



Before the
Pennsylvania Public Utility Commission

**TAFTON #2
138/69 kV TAP LINE**

**Attachments in Support of the
Letter of Notification**

Application Docket No. _____

Submitted by: PPL Electric Utilities Corp.

SUMMARY

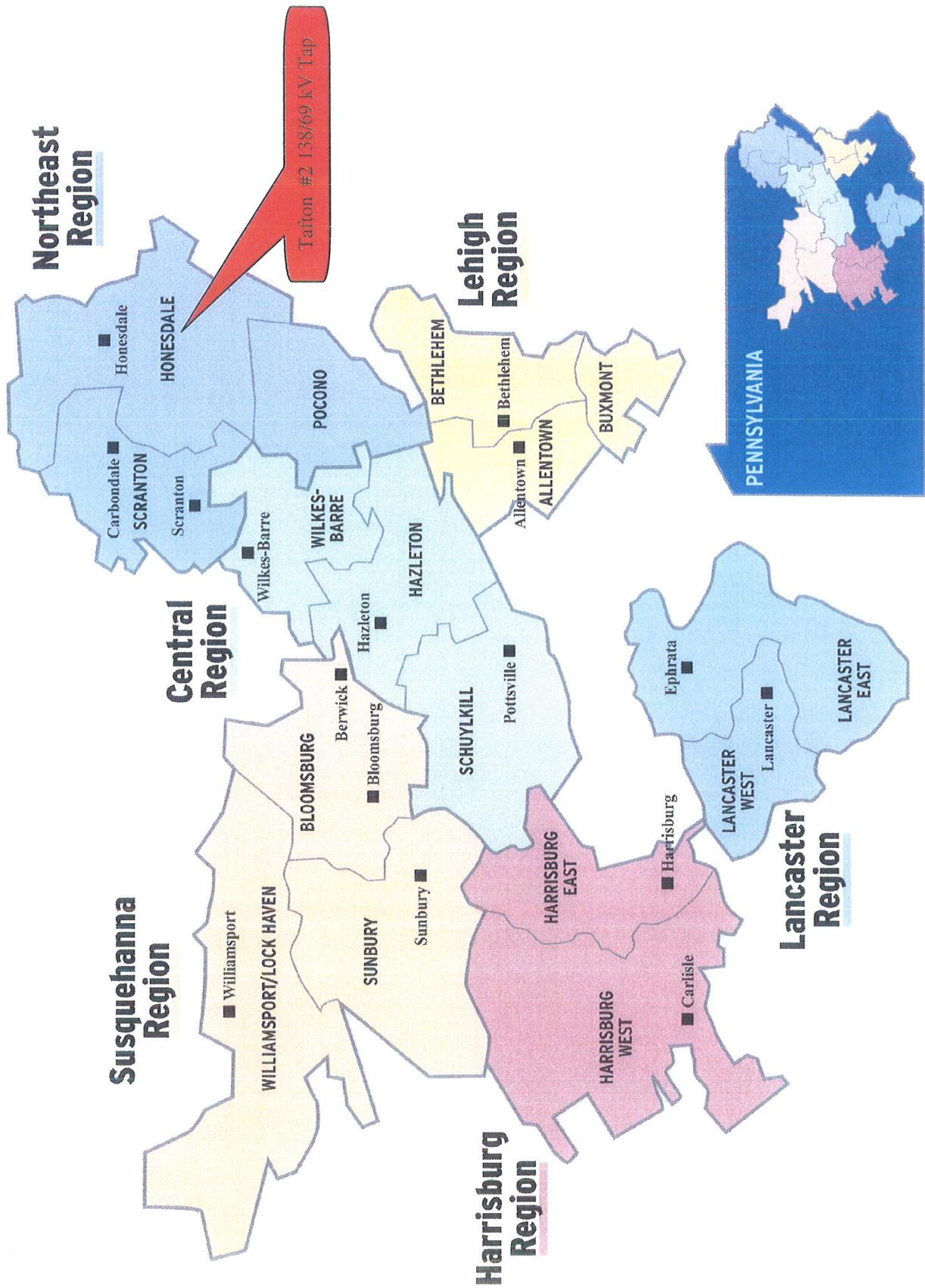
This Letter of Notification is being submitted by PPL Electric Utilities Corporation (PPL Electric) pursuant to the Pennsylvania Public Utility Commission's (PUC or the Commission) regulations at 52 Pa. Code §§ 57.71 through 57.77 for approval to site and construct the Tafton #2 Tap. This proposed tap will be connected to the Tafton 138/69 kV Tap which serves the Tafton 69-12 kV Substation to create a double tap-single feed configuration which will provide a second source of electricity to the Tafton Substation and improve the reliability of electric service to customers in the area. This project is located in Blooming Grove Township, Pike County. The modified tap will be designed and constructed for 138 kV operation, although the tap will initially be operated at 69 kV.

The total estimated cost to site, design and construct the modified tap is approximately \$565,000. This project has a scheduled construction start date of February 2012, in order to meet an in-service date of September 2012.

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 Involved Governmental Agencies, Municipalities, and Other Public Entities |
| Attachment "7" | List of Owners of Property within the Right-of-Way |

PPL ELECTRIC UTILITIES SERVICE TERRITORY



Attachment 1

**ATTACHMENT “1”
TAFTON #2 138/69 kV TAP LINE
NECESSITY STATEMENT**

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MAP

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ATTACHMENT "1"
TAFTON #2 138/69 kV TAP LINE
NECESSITY STATEMENT

A. INTRODUCTION

PPL Electric is proposing to reinforce its 138/69 kV electrical system in Pike and Wayne Counties by reducing the loading on the Blooming Grove – West Damascus 138/69 kV line. As explained herein, PPL Electric is proposing to transfer the electric service source for the Tafton 69-12 kV Substation from the Blooming Grove – West Damascus 138/69 kV Transmission Line to the Blooming Grove – Honesdale 138/69 kV Transmission Line.

This project is located in Blooming Grove Township, Pike County. The total estimated cost of the proposed project is \$565,000. PPL Electric plans to begin construction in February 2012 to meet an in-service date of September 2012. This project is the first step of a multi-stage program that will be implemented to increase the reliability of service in Pike and Wayne Counties.

B. EXISTING SYSTEM

Presently, PPL Electric's Tafton 69-12 kV substation is supplied from the Blooming Grove-West Damascus 138/69 kV Line. This line presently provides electricity to 7 distribution substations that serve approximately 22,000 customers in Pike and Wayne Counties. The Tafton Substation serves 3,400 customers and is tied to the Blooming Grove – West Damascus line via a 138/69 kV transmission tap that is approximately 4 miles long. The Blooming Grove – West Damascus Line, in the vicinity of the Tafton 138/69 kV Tap, is situated adjacent to the Blooming Grove – Honesdale 138/69 kV Line.

C. DEFINITION OF THE PROBLEM

In order to guide its planning processes and to establish standards for its transmission and distribution systems which will enable it to provide safe and reliable service at a reasonable cost,

PPL Electric has adopted its Reliability Principles and Practices (RP&P). PPL Electric relies on the standards set forth in the RP&P for guidance in determining when it is appropriate to reinforce its transmission and distribution systems. The RP&P guidelines recommend that normal 69 kV line loading not exceed 60 MVA, so that for the loss of one line, the load from the out-of-service line can be transferred to another in-service line.

By the 2012-2013 winter, the projected loading on the Blooming Grove-West Damascus Line during peak winter conditions will be 81 MVA. The loading on the Blooming Grove-West Damascus Line will exceed the recommended guideline of 60 MVA. Also, the loss of one line would exceed the emergency thermal ampacity rating on the remaining in-service line. The projected loading on the Blooming Grove-Honesdale Line, by the 2012-2013 winter, will be 35 MVA.

Additionally, by the 2012-2013 winter, the loss of the Blooming Grove-West Damascus 138/69 kV Line, which is supplied by the Blooming Grove Substation, would initially interrupt 81 MW of load. Transferring load from the Blooming Grove to the Peckville Substation would be limited (a) to prevent low voltage at the end of the Blooming Grove-West Damascus Line, and (b) to prevent overloading segments of small-sized conductor on the Peckville-Varden Line. Under these circumstances, customer load served by distribution substations located at Tafton, Kimbles, Tennessee Gas Pipeline (Customer), Indian Orchard, Bohemia, and West Damascus would be interrupted by the Power Dispatcher to restore voltage along the line to within the acceptable operating range.

For these reasons, an outage of the Blooming Grove – West Damascus Line would interrupt approximately 72 MW of customer load for extended periods. The maximum allowable load loss for a single-circuit line outage for up to 10 hours under the RP&P guidelines is 30 MW. An outage on the Blooming Grove – West Damascus Line, as it is currently configured, would violate the RP&P guideline.

D. PROPOSED SOLUTION

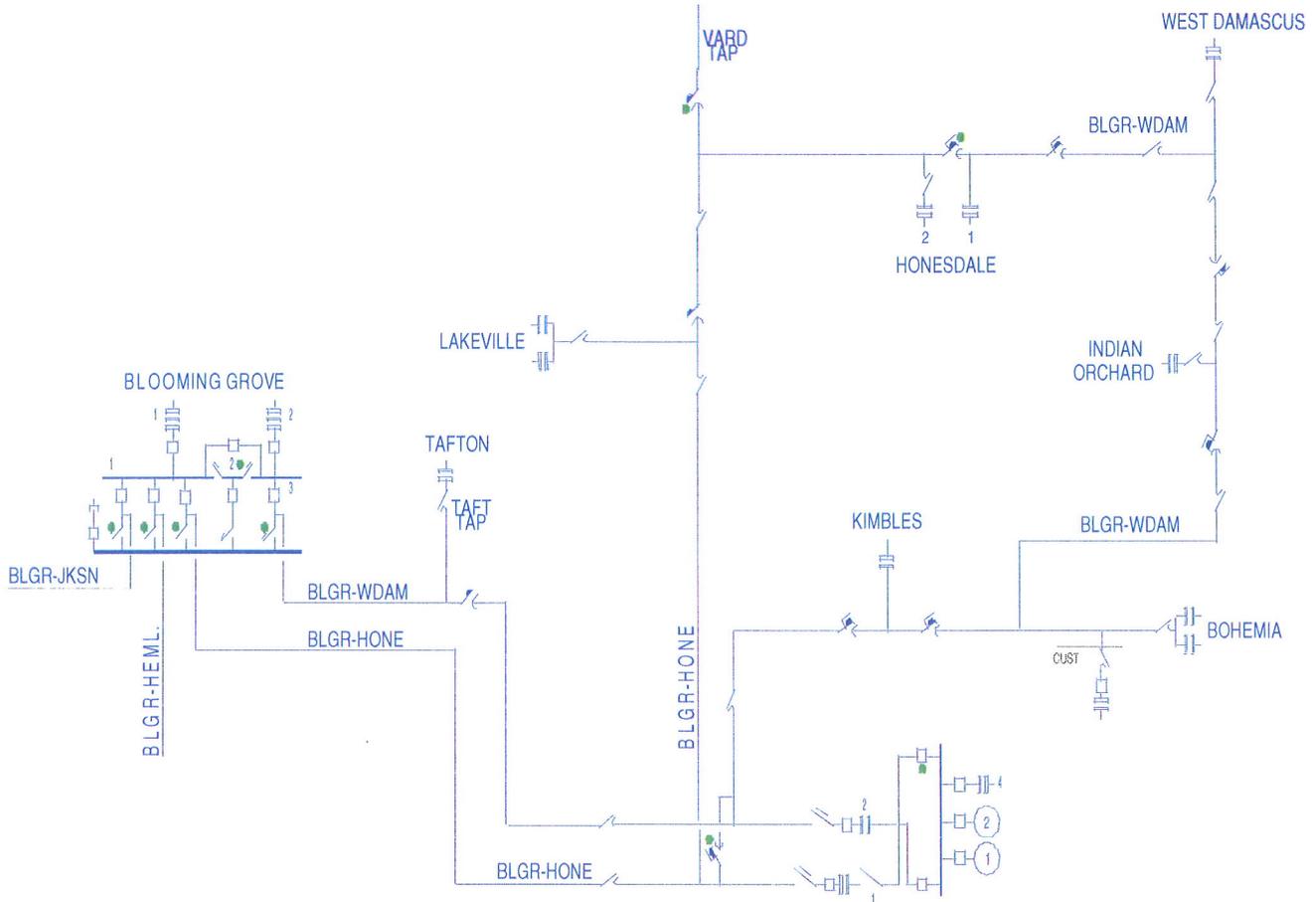
To resolve the problem described above, PPL Electric proposes several projects to reduce the loading on the Blooming Grove-West Damascus 138/69 kV Line. The project described herein is one of the projects that, together, will resolve the overloading of the Blooming Grove – West Damascus 138/69 kV Line. This project will transfer the electric supply source for the Tafton 69-12 kV Substation from the Blooming Grove – West Damascus 138/69 kV Transmission Line to the Blooming Grove – Honesdale 138/69 kV Transmission Line. This transfer will be accomplished by constructing a double tap-single feed connection (“DT/SF”) to the Tafton 69-12 kV Substation. Presently, the Tafton Substation is supplied via the single circuit Tafton #1 138/69 kV Tap from the Blooming Grove – West Damascus 138/69 kV Transmission Line. The proposed project involves the construction of the Tafton #2 138/69 kV Tap from the Blooming Grove – Honesdale 138/69 kV Transmission Line. The DT/SF connection will be used by the Transmission Operations group to balance the load on the Blooming Grove-West Damascus line by transferring the load to the Blooming Grove-Honesdale line. Switches in the Blooming Grove-West Damascus and Blooming Grove-Honesdale 138/69 Lines and the DT/SF connection also provide the Transmission Operations group with the flexibility to transfer the Tafton load between the Blooming Grove-West Damascus Line and Blooming Grove-Honesdale Lines to permit maintenance and during an outage.

After this project is completed, the projected peak winter load on the Blooming Grove-Honesdale Line will be 48 MVA, and the projected loading on the Blooming Grove-West Damascus Line under peak winter conditions will be approximately 71 MVA, which is closer to the RP&P guideline. As stated above, this project is part of a multi-project solution to increase reliability of service in Pike and Wayne Counties. Upon completion of the remaining projects within this program, the projected peak winter loading on the Blooming Grove – West Damascus Line will be below the RP&P guideline. PPL Electric will submit additional filings relative to the remaining projects as required.

E. FUNCTIONAL ALTERNATIVES

PPL Electric was unable to identify any reasonable or practical alternative means of transferring the load served by the Tafton 69-12 kV Substation from the Blooming Grove – West Damascus 138/69 kV Transmission Line to the Blooming Grove – Honesdale 138/69 kV Transmission Line. Therefore, no functional alternative was evaluated.

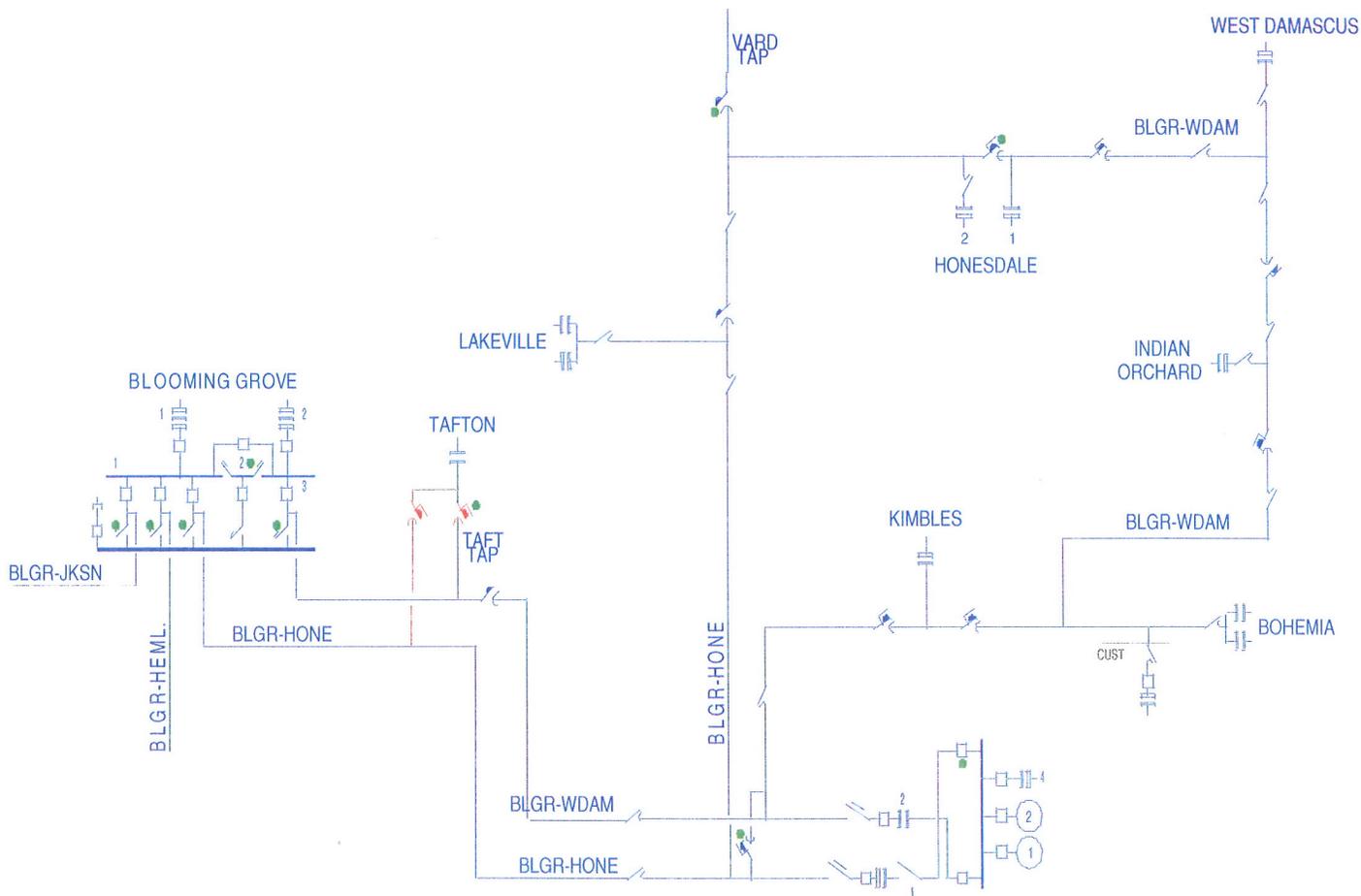
**FUNCTIONAL ONE-LINE DIAGRAM
EXISTING 138/69 kV TRANSMISSION SYSTEM**



BLGR-HONE = Blooming Grove-Honesdale 138/69 kV line
 BLGR-WDAM = Blooming Grove-West Damascus 138/69 kV line
 BLGR-HEML = Blooming Grove-Hemlock 138/69 kV line
 BLGR-JKSN = Blooming Grove-Jackson 138/69 kV line

FIGURE 1

**FUNCTIONAL ONE-LINE DIAGRAM
PROPOSED 138/69 kV TRANSMISSION SYSTEM**



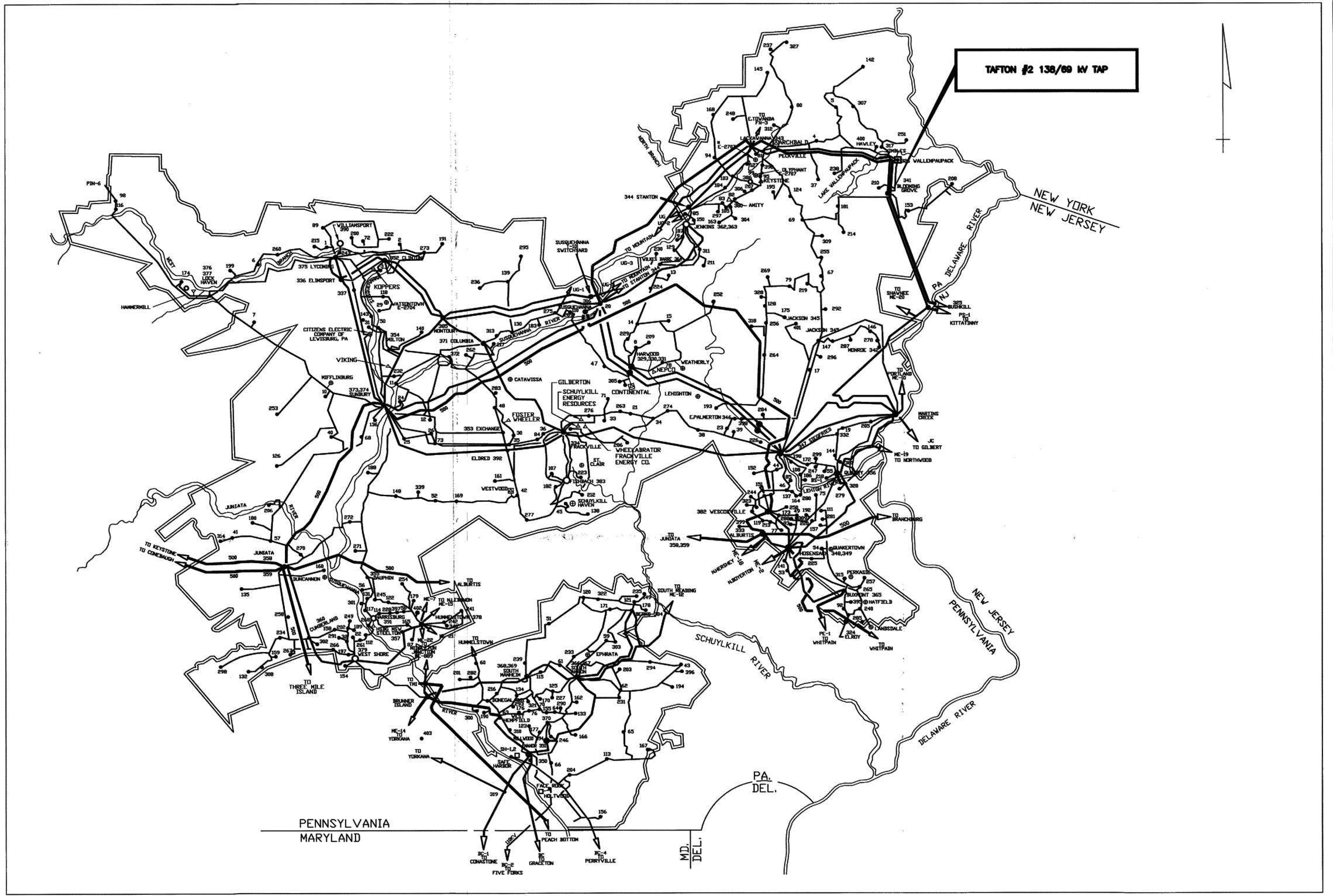
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 BLGR-JKSN = Blooming Grove-Jackson 138/69 kV Line

FIGURE 2

SUBSTATION LISTING

1	WEST WILLIAMSPORT	151	CRACKERSPORT	301	CENTER CITY
2	FAIRFIELD	152	SCHNECKSVILLE	302	NEW KINGSTOWN
3	MONTGOMERY	153	HENRICK	303	REAMSTOWN
4	YARDEN	154	MT. ALLEN	304	DUPONT
5	HONESDALE	155	PRINCE	305	HUMBLDT
6	JERSEY SHORE	156	WAKEFIELD	306	CEDAR AVE
7	LEGANTON	157	COOPERSBURG	307	INDIAN ORCHARD
8	VALMONT	158	VERTZVILLE	308	NOTTINGHAM
9	RIVER	159	WEST CARLISLE	309	NORTH COOLBAUGH
10	LIMESTONE	160	BENVENUE	310	LETOPI
11	NORFOLK	161	HEGINS	311	EAST MOUNTAIN
12	REED	162	LEOLA	312	JERMYN
13	VRIGHT	163	YATESVILLE	313	BLONDSBURG
14	ST. JOHNS	164	CENTRAL ALLENTOWN	314	MIFFLINTOWN
15	FREELAND	165	OSBERLIN	315	RIDGE ROAD
16	GILBERT	166	STRASBURG	316	SUSQUEHANNA
17	CHERRY HILL	167	T-10 SW. Y.D.	317	KIMBLES
18	SUSQUEHANNA 230KV	168	BROOKSIDE	318	CHRISTMANS
19	TAMMEND	169	VILLIAMSPORT	319	OTTIACREEK
20	WHITE HILL	170	E. PETERSBURG	320	STEEL CITY
21	PALMERTON	171	WERNERSVILLE	321	MC GOVERNORVILLE
22	HAMILTON	172	N. BETHLEHEM	322	ROBSOMIA
23	HUNTER	173	W. ALLENTOWN	323	S.FUGELSVILLE
24	FAIRVIEW	174	FLEMINGTON	324	ELROY
25	MONTOUR PUMP	175	MECKESVILLE	325	BUSHKILL
26	MT. CARMEL	176	JUNERSVILLE	326	VALLENPAUPACK
27	SPORTING HILL	177	MILLERSVILLE	327	ELK MOUNTAIN
28	MAHANDY CITY	178	SHILLINGTON	328	JACK FROST
29	GREENWOOD	179	DUKE	329	HARWOOD 230/69KV
30	MOVRY	180	W. LISTERVILLE	330	HARWOOD CTG
31	ALTAHOUNT	181	NEWFUNDLAND	331	HARWOOD 69/12KV
32	HAWK	182	MARLIN	332	NAZARET CTG
33	ASHFIELD	183	WEST BERWICK	333	ALBURTIS
34	SOUTH SLATINGTON	184	KEYSER AVENUE	334	FRACKVILLE
35	SOUTH MIDDLEBURG	185	MICKLEYS	335	ELIMSPT
36	FRAYLEY	186	EAST ALLENTOWN	336	ALLENWOOD
37	MORGANTOWN	187	PINE RIDGE	337	ALLENWOOD
38	EGYPT	188	DALMATIA	338	GRATZ
39	CRESSONA	189	PENNSBURG	339	HOCKERSVILLE
40	SOUTH WHITEHALL	190	NORTH COLUMBIA	340	BLOOMING GROVE
41	EAST TOMCHICKEN	191	HUGHESVILLE	341	MORRIS
42	BEAR GAP	192	SOUTH ALLENTOWN	342	JACKAWANNA #
43	SALISBURY	193	W. ALLENTOWN	343	STANTON
44	SOUTH MILTON	194	HONEYBROOK	344	JACKSON
45	LYKEN	195	MOSCOW	345	EAST PALMERTON
46	UPPER HANDOVER	196	ROSSMOYNE	346	SIEGFRIED
47	RIEHLAND	197	NORTHAMPTON	347	HOSENSACK 230/69KV
48	MACADA	198	WOLFRICH	348	HOSENSACK 500KV
49	ROCKVILLE	199	FAXON	349	CONESTOGA
50	THOMPSONTOWN	200	ELIZABETHTOWN	350	MANOR
51	PAXTON	201	ENOLA	351	CLINTON
52	COCALICO	202	HEGANS HILL	352	EXCHANGE
53	EAST ELIZABETHTOWN	203	BUCK	353	MILTON
54	WARWICK	204	MT. BETHEL	354	DAUPHIN
55	EARL	205	RICHFIELD	355	QUARRY SUB.
56	EAST LANCASTER	206	THOMPSONTOWN	356	STEELTON
57	KINZER	207	TWIN LAKES	357	JUNIATA 500/230KV
58	MT. NEBO	208	HARLEIGH	358	JUNIATA 230/69KV
59	POCONO	209	EAST TEXAS	359	CUMBERLAND
60	PENNS	210	CANDENSIS	360	DONEGAL
61	GOULDSPORT	211	LINDEN	361	JENKINS 230/69KV
62	DILLERVILLE	212	MT. JAY	362	JENKINS CTG
63	GIRARD HANDB	213	MINI TRAIL	363	WILKES-BARRE
64	KENMAR	214	LAKE NAOMI	364	BUXMONT
65	GOVEN CITY	215	LANARK	365	SOUTH AKRON 230/138/69KV
66	ELLIOT HEIGHTS	216	LANARK	366	SOUTH AKRON 69/12KV
67	ROHRERSTOWN	217	MONTOURSVILLE	367	SOUTH MANHEIM 69/12KV
68	MACUNGIE	218	PORT CARBON	368	SOUTH MANHEIM 230/69KV
69	EAST HAZLETON	219	BLYTHEBURN	369	ENGLESDALE
70	WAGNERS	220	MILFORD	370	COLUMBIA
71	EAST CARBONDALE	221	TRICHLERS	371	DANVILLE
72	EYNON	222	SOUTH WILKES	372	SUNBURY
73	MINDOKA	223	RUTHERFORD	373	HUMMELS VHAUF
74	OLD FORGE	224	HARLAND	374	LYCOMING
75	FOUNTAIN SPRINGS	225	WEST NEW HOLLAND	375	LOCK HAVEN CTG
76	SULLIVAN TRAIL	226	POINT	376	LOCK HAVEN 69/12KV
77	SVATARA	227	MIDDLETON	377	HUMMELSTOWN
78	HEPBURN	228	STATE HILL	378	WEST SHORE
79	FRANCONIA	229	MILLVILLE	379	MONTAGE
80	EMMAUS	230	TINKER	380	SOUTH FARMERSVILLE
81	MORGAN	231	LAKEVILLE	381	VESCOVILLE
82	THROOP	232	NORTH MANHEIM	382	FISHBACH
83	CATAWAHA	233	HATFIELD	383	BERKS
84	SEIDERSVILLE	234	HERSHEY	384	MENTOR
85	ROSEMONT	235	S. HERSHEY	385	SUBURBAN YARD
86	QUARRYVILLE	236	WILLIAMSPORT	386	EDLA
87	LAWNTON	237	FOGELSVILLE	387	SUMMERDALE
88	LITITZ	238	WINDSOR	388	DORNEYVILLE
89	RENOVO	239	W. WILLOW	389	BOHEMIA
90	WALNUT	240	WESTGATE	390	WHITE HAVEN
91	CHAPMAN	241	EDLA	391	LAURELTON
92	SUBURBAN	242	SUMMERDALE	392	LINGLESTOWN
93	PROVIDENCE	243	DORNEYVILLE	393	POCONO FARMS
94	AVOCA	244	BOHEMIA	394	HICKORY RUN
95	CASS	245	WHITE HAVEN	395	BLOOMING GLEN
96	CATAWAHA	246	LAURELTON	396	SHERMANSDALE
97	SUSQUEHANNA 500KV	247	LINGLESTOWN	397	LARRY'S CREEK
98	SEIDERSVILLE	248	POCONO FARMS	398	SPANGLER MILLS
99	ROSEMONT	249	HICKORY RUN	399	EL DANVILLE
100	QUARRYVILLE	250	BLOOMING GLEN	400	SCHADENECK
101	LAWNTON	251	SHERMANSDALE	401	HAWLEY
102	LITITZ	252	LARRY'S CREEK	402	EFFORT MOUNTAIN
103	RENOVO	253	SPANGLER MILLS	403	COOPERSTONE
104	WALNUT	254	EL DANVILLE		RED FRONT
105	CHAPMAN	255	SCHADENECK		
106	SUBURBAN	256	HAWLEY		
107	PROVIDENCE	257	EFFORT MOUNTAIN		
108	AVOCA	258	COOPERSTONE		
109	CASS	259	RED FRONT		
110	CATAWAHA	260			
111	SUSQUEHANNA 500KV	261			
112	SEIDERSVILLE	262			
113	ROSEMONT	263			
114	QUARRYVILLE	264			
115	LAWNTON	265			
116	LITITZ	266			
117	RENOVO	267			
118	WALNUT	268			
119	CHAPMAN	269			
120	SUBURBAN	270			
121	PROVIDENCE	271			
122	AVOCA	272			
123	CASS	273			
124	CATAWAHA	274			
125	SUSQUEHANNA 500KV	275			
126	SEIDERSVILLE	276			
127	ROSEMONT	277			
128	QUARRYVILLE	278			
129	LAWNTON	279			
130	LITITZ	280			
131	RENOVO	281			
132	WALNUT	282			
133	CHAPMAN	283			
134	SUBURBAN	284			
135	PROVIDENCE	285			
136	AVOCA	286			
137	CASS	287			
138	CATAWAHA	288			
139	SUSQUEHANNA 500KV	289			
140	SEIDERSVILLE	290			
141	ROSEMONT	291			
142	QUARRYVILLE	292			
143	LAWNTON	293			
144	LITITZ	294			
145	RENOVO	295			
146	WALNUT	296			
147	CHAPMAN	297			
148	SUBURBAN	298			
149	PROVIDENCE	299			
150	AVOCA	300			

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



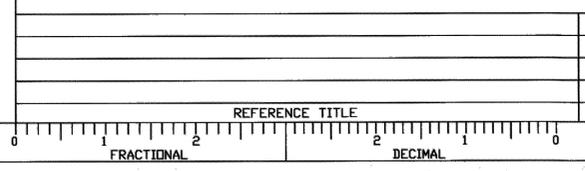
INTERCONNECTIONS

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 (circle with dot)
 - HYDRO ELECTRIC (square with dot)
 - COMBINATION (square with circle)
 - FIRM SALES (circle with dot)
 - SUBSTATION / SWITCHING STATION (square with dot)
 - STEAM ELECTRIC (square with dot)
 - NON-UTILITY GENERATION (triangle with dot)
 - INDEPENDENT POWER PRODUCERS (square with dot)
- 500KV OPERATION (thick line)
 230KV OPERATION (medium line)
 138KV OPERATION (thin line)
 69KV OPERATION (dashed line)

ACCT - 805201	ELECTRICAL SYSTEM MAP	
SCALE - NONE	TAFTON	
BY - CDW	#2 138/69KV TAP LINE	
APPROVED	DATE	PPL ELECTRIC UTILITIES
G. HAKUN III	7/17/85	
PPL DRAWING NO.	SHEET NO.	REV.
D191830	1	89

PPL ELECTRIC UTILITIES



NO.	DATE	ACCT.	DESCRIPTION	BY	REVIEWED	APPROVED
88	5/6/11	0012075	ADDED LEDGEDALE 138/69 KV TAP LINE PROJECT RELOCATION.	MG	RWM	KBK
87	4/17/11	161723	ADDED HARWOOD - JENKINS #1 & #2 138/69 KV LINE	MG	RWM	DLH
86	4/15/11	0013847	ADDED HOSENSACK - WESCOESVILLE #3 230 KV LINE REPLACEMENT	MG	RWM	DLH
85	5/20/11	0014555	ADDED TAFTON #2 138/69KV TAP	GRC	RWM	DJG

Attachment 2

ATTACHMENT "2"
TAFTON #2 138/69 kV TAP LINE
ENGINEERING DESCRIPTION

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MAP

MAP 1	AERIAL EXHIBIT – DRAWING.....	ATTACHMENT "2" MAP POCKET
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ATTACHMENT “2”
TAFTON #2 138/69 kV TAP LINE
ENGINEERING DESCRIPTION

A. DESCRIPTION OF PROPOSED LINE

PPL Electric proposes to transfer the electric supply source for the Tafton 69-12 kV Substation from the Blooming Grove – West Damascus 138/69 kV Transmission Line to the Blooming Grove – Honesdale 138/69 kV Transmission Line. This transfer will be accomplished by constructing a double tap-single feed (DT/SF). Presently, the Tafton Substation is served via a single circuit 138/69 kV tap off the Blooming Grove – West Damascus 138/69 kV Transmission Line. The proposed project includes the construction of a second tap to the Tafton 69-12 kV Substation. The new tap will be from the Blooming Grove – Honesdale 138/69 kV Transmission Line. The DT/SF connection will be used by the Transmission Operations group to balance the load on the Blooming Grove-West Damascus line by transferring the load between the Blooming Grove-Honesdale Line and the Blooming Grove – West Damascus Line. The DT/SF connection will also provide the Transmission Operations group the ability to transfer the Tafton load between the Blooming Grove-West Damascus Line and Blooming Grove-Honesdale Line for maintenance and during outages.

The new tap will be designed and constructed for single-circuit 138 kV operation, although it initially will be operated at 69 kV. The remaining portion of the tap, which was constructed in 1975, and pre-dated the siting regulations, presently operates at 69 kV but was designed and built for 138 kV operation. The modified tap will be operated at 138 kV when future load increases make it appropriate to do so. This project is located in Blooming Grove Township, Pike County. The location of these proposed facilities is shown on the Aerial photograph in the pocket at the end of Attachment “2.”

The proposed tap line design includes approximately 460 feet of new conductor which will be supported by 3 steel mono-poles, a steel double H-Frame structure and 2 Load Sectionalizing Air

Break Switch (LSAB) structures. One existing pole currently supporting the existing tap will be removed and the conductor will be re-hung on half of the new steel pole double H-Frame structure. PPL Electric will use a pole for the proposed tap that was previously installed during the construction of the Blooming Grove-Honesdale Line. This structure is approximately 49 feet in height (see Figure 1). This structure will be re-configured to accommodate the new tap and will be guyed. The double H-Frame structure will be approximately 38 feet tall with conductors at 28 feet above grade and will be guyed. The relatively low 28 foot height is required since the two taps will cross beneath the existing Blooming Grove – Peckville 230 kV Transmission Line. The two LSAB structures will be approximately 57 feet tall and will be direct embedded. A dead end pole will be placed at the northern end of the new tap line and will be approximately 57 feet tall and will be direct embedded.

The new circuit will consist of three power conductors and one overhead ground wire. The power conductors will be 556.5 kcmil,¹ 24/7 strand ACSR.² A 3/8-inch steel overhead ground wire will provide lightning protection for the tap line. The proposed configuration is shown on the Aerial photograph in the pocket at the end of Attachment “2.”

The new 138/69 kV tap 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 provided in Attachment 4. The minimum conductor-to-ground clearance will be 27 feet for the new tap. This minimum clearance occurs at a maximum thermal conductor temperature of 125°C. The design minimum conductor ground clearances and conductor thermal ratings are as follow:

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 ACSR³

<u>Condition</u>	<u>Single-circuit Design Clearance-to-Ground</u>
Normal load, average weather (16°C ambient, 60°F temperature)	28 feet
Predicted extreme thermal load (125°C conductor, 257°F temperature)	27 feet
Predicted NESC extreme wind load conditions (25 lbs., 16°C, 60°F temperature)	28 feet
Predicted extreme weather conditions, 0°F (1-inch ice, 4 lbs. wind, -18°C)	28 feet

TABLE 2
CONDUCTOR THERMAL RATING
556.5 KCMIL 24/7 ACSR
125°C MAXIMUM CONDUCTOR TEMPERATURE

<u>Condition</u>	Ambient Temperature <u>°C</u>	Wind Speed <u>Knots</u>	Ampacity <u>Amps</u>
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 a maximum tension of 3,000 pounds and a ruling span of 75 feet.

B. MAGNETIC FIELD MANAGEMENT

PPL Electric has instituted a Magnetic Field Management Program for new and rebuilt transmission lines, which is included as Attachment “5”. PPL Electric does not believe that current scientific evidence demonstrates that magnetic fields cause any adverse health effects or pose a health and safety danger to the public. Nevertheless, PPL Electric has determined, as a matter of policy, to design its new and rebuilt transmission lines to reduce magnetic fields when that can be done at low or no cost and consistent with functional requirements. This program generally calls for the use of line design that provides higher ground clearances and reverse phasing of new double circuit lines.

Reverse phasing is not possible because the proposed line is single-circuit. The use of taller structures is also not feasible, because the proposed tap will cross beneath the existing Blooming Grove – Peckville 230 kV Transmission Line.

C. RIGHT-OF-WAY STATUS

The new tap will be constructed in part on property owned in fee by PPL Electric and in part within an existing right-of-way. No additional right-of-way is required for the construction of the proposed tap.

FIGURE 1
PROPOSED 138/69 kV TAP STRUCTURE
APPROXIMATE HEIGHT - 49'

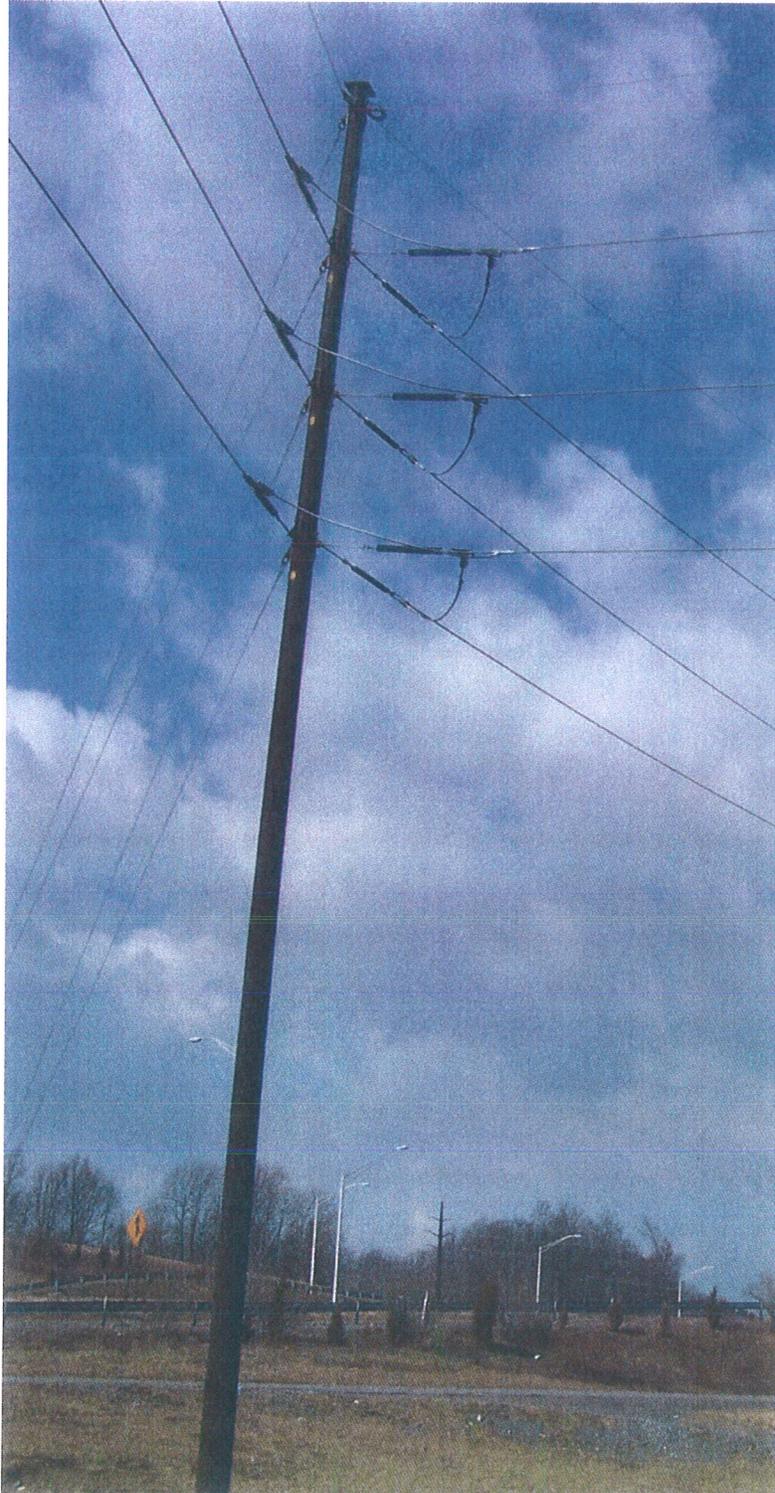


FIGURE 2
PROPOSED 138/69 kV TENSION STRUCTURE
APPROXIMATE HEIGHT – 29'

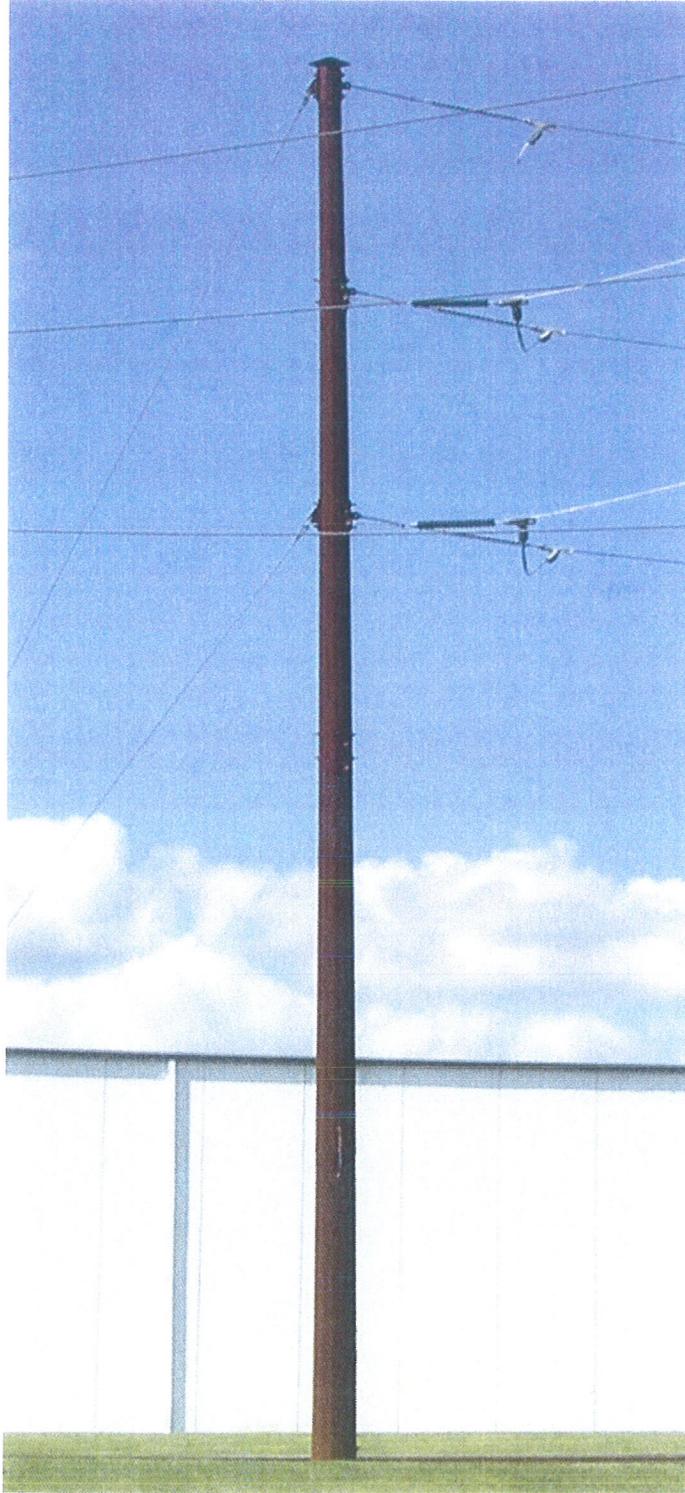
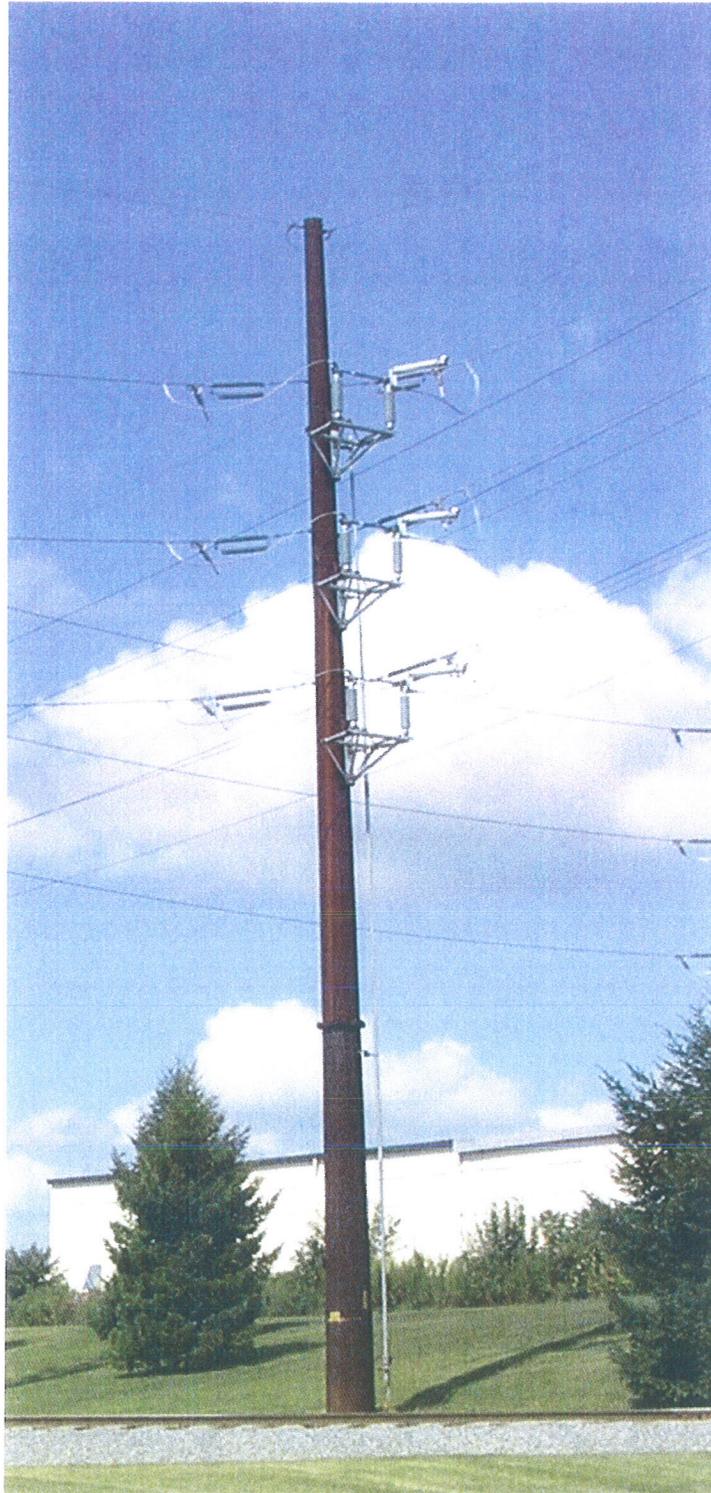
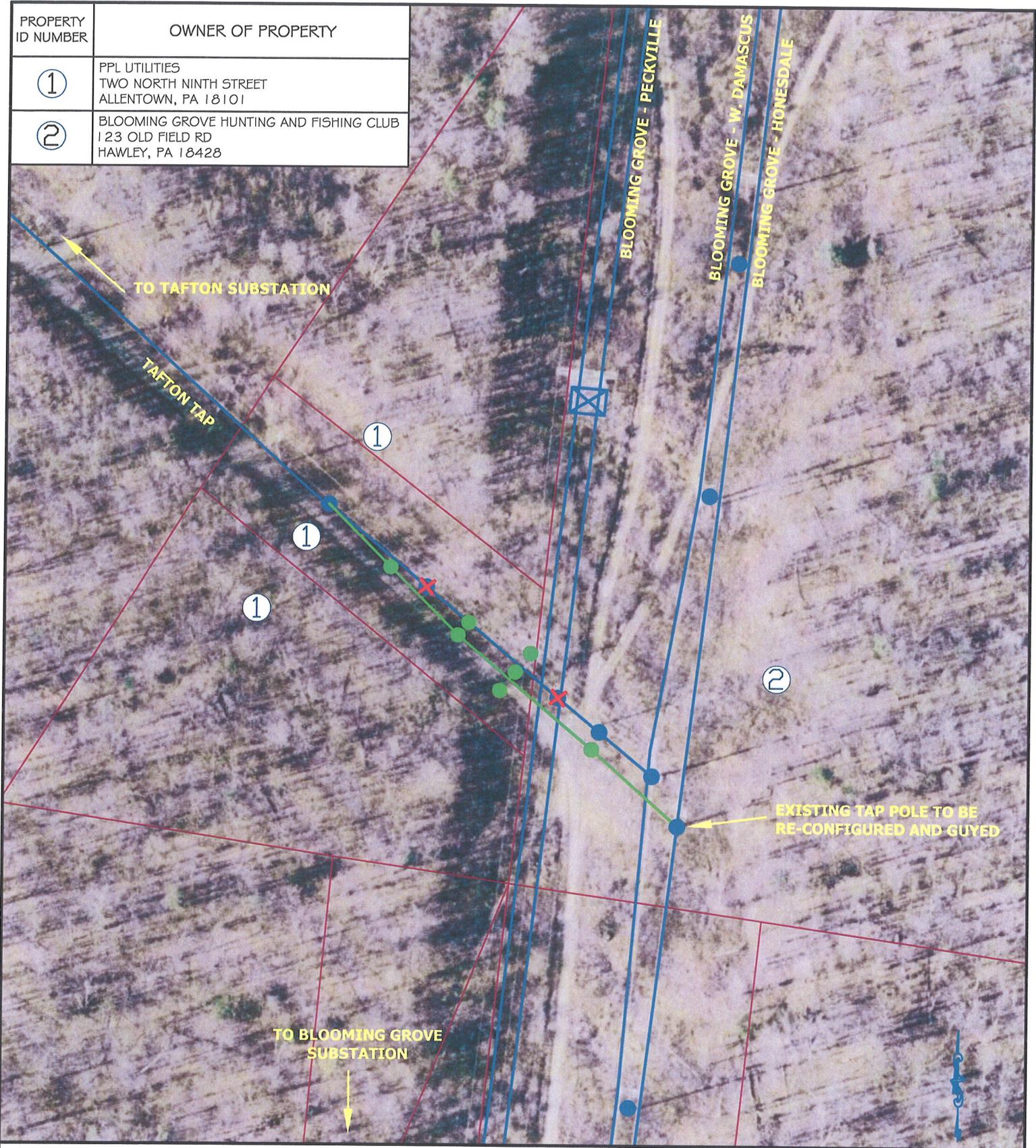


FIGURE 3
PROPOSED 138/69 kV SWITCH STRUCTURE
HEIGHT VARIES



PROPERTY ID NUMBER	OWNER OF PROPERTY
①	PPL UTILITIES TWO NORTH NINTH STREET ALLENTOWN, PA 18101
②	BLOOMING GROVE HUNTING AND FISHING CLUB 123 OLD FIELD RD HAWLEY, PA 18428



AERIAL PLAN
TAFTON #2 138/69 TAP
BLOOMING GROVE TOWNSHIP
PIKE COUNTY



PREPARED BY:
PPL ELECTRIC UTILITIES CORP.

LEGEND

- PROPERTY LINE (APPROX) —
- EXISTING PPL TRANSMISSION/TAP LINE —
- PROPOSED PPL TAP LINE —
- EXISTING LATTICE TOWER/POLE ⊠
- EXISTING POLE TO BE REMOVED ✕
- PROPOSED STEEL POLE (APPROX. LOCATION) ●

APPROXIMATE SCALE 1" = ~100'

Attachment 3

ATTACHMENT “3”
TAFTON #2 138/69 kV TAP LINE
ENVIRONMENTAL ASSESSMENT

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E.	THREATENED AND ENDANGERED SPECIES.....	3

ATTACHMENT “3”
TAFTON #2 138/69 kV TAP LINE
ENVIRONMENTAL ASSESSMENT

A. INTRODUCTION

PPL Electric proposes to transfer the electric supply source for the Tafton 69-12 kV Substation from the Blooming Grove – West Damascus 138/69 kV Transmission Line to the Blooming Grove – Honesdale 138/69 kV Transmission Line. This transfer will be accomplished by constructing a DT/SF connection, and will improve reliability of service and increase operational flexibility for PPL Electric customers in the area. Presently the Tafton Substation is served via a single circuit 138/69 kV tap off the Blooming Grove – West Damascus 138/69 kV Transmission Line. The proposed modification includes the installation of a second tap for the Tafton Substation. The supply source for the proposed tap will be from the Blooming Grove – Honesdale 138/69 kV Transmission Line. The second tap will be designed for single-circuit 138 kV operation, although it initially will be operated at 69 kV until future load growth makes it appropriate to upgrade the system to 138 kV.

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

B. LAND USE

The proposed DT/SF connection will be constructed entirely within an existing transmission corridor partially situated on land owned in fee by PPL Electric and partially on existing right-of-way. The project area is currently cleared of trees and contains an unpaved access road and residual brush. The project area is traversed by the existing Tafton Tap to the north. The Blooming Grove – Peckville 230 kV Line, Blooming Grove

- Honesdale 138/69 kV Line, and Blooming Grove – West Damascus 138/69 kV Line cross the eastern portion of the project site. The project area is primarily surrounded by undeveloped wooded parcels. The Blooming Grove 230 – 69 kV Substation is located approximately 0.25 miles to the south. Due to the transmission facilities already existing in the area and the limited size of this project, the incremental visual impacts of the project will be minimal.

No nearby communication towers, pipelines, or other utilities will be affected by the proposed project. Mountain Bay Airpark, a private airport, is located approximately 4.1 miles to the west of the project site. Impacts to this airport are not expected since the property currently contains structures that are taller than the proposed structures. Nonetheless, PPL Electric will file the appropriate notifications with the Federal Aviation Administration and the PennDOT Bureau of Aviation to confirm that the new tap 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 are no National Register eligible or listed historic or archaeological properties in the area (File No. ER 2011-0371-103-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 Delaware State Forest, which is located approximately 0.1 miles north of the project site and abuts the existing Tafton Tap further to the west; Bruce Lake Natural Area, which is located approximately 1.3 miles south of the project area; and State Game Lands No. 183, which is located 2.6 miles from the project site. There are no anticipated impacts to these areas due to the

relatively small size of the project compared to the existing electrical facilities already located adjacent to and near the project area, the distance from these features to the project area, and the existing mature forests surrounding the project area which provide a vegetative buffer.

It is not anticipated that significant tree clearing or brush removal will be required as part of this project since the project area is located on property traversed by multiple transmission lines that has already been cleared. However, if tree clearing or brush removal is required, 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” while performing the tree clearing

The proposed transmission tap will not cross any wetlands or areas designated as “Waters of the U.S.” or “Waters of the Commonwealth.” PPL Electric will acquire any required soil erosion and sedimentation control permits and PPL Electric will comply with all conditions placed on the permits.

E. THREATENED AND ENDANGERED SPECIES

PPL Electric has coordinated with 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 reported a potential impact to osprey and additional follow-up was required (PNDI Search ID: 20101109270233). Based on the results of the PNDI review, PPL Electric contracted Mellon Biological Services, LLC to review the project area and identify whether the proposed project would impact ospreys. The review concluded that the project would not impact ospreys and a report was submitted to the Pennsylvania Game Commission.

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 Involved Governmental Agencies, Municipalities
and Other Public Entities

ATTACHMENT “7” List of Owners of Property Within the Right-of-Way

ATTACHMENT "4"
TAFTON #2 138/69 kV TAP LINE
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

<u>Surface Underneath Conductors</u>	<u>Vertical Clearance to Ground</u>	
	<u>NESC Standard</u>	<u>PPL Electric Design</u>
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

<u>Surface Underneath Conductors</u>	<u>Vertical Clearance to Ground</u>	
	<u>NESC Standard</u>	<u>PPL Electric Design</u>
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

<u>Surface Underneath Conductors</u>	<u>Vertical Clearance to Ground</u>	
	<u>NESC Standard</u>	<u>PPL Electric Design</u>
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:

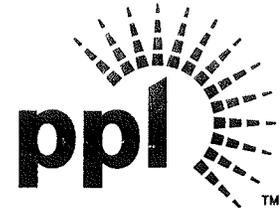
<u>Voltage-kV</u>	<u>Minimum Clearance</u>
138	3'-7"
230	5'-3"
500	11'-3"

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

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

Attachment

5



**MAGNETIC
FIELD
MANAGEMENT
PPL Electric Utilities
Corporation**

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

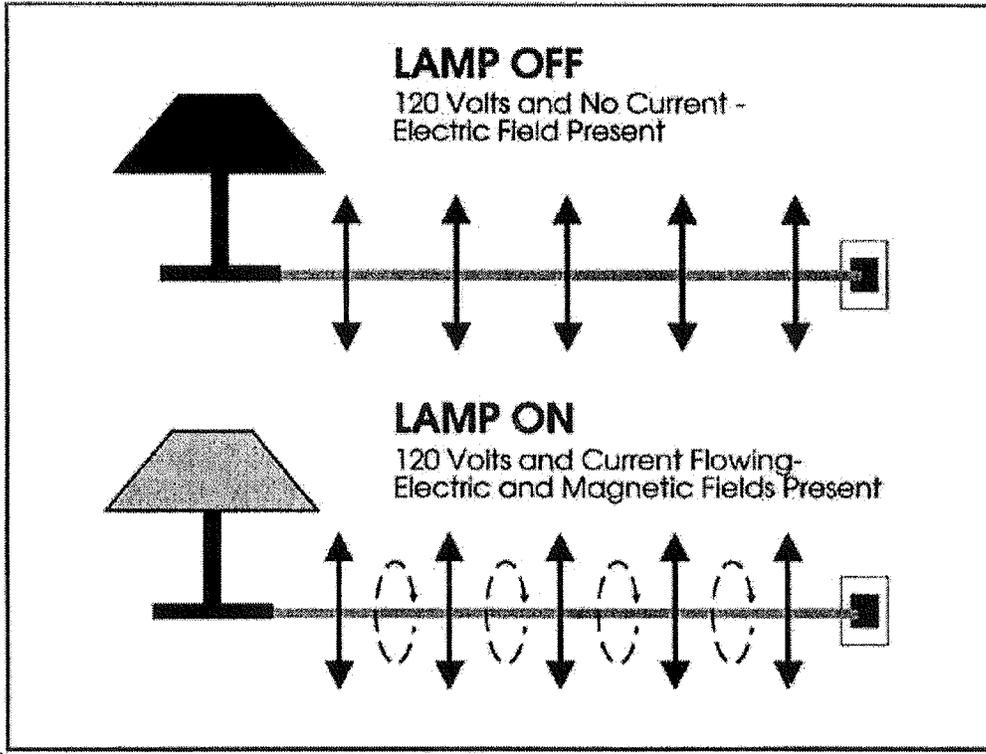


Figure 2

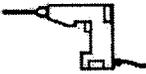
Magnetic field strengths decrease with distance Magnetic fields are measured in milligauss		Source: "EMF In Your Environment", U.S. Environmental Protection Agency 1992		
		At 6 inches	At 1 foot	At 2 feet
Clothes dryer		2 to 10	* to 3	*
Microwave oven		100 to 300	1 to 200	1 to 30
Toaster		5 to 20	* to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

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

Measuring Magnetic Fields

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

Figure 3

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

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

DEVELOPMENT OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

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

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

VARIABLES THAT AFFECT MAGNETIC FIELDS

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

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

EFFECT OF PHASE CURRENT ON MAGNETIC FIELDS

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

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

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

EFFECT OF CONDUCTOR CONFIGURATION ON MAGNETIC FIELDS

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

EFFECT OF DISTANCE FROM THE MAGNETIC FIELD SOURCE

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

SUMMARY OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

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

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

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

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

MAGNETIC FIELD MANAGEMENT PROGRAM GUIDELINES

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

OVERHEAD LINES

NEW OR REBUILT TRANSMISSION LINES

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

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

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

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

Chart VI illustrates the compact design structure.

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

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

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

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

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

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

138/69 kV Transmission Lines

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

230 kV Transmission Lines

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

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

500 kV Transmission Lines

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

RECONDUCTORING OR ADDING ADDITIONAL CIRCUITS TO EXISTING TRANSMISSION LINES

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

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

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

DISTRIBUTION LINES

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

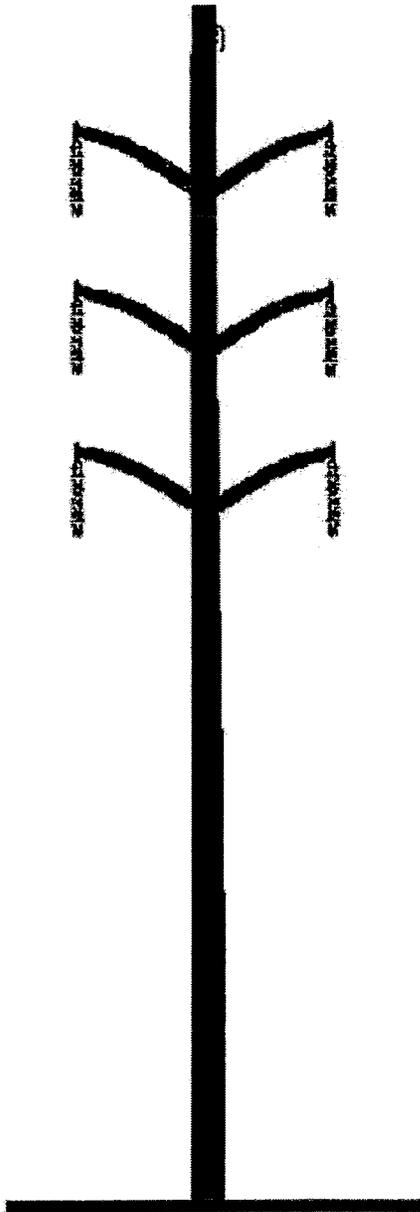
- Main lines are the most heavily loaded sections of a distribution line and therefore have the highest magnetic fields associated with them.
- Increasing the ground clearance by five feet reduces the magnetic field under the line from 14 mG to 11 mG using the standard eight-foot crossarm design. These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

UNDERGROUND TRANSMISSION LINES

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

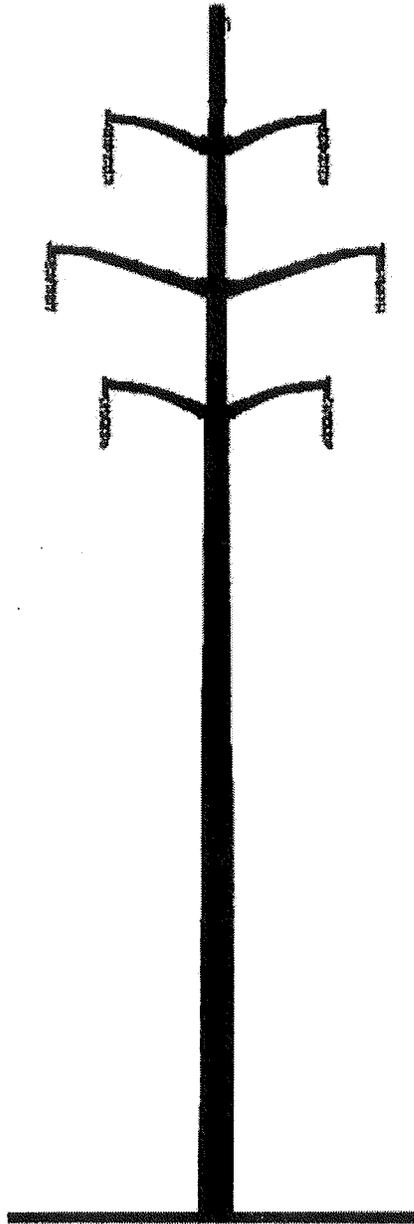
- The phase arrangement that produces the lowest field will be determined.
- The depth of burial of the line will be determined considering the cost of excavation and the location of other buried utilities in the area.
- The use of steel pipe ferromagnetic shielding that reduces magnetic fields will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

Short-Span Construction



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

Long-Span Construction Remains PPL EU 138 kV Standard



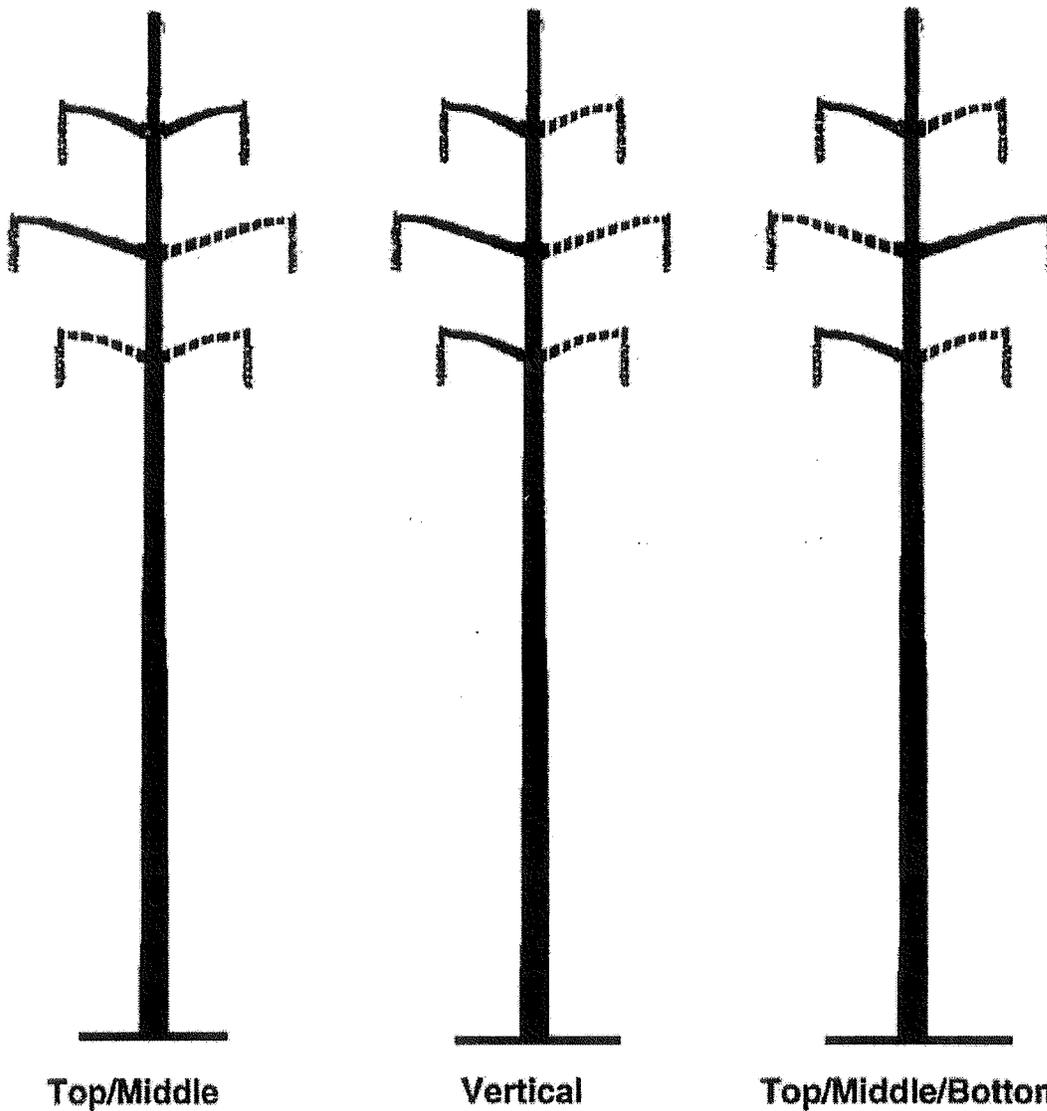
- Lower cost alternative
- Reduces magnetic fields due to higher structures
- Typical conductor data:
 - 1 3/8" HS steel overhead ground wire - 17.3 feet sag
 - 6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 23.0 feet sag
 - Average span - 600 feet

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

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

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

Typical Single-Circuit Structure Designs



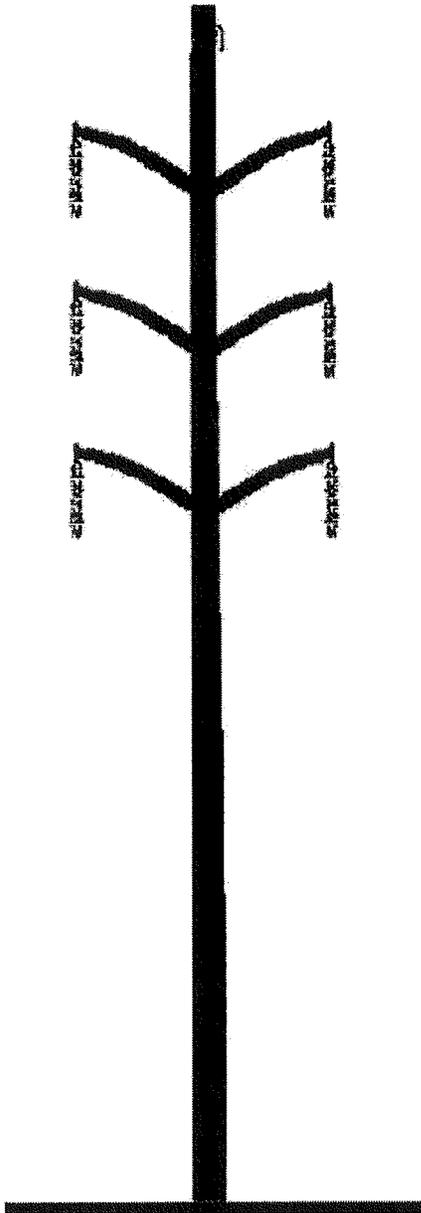
——— initial single circuit
- - - - - future second circuit

**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

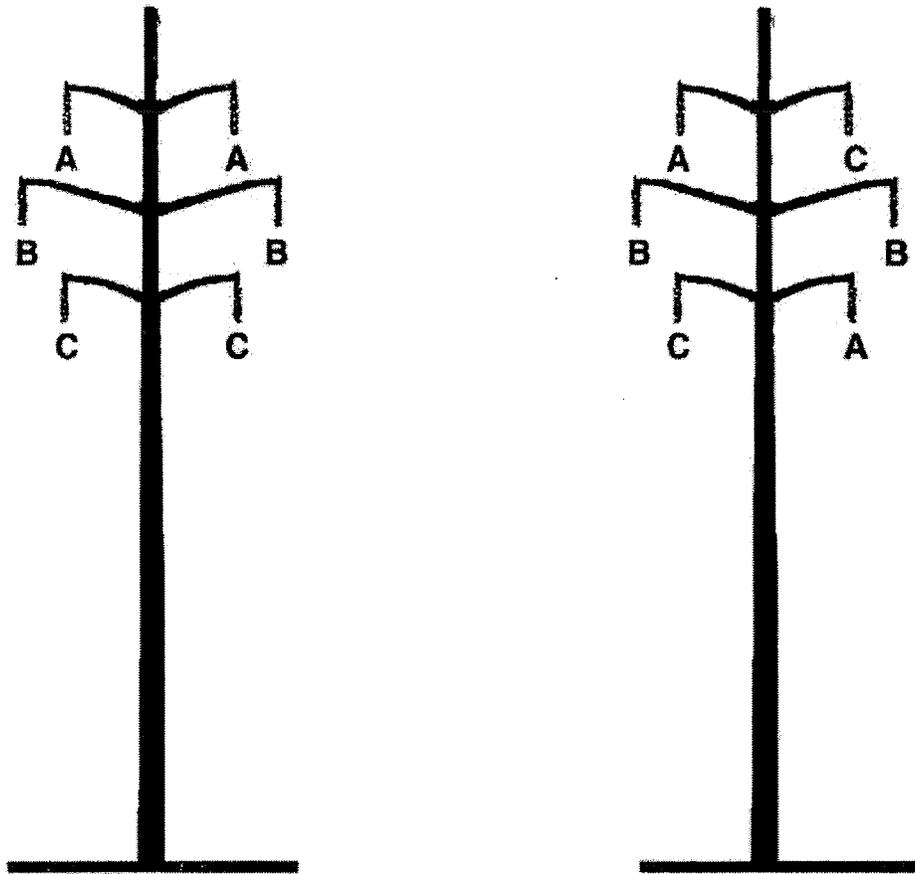
The edge of right of way is 50 feet from the line centerline.
The 400 ampere phase current is balanced between phases.
Calculations are based on a minimum ground clearance of 25 feet.

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: $\longrightarrow \longrightarrow \longrightarrow \longrightarrow$ To:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Attachment 6

ATTACHMENT "6"
TAFTON #2 138/69 kV TAP LINE
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

Pike County Commissioners
506 Broad Street
Milford, PA 18337
Attn: Richard A. Caridi, Chairman

Pike County Planning Commission
837 Rte 6, Unit 4,
Shohola, PA 18458
Attn: Georgene Snyder, Chair

Blooming Grove Township Board of Supervisors
488 Route 739
Blooming Grove, PA 18428
Attn: Fred D. Hatton, Chairman

Blooming Grove Township Planning Board
488 Route 739
Blooming Grove, PA 18428
Attn: Levi Travis, Sr., Chair

Attachment

7

ATTACHMENT "7"

TAFTON #2 138/69 kV TAP LINE

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

1. PPL Electric Utilities
Two North Ninth Street
Allentown, PA 18101

2. Blooming Grove Hunting and Fishing Club
123 Old Field Road
Hawley, PA 18428