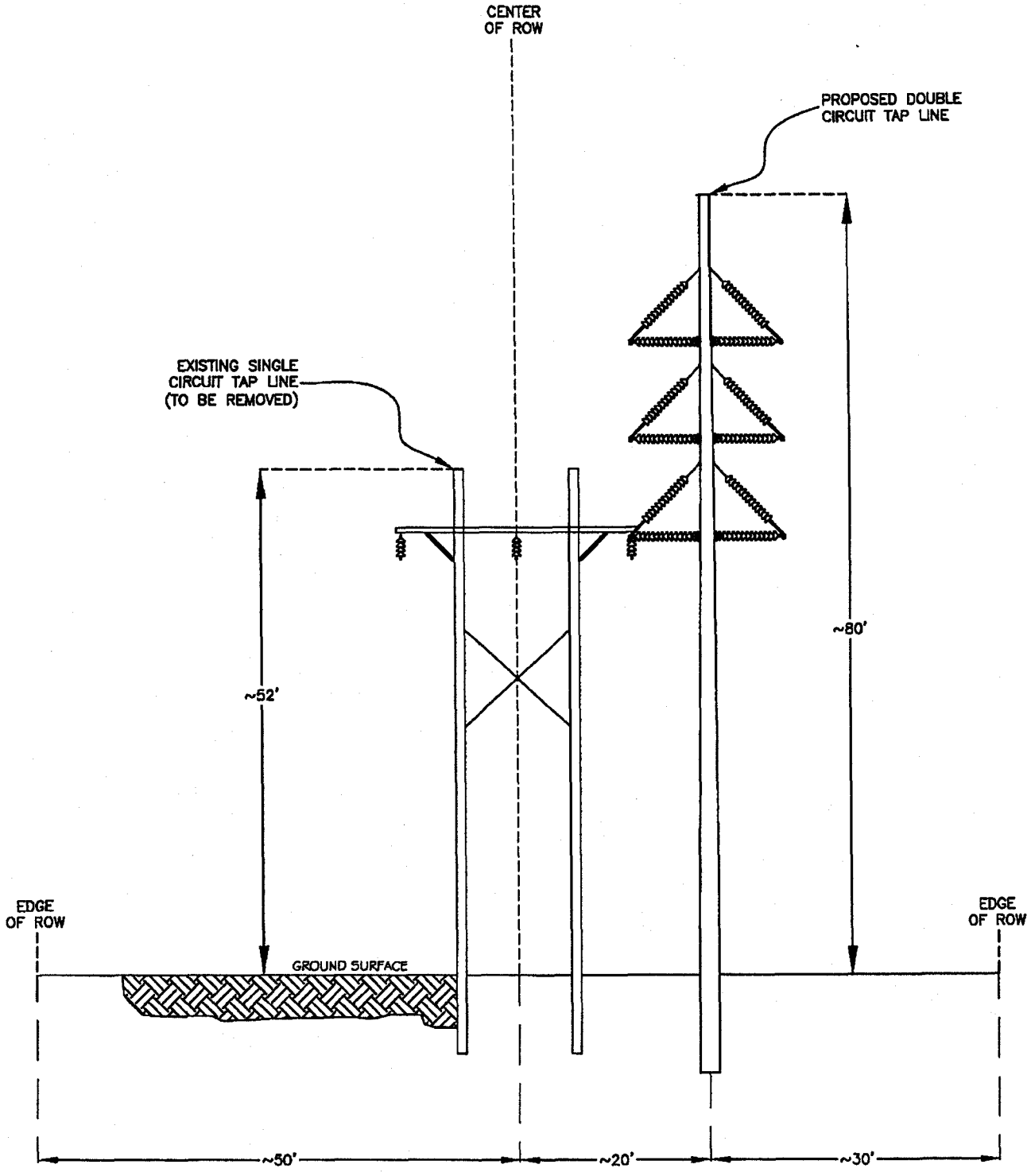
FIGURE 2
PROPOSED 138/69 kV ANGLE STRUCTURE
APPROXIMATE HEIGHT – 80'



* - ARM LENGTH AND VERTICAL ARM SPACING DEPENDENT ON SEVERITY OF ANGLE. MAXIMUM VALUES ARE DEPICTED FOR INFORMATIONAL PURPOSES.

DRAWING NOT TO SCALE.

FIGURE 3
PROPOSED RIGHT-OF-WAY LAYOUT



DRAWING NOT TO SCALE

TOBYHANNA LAKE

BLOOMING GROVE - JACKSON 138/69 kV LINE
& PECKVILLE - JACKSON 138/69 kV LINE

200' PPL ROW

100' PPL ROW

PROPOSED SUBSTATION

EXISTING SUBSTATION

PROPOSED R.O.W. (APPROXIMATE)

TOBYHANNA ARMY DEPOT

ADDITIONAL R.O.W. FOR BLOWOUT CLEARANCE (APPROXIMATE)

EXISTING 69 kV TAP LINE

PROPOSED 138/69 kV TAP

HAP ARNOLD BLVD

MARTIN ST

CHURCH ST (S.R. 4039)

LAKESIDE DRIVE

LAKESIDE DRIVE

MAIN ST

MAPLE ST

MILLPOND NUMBER ONE

PROPERTY ID NUMBER	OWNER OF PROPERTY	PROPERTY ID NUMBER	OWNER OF PROPERTY
①	WILLIAM L. LEONARD JR. ET AL (MARILOU C. HITT & JOSEPH P. LEONARD) 614 LEONARD LANE TOBYHANNA, PA 18466	⑦	LAWRENCE LEONARD 4111 US HIGHWAY 158 ADVANCE, NC 27006
②	WILLIAM L. LEONARD JR. & DIANE LEONARD 614 LEONARD LANE TOBYHANNA, PA 18466	⑧	GLENN & JILL BOINSKE PO BOX 848 TOBYHANNA, PA 18466
③	GEORGE F. & MARY LEONARD 617 LEONARD LANE TOBYHANNA, PA 18466	⑨	GLENN & JILL BOINSKE PO BOX 848 TOBYHANNA, PA 18466
④	GEORGE & MARY LEONARD 617 LEONARD LANE TOBYHANNA, PA 18466	⑩	FRANK BROZZETTI JR. AND MICHAEL BROZZETTI 4386 ELMHURST BLVD. MOSCOW, PA 18444
⑤	PAUL R. LEONARD 615 LEONARD LANE TOBYHANNA, PA 18466	⑪	TOWNSHIP OF COOLBAUGH ATTN: DOUGLAS HEIN, BUSINESS MGR 5550 MEMORIAL BOULEVARD TOBYHANNA, PA 18466
⑥	MICHAEL W. & SHIRLEY I SMITH PO BOX 302 TOBYHANNA, PA 18466	⑫	TOBYHANNA MILITARY RESERVATION, US ARMY TOBYHANNA ARMY DEPOT 11 HAP ARNOLD BOULEVARD TOBYHANNA, PA 18466-5078

LEGEND

- EXISTING TOBYHANNA TAP
- PROPOSED TOBYHANNA #1 & #2 TAP
- PROPERTY LINE (APPROXIMATE)
- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- APPROX. LIMIT OF ARMY PROPERTY

AERIAL EXHIBIT

TOBYHANNA #1 & #2 138/69 TAP
COOLBAUGH TOWNSHIP
MONROE COUNTY, PA.

SCALE: 1" = 500'

500' 0 250' 500' 1000'

PREPARED BY:
PPL ELECTRIC UTILITIES CORP.

PPL ELECTRIC UTILITIES

ATTACHMENT

3

ATTACHMENT "3"

TOBYHANNA #1 & #2 138/69 kV TAP

ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

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ATTACHMENT "3"

TOBYHANNA #1 & #2 138/69 kV TAP

ENVIRONMENTAL ASSESSMENT

A. INTRODUCTION

At the Army's request to improve reliability at the Tobyhanna Army Depot, PPL Electric is proposing to construct a new 138/69 kV double circuit tap to replace the existing 69 kV single circuit tap line. The project involves the installation of approximately 2.08 miles of new transmission line on steel monopoles, and installing one new LSAB switch. The transmission tap will be designed for double-circuit 138 kV operation, although it initially will be operated at 69 kV. The section of the tap line located off the Army Depot property will be constructed within the existing right-of-way. The section located on the Army Depot Property will be substantially located within the existing right-of-way. A portion of the transmission tap lines approaching the proposed substation will require additional right-of-way from the Army. Additionally, the existing right-of-way where the tap spans the wetlands adjacent to Hap Arnold Boulevard will need to be widened. For these sections, as shown on the Aerial Exhibit included in the back of Attachment "2", the Army has agreed to grant PPL Electric the required rights-of-way.

PPL Electric provided information describing the project to Coolbaugh Township and Monroe County, and neither the Township nor the County objected to the project. A list of involved governmental agencies, municipalities, and other public entities is in Attachment "6".

B. LAND USE

Construction of the proposed line will have minimal incremental land use impacts, as it will be constructed substantially within the existing right-of-way adjacent to the existing 69 kV single circuit tap line. The proposed tap line is located in woodland and open areas and crosses 12 properties. These properties include the Army Depot property,

Coolbaugh Township Municipal Park, and 10 residential properties. Due to the presence of the existing tap line in the right-of-way, the incremental visual impacts of the project to these properties will be minimal.

No nearby railroads, communication towers, pipelines or other utilities will be affected by the proposed project. The Pocono Mountains Municipal Airport in Mt. Pocono is the nearest airport and is located approximately 2.8 miles to the east of the project site. Impacts to this airport are not expected due to the distance between the project and the airport and the orientation of the runways with respect to the project location. PPL Electric will file the appropriate notifications with the Federal Aviation Administration and PennDOT Bureau of Aviation to confirm that the proposed tap line will not be a hazard to the airports' flight operations.

Existing access roads will be used for construction with the exception of areas where species of concern have been identified (as discussed below in Section E.). In these areas, new access roads will be constructed to avoid impact to the species of concern.

C. CULTURAL RESOURCES

The project was reviewed by the Pennsylvania Historical and Museum Commission (PHMC). The PHMC has determined that this project will have no effect on any historic buildings, structures, districts or objects that may be present within the project area and eligible for the National Register of Historic Places. Furthermore, it is PHMC's opinion that no archeological resources will be affected by this project (File No. ER 2011-0332-089-A). Therefore, no impacts to such resources are anticipated and no further investigations are required.

D. NATURAL FEATURES

The project will not affect any unique geological, scenic, or natural areas. The recreational areas located closest to the project site are: the Pennsylvania State Game

Lands Number 127, which is located approximately 150 feet east of the project site; Gouldsboro State Park, located approximately 0.5 miles west of the project site; and Tobyhanna State Park, which is located approximately 0.6 miles north of the project site. There are no anticipated impacts to these features since: (1) the proposed tap line will be constructed adjacent to the existing line and constructed within the existing cleared right-of-way, (2) the distance from the project area and the recreational areas, and (3) the existing vegetative buffer between the project area and the recreational areas. Additionally, with respect to the Coolbaugh Township Municipal Park, the proposed line will remain within the existing right-of-way and shifted further away from the developed portion of the park. Within the municipal park, a skateboarding complex encroaches on the right-of-way and some ramps and jumps are located directly below the existing conductors. With the proposed layout of the new tap, the ramps and jumps will no longer be located directly under the conductors.

Substantial tree clearing is not anticipated off the Army Depot property since the proposed line will be constructed within the existing maintained right-of-way. Some tree clearing may be required along the edges of the right-of-way and on the Army Depot Property adjacent to the new substation. In addition, some brush removal will be required to access the work areas. PPL Electric will apply its "Specifications for Initial Clearing and Control of Vegetation on or Adjacent to Electric Right-of-Way Through Use of Herbicides, Mechanical, and Hand Clearing Techniques" to mitigate impacts.

The tap line will cross both wetlands and areas designated as "Waters of the U.S." or "Waters of the Commonwealth." PPL Electric will obtain all required permits from the Pennsylvania Department of Environmental Protection and the United States Army Corps of Engineers prior to construction, and PPL Electric will comply with all conditions placed on the permits. In addition, PPL Electric will obtain any required soil erosion and sedimentation control permits, and comply with conditions placed on those permits.

E. THREATENED AND ENDANGERED SPECIES

PPL Electric has coordinated with various state and federal agencies to obtain information regarding threatened and endangered species in close proximity to the project area. A review of the Pennsylvania Natural Diversity Inventory (PNDI) records indicates that *Carex Disperma* (Soft-leaved Sedge), *Carex paupercula* (Bog Sedge), *Juncus filiformis* (Thread Rush), *Ledum groenlandicum* (Labroador Tea), and *Myrica gale* (Sweetgale) may be impacted by the proposed project (PNDI Search ID: 20100719253184).

Based on the results of the PNDI review, PPL Electric contracted with Mellon Biological Services to conduct a survey of the project area to identify whether the above identified species were present. The survey found two of the above species, *Juncus filiformis* and *Ledum groenlandicum*, within the existing right-of-way. A third species, Pennsylvania endangered plant species *Muhlenbergia uniflora* (Bog Muhly), was also identified within the existing right-of-way. Following identification of these three species, Mellon Biological Services delineated the extent of each species and also identified suitable routes that could be utilized to access work areas without impacting these species. These access routes will be included within the engineering drawings and utilized during construction to limit impacts to the species of concern. PPL Electric will coordinate with the appropriate agencies and obtain all required approvals prior to the commencement of construction.

In addition, a *Pandion haliaetus* (Osprey) nest was observed on one of the existing transmission tap structures. PPL Electric will submit this finding to the Pennsylvania Game Commission and obtain the appropriate approvals prior to the commencement of construction.

ATTACHMENT

4

LIST OF SUPPLEMENTAL ATTACHMENTS

ATTACHMENT "4" PPL Design Criteria and Safety Practices

ATTACHMENT "5" PPL Magnetic Field Management Program

ATTACHMENT "6" List of Property Owners Within the Right-of-Way

ATTACHMENT "7" List of Involved Governmental Agencies, Municipalities and Other Public Entities

ATTACHMENT "4"

TOBYHANNA #1 & #2 138/69 kV TAP

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, or 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 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

Surface Underneath Conductors	Vertical Clearance to Ground	
	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. Numerous 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

MAGNETIC FIELD MANAGEMENT

PPL Electric Utilities Corporation

ATTACHMENT 5

DECEMBER 2004

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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

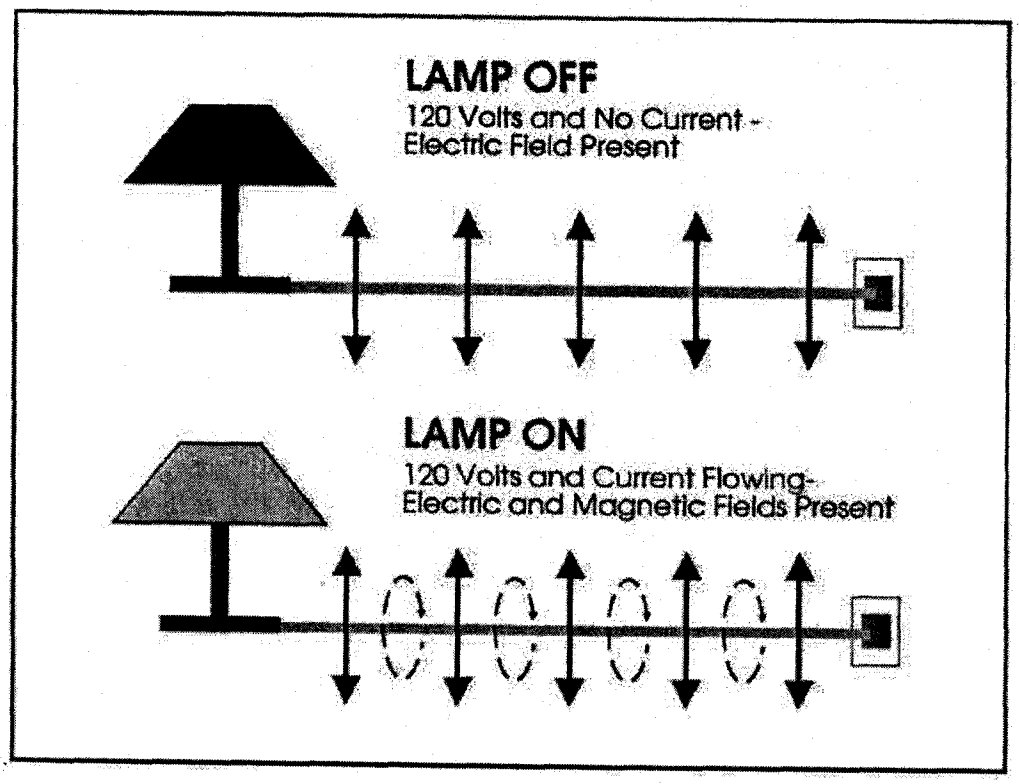

LAMP OFF
120 Volts and No Current -
Electric Field Present
LAMP ON
120 Volts and Current Flowing-
Electric and Magnetic Fields Present

Figure 2

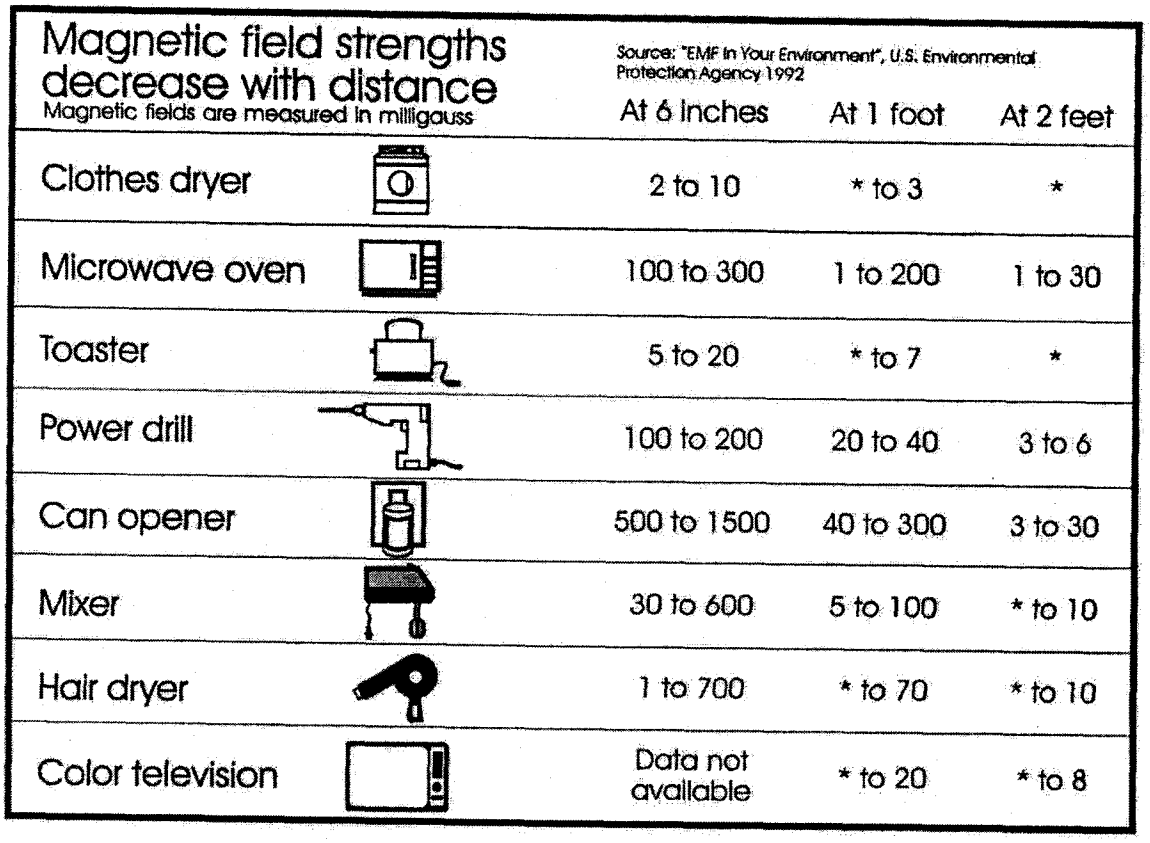


FIGURE 2 * The magnetic field measurement at this distance from the operating appliance could not be distinguished from background measurements taken before the appliance had been turned on.

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.

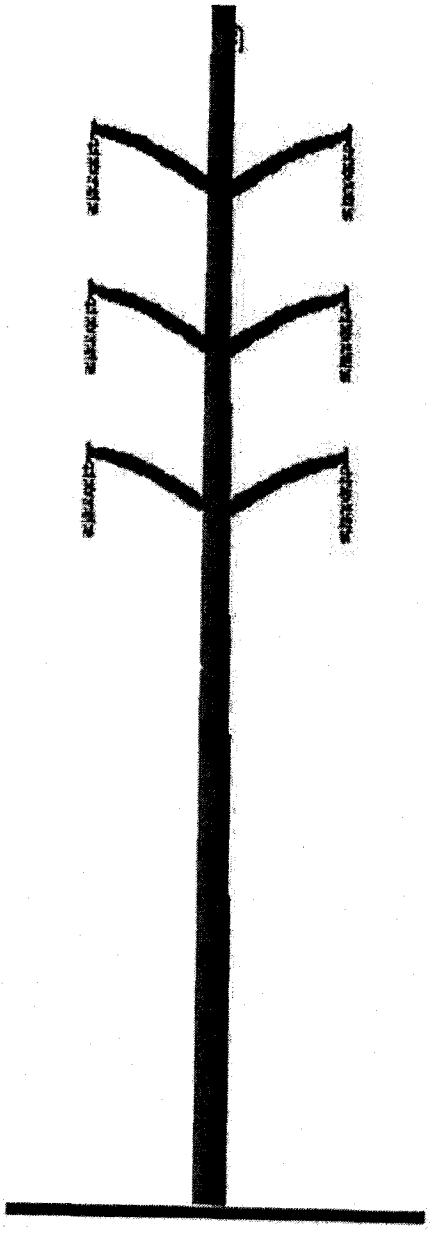
- Main lines are the most heavily loaded sections of a distribution line and therefore have the highest magnetic fields associated with them.
- Increasing the ground clearance by five feet reduces the magnetic field under the line from 14 mG to 11 mG using the standard eight-foot crossarm design. These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

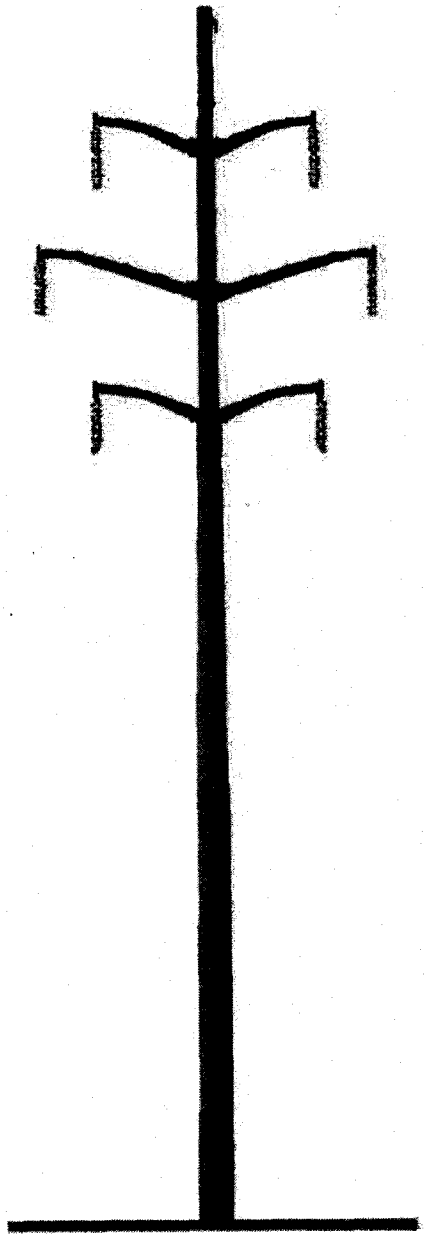
Short-Span Construction



- 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:**

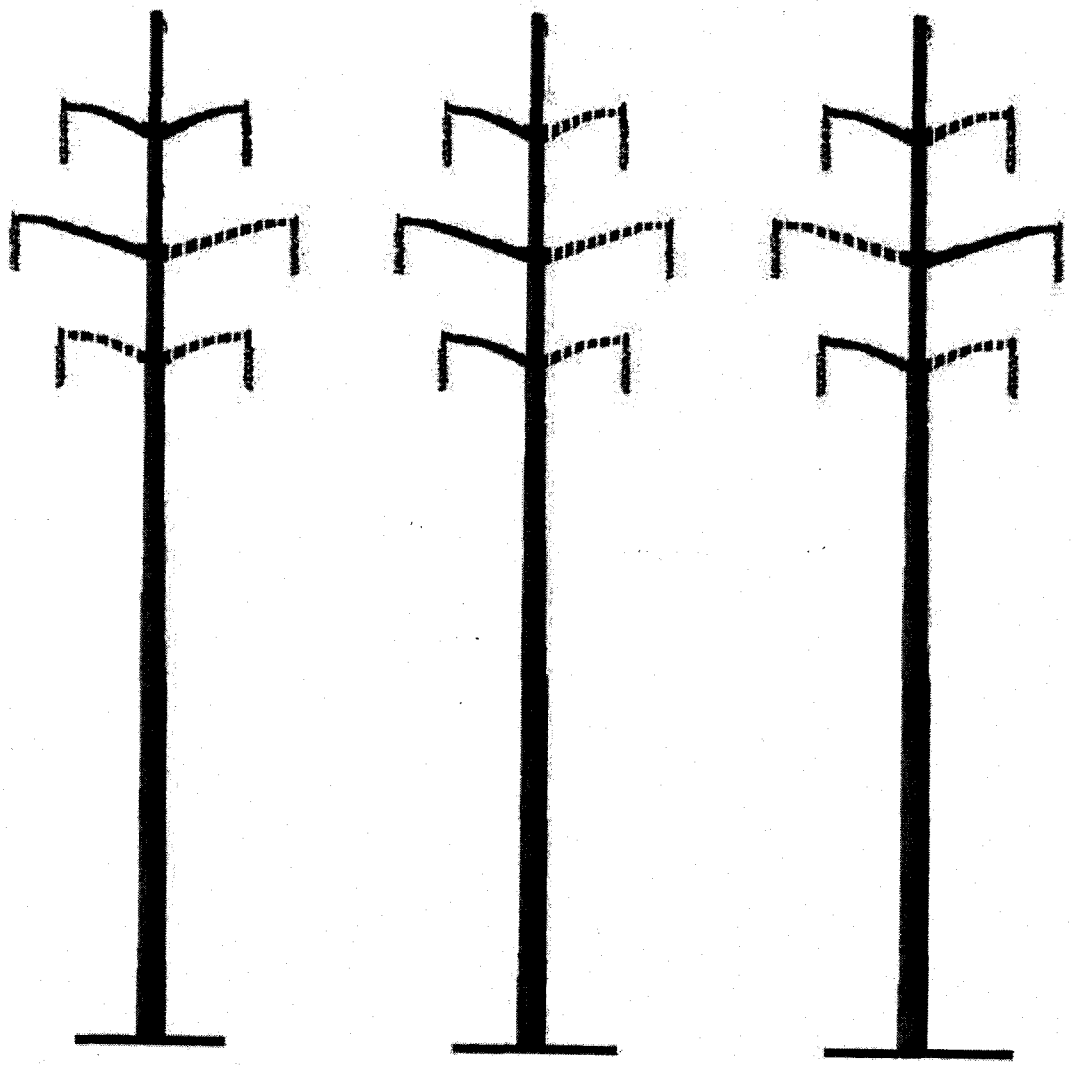
  1 3/8" HS steel overhead ground wire - 17.3 feet sag
  6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 23.0 feet sag
  Average span - 600 feet

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



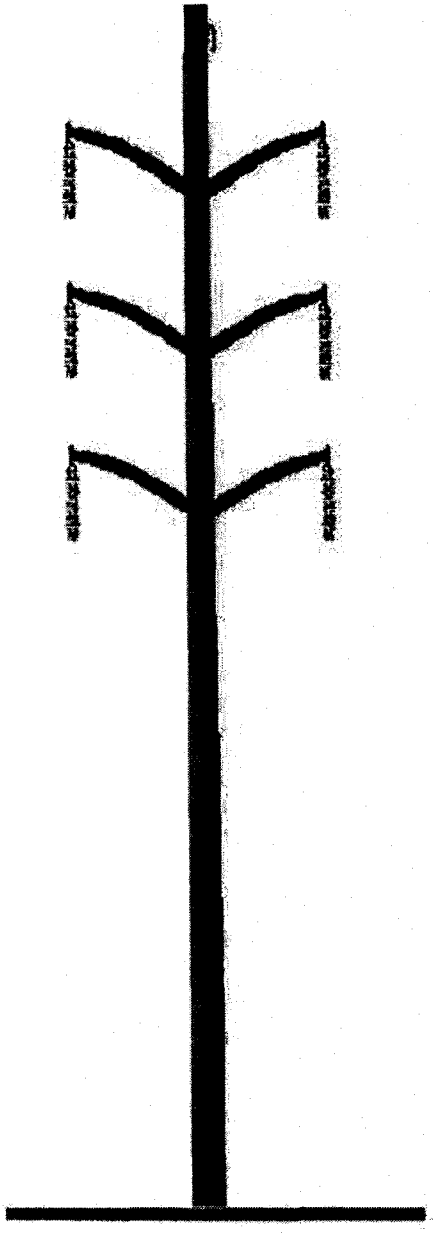
initial single circuit
future second circuit

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.

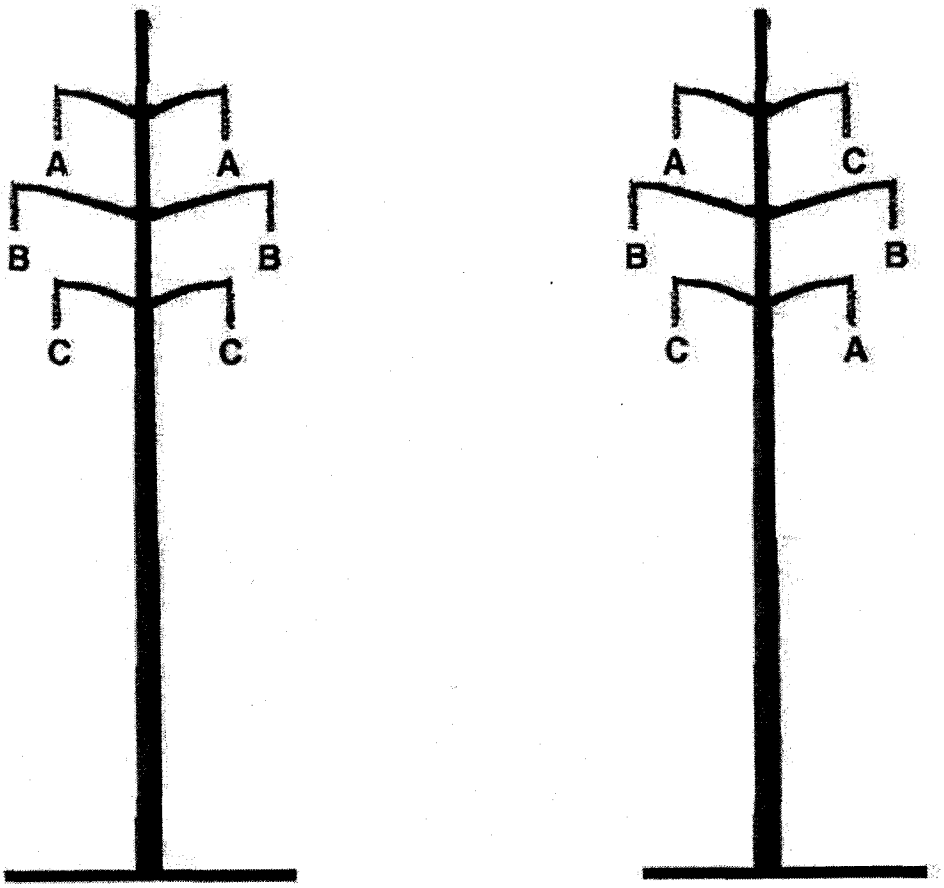
Compact Design Structure



- **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

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.

CHART XIII

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

ATTACHMENT "6"

TOBYHANNA #1 & #2 138/69 kV TAP

LIST OF PROPERTY OWNERS WITHIN THE RIGHT-OF-WAY

Property Identification Number (as shown on Aerial Exhibit)	Property Owner and Mailing Address
1	William L. Leonard Jr. et al (Marilou C. Hitt & Joseph P. Leonard) 614 Leonard Lane Tobyhanna, PA 18466
2	William L. Leonard Jr. & Diane Leonard 614 Leonard Lane Tobyhanna, PA 18466
3	George F. & Mary Leonard 617 Leonard Lane Tobyhanna, PA 18466
4	George & Mary Leonard 617 Leonard Lane Tobyhanna, PA 18466
5	Paul R. Leonard 615 Leonard Lane Tobyhanna, PA 18466
6	Michael W. & Shirley I Smith PO Box 302 Tobyhanna, PA 18466
7	Lawrence Leonard 4111 US Highway 158 Advance, NC 27006
8	Glenn & Jill Boinske PO Box 848 Tobyhanna, PA 18466
9	Glenn G. & Jill P. Boinske PO Box 848 Tobyhanna, PA 18466
10	Frank Brozzetti Jr. and Michael Brozzetti 4386 Elmhurst Blvd. Moscow, PA 18444

Property Identification Number (as shown on aerial exhibit)	Property Owner and Mailing Address
11	Township of Coolbaugh, Attn: Douglas Hein, Business Mgr 5550 Memorial Boulevard Tobyhanna, PA 18466
12	Tobyhanna Military Reservation United States Army Tobyhanna Army Depot 11 Hap Arnold Boulevard, Tobyhanna, PA 18466-5078 Attn: Joe Merli

ATTACHMENT

7

ATTACHMENT "7"

TOBYHANNA #1 & #2 138/69 kV TAP

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. McLearen, Chief

Pennsylvania Department of Transportation
Commonwealth Keystone Building
400 North Street, 8th Floor
Harrisburg, Pennsylvania 17120
Attn: The Honorable Allen D. Beihler, P.E.,
Secretary

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

Monroe County Commissioners
1 Quaker Plaza, Room 201
Stroudsburg, PA 18360
Attn: Suzanne McCool, Chairman

Monroe County Planning Commission
1 Quaker Plaza, Room 106
Stroudsburg, PA 18360
Attn: John Woodling, Executive Director

Coolbaugh Township
5550 Memorial Boulevard
Tobyhanna, Pa 18466
Attn: Douglas A. Hein, Business Manager

Coolbaugh Township Board of Supervisors
5550 Memorial Boulevard
Tobyhanna, Pa 18466
Attn: Joseph O'Boyle, Chairman

Coolbaugh Township Planning Commission
5550 Memorial Boulevard
Tobyhanna, Pa 18466
Attn: Wayne C. Horne, Chairman