Before the
Pennsylvania Public Utility Commission

SOUTH AKRON-DILLERVILLE
#1 & #2 138 kV LINE

ATTACHMENTS IN SUPPORT OF THE
Letter of Notification

Application Docket No.____________

Submitted by: PPL Electric Utilities Corporation

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 construct approximately 1,360 feet of new double-circuit 138 kV transmission line and to increase the operating voltage of a portion of the existing South Akron-South Manheim #1 and #2 69 kV Transmission Line and the Dillerville #1 and #2 69 kV Taps, approximately 12 miles in total, from 69 kV to 138 kV. PPL Electric will utilize existing structures in the portion of the Line that is being converted to 138 kV operation. These structures, however, will be modified to meet current standards for 138 kV operation. Specifically, the structures will be reinsulated, and the upper arms, which support two of the six conductors, will be extended by approximately four feet on each side to achieve proper clearances between the conductors. In addition, PPL Electric will construct 10 new structures in the portion of the line being converted to 138 kV operation in order to achieve ground clearances which meet National Electrical Safety Code standards.

Upon completion of the project, the sections of transmission lines identified above will be combined and renamed the South Akron-Dillerville #1 and #2 138 kV Transmission Line. At the conclusion of this Project all of the above referenced transmission lines will operate at 138 kV.

This phase of the Project is located in the Townships of East Hempfield, Manheim, Warwick, and West Earl and the City of Lancaster, Lancaster County. This filing is the third in a series of related filings seeking PUC approval of various phases of the conversion of the transmission system that serves central Lancaster County from 69 kV to 138 kV operation.[1] Future filings, which will address other phases of the Lancaster 69 kV to 138 kV conversion, will be submitted to the PUC.

This project is required to improve reliability and operating flexibility of PPL Electric's system. The future conversion from 69 kV to 138 kV will help meet the increasing demand for electricity

[1] The first phase of the 69 kV to 138 kV conversion was approved by the Commission on June 25, 2009, at Docket No. A-2009-21000767. The second phase of the conversion was approved by the Commission on April 15, 2010, at Docket No. A-2010-2156418.

in the Lancaster area. Converting the existing 69 kV facilities along this corridor to 138 kV operation is PPL Electric's long range plan for providing reliable service to the heavily loaded core service area of the Lancaster region. Increasing the operating voltage from 69 kV to 138 kV will double the capacity of the existing transmission lines and enable PPL Electric to continue to provide reliable service to its customers without establishing additional major transmission corridors.

The total estimated cost of the proposed transmission line work is $3.90 million. In addition, PPL Electric estimates that it will spend $1.31 million (including the transformer cost) for the modifications of the South Akron Substation. Construction is scheduled to begin in January, 2012 to support the project's in-service date of November, 2013.

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

Attachment 1	Necessity Statement
Attachment 2	Engineering Description
Attachment 3	Environmental Assessment
Attachment 4	PPL 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, and Other Public Entities

PPL ELECTRIC UTILITIES SERVICE TERRITORY

Attachment
1

ATTACHMENT 1
SOUTH AKRON-DILLERVILLE #1 AND #2 138 kV LINE
NECESSITY STATEMENT

TABLE OF CONTENTS

LIST OF FIGURES

MAP

ATTACHMENT 1
SOUTH AKRON – DILLERVILLE #1 AND #2 138 kV LINE
NECESSITY STATEMENT

A. INTRODUCTION

With Commission approval, PPL Electric plans to construct a new section of double-circuit 138 kV transmission line and increase the operating voltage of a portion of the existing transmission system, which supplies the highly developed core of Lancaster County from 69 kV to 138 kV. The conversion of the transmission system which supplies this area from 69 to 138 kV operation had to be accomplished in stages so that PPL Electric could continue to provide service during the conversion process. This is the third phase of the integrated overall conversion plan. This phase has two parts.

For the first part of this phase, PPL Electric proposes to upgrade a section of the existing South Akron – South Manheim #1 and #2 69 kV Line and the Dillerville #1 and #2 69 kV Taps to 138 kV to support the conversion from 69 kV to 138 kV. Sections of the existing South Akron – South Manheim #1 and #2 69 kV Line and the Dillerville #1 and #2 69 kV Taps are currently insulated for and operated at 69 kV. PPL Electric proposes to reinsulate these sections of the line to meet PPL Electric's current 138 kV design standards. In addition, PPL Electric will extend the upper arms of the lattice towers, which support the conductors, by approximately four feet on each side to achieve the necessary clearances between the conductors in order to meet current 138 kV standards. PPL Electric will also erect ten (10) new poles, which will be interspersed throughout the existing line section in order to meet current National Electric Safety Code (NESC) ground clearance standards.

Second, PPL Electric will construct approximately 1,360 feet of new double-circuit 138 kV transmission line in order to connect the South Akron-South Manheim Line to the 138 kV source of supply at the South Akron 230-138-69 kV Substation. When this phase has been completed, the South Akron – South Manheim #1 and #2 Line and the Dillerville #1 and #2 Taps will be renamed the South Akron – Dillerville #1 and #2 138 kV Line.

The proposed reconfiguration is part of an integrated plan which is required to resolve violations to PPL Electric's 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 reconfiguration will also increase reliability of service, and improve operating flexibility in the central core of the Lancaster region. Finally, the reconfiguration will help to meet the increasing demand for electrical power in the area.[1]

B. EXISTING SYSTEM

The existing South Akron – South Manheim #1 and #2 69 kV Line is supplied from two regional supply substations: the South Akron 230-138-69 kV Substation and the South Manheim 230-69 kV Substation. The Lines are served radially, meaning that there is an electrical normally open point (i.e. open switch) in the lines which splits the load between the two source regional substations. On the South Akron Substation end of the South Akron – South Manheim #1 and #2 69 kV Line, the existing lines terminate into dead-end structures located within the South Akron 69 kV yard.

The existing Dillerville #1 and #2 69 kV Taps are supplied from the South Akron – South Manheim #1 and #2 69 kV Line, respectively. The South Akron – South Manheim #1 and #2 69 kV Line and the Dillerville #1 and #2 69 kV Taps were placed in-service in the 1950s. These lines were designed to support only 69 kV operation, and will require modifications to convert to 138 kV operating voltage.

Four distribution substations and two large transmission customers are supplied from the line sections that are the subject of this filing. In total, approximately 15,950 customers are supplied from the substations supplied by these transmission facilities.

[1] In future filings, PPL Electric plans to request Commission approval to convert the remaining 69 kV transmission facilities along the South Akron – Dillerville corridor to 138 kV operation, which will enable PPL Electric to complete the 69 kV to 138 kV conversion.

Distribution Supply Substation	Number of Customers
Roseville 138/69-12 kV	4,600
Neffsville 69-12 kV	4,900
East Petersburg 69-12 kV	5,050
Dillerville 138-12 kV	1,400
Total	15,950

Previously, PPL Electric submitted filings requesting Commission approval of two stages of the plan to convert the 69 kV facilities along the South Akron – Dillerville transmission corridor to 138 kV.

In the first phase of the integrated 138 kV conversion plan, the distribution supply substation Dillerville was converted from a 69-12 kV facility to a 138-12 kV facility. In addition, new 138 kV ties were created between the Dillerville Taps and the West Hempfield – Prince #1 and #2 138 kV Lines. The Dillerville 138-12 kV Substation was temporarily transferred to the West Hempfield – Dillerville #1 and #2 138 kV Ties which are supplied from West Hempfield 230-138 kV Substation via the West Hempfield – Prince #1 and #2 138 kV Lines. The first phase of the 138 kV conversion was the subject of a previous PUC filing in *Letter of Notification of PPL Electric Utilities Corporation filed pursuant to 52 Pa. Code Chapter 57.72 with respect to the West Hempfield-Dillerville #1 and #2 138 kV Tie and the Dillerville #1 and #2 138/69 kV Taps in the City of Lancaster, Lancaster County, PA,* which was approved by the PUC at Docket No. A-2009-2100767 on June 25, 2009. The system modifications have been completed, and the facilities are in-service.

In the second phase of the integrated 138 kV conversion plan, the existing Roseville 138/69 kV Tap and the Neffsville #1 and #2 69 kV Taps were upgraded for 138 kV operation. The Roseville and Neffsville #1 and #2 Taps remain energized at 69 kV but will be transferred to the 138 kV system when this next phase of the 138 kV conversion plan has been completed. The second phase of the 138 kV conversion was approved by the PUC in *Letter of Notification of PPL Electric Utilities Corporation, filed pursuant to 52 Pa. Code Chapter 57.72, with respect to the Roseville 138/69 kV Tap in Manheim Township, Lancaster County, PA*, at Docket No. A-

2010-2156418, on April 15, 2010. The system modifications approved by the PUC in this proceeding have been completed and the facilities are in-service.

In the final 138 kV system arrangement, the Dillerville 138-12 kV Substation will be transferred to the South Akron – Dillerville #1 and #2 138/69 kV Lines and supplied from the South Akron 230-138 kV Substation.

See Figure 1 on page 7 for the existing transmission system configuration.

C. DEFINITION OF THE PROBLEM

PPL Electric's 69 kV transmission system serving the core service area of the Lancaster region does not meet PPL Electric's design and planning standards. Without the conversion to 138 kV operation, the loss of the double-circuit Dillerville #1 and #2 69 kV Taps would interrupt approximately 60 MW of load during periods of high demand. Under PPL Electric's RP&P, the maximum amount of load that can be interrupted due to a double-circuit line outage is 45 MW after all allowable switching moves have been made. Due to limited transmission and distribution switching capability, the load would remain interrupted until repairs could be made. Such a service interruption could affect approximately 1,400 customers supplied from the PPL Electric distribution system, as well as two large transmission customers.

As stated earlier, the Dillerville 138-12 kV Substation transfer to West Hempfield was preformed as a temporary measure to phase in the overall 138 kV conversion. The Dillerville 138-12 kV Substation cannot remain permanently supplied from the West Hempfield – Dillerville #1 and #2 138 kV Ties due to operating limitations that the additional load imposes on the West Hempfield – Prince #1 and #2 138 kV Lines. The West Hempfield – Prince #1 and #2 138 kV Lines are frequently used for operational contingency control to ensure system reliability. When the lines are being used for operational contingency control, the loss of either the West Hempfield – Prince #1 or #2 138kV line will cause the loading on the other 138 kV line to approach its thermal rating. This could cause conductor damage or failure which would result in customer outages. The final solution will alleviate the 138 kV line loading concern and provide more operational flexibility.

Until the completion of the 138 kV conversion, there are two additional load loss reliability exposures that impact system reliability. Although these concerns do not violate the PPL Electric RP&P, they will be resolved with the completion of the overall proposed 138 kV conversion.

First, if the double circuit West Hempfield – Dillerville #1 and #2 138 kV Ties experienced an outage, there would be no other 138 kV Ties available to supply the Dillerville 138 – 12 kV Substation. PPL Electric's ability to transfer the load served by the Dillerville 138 - 12 kV Substation to other nearby distribution substations is limited during peak loading conditions due to the existing 12 kV transfer capability. Therefore, service to approximately 1,400 customers would remain interrupted until repairs could be completed.

Second, if there were an outage of the double-circuit Dillerville #1 and #2 69 kV Tap, there would be no other 69 kV Ties available to serve the large transmission customers. Transmission service to these customers would remain interrupted until line repairs could be made.

The South Akron – South Manheim #1 and #2 69 kV Line and the Dillerville #1 and #2 69 kV Taps are constructed and insulated for 69 kV operation only. The current insulation level does not meet PPL Electric's 138 kV design specifications. These lines need to be upgraded to PPL Electric's current 138 kV design specifications prior to the conversion from a 69 kV to a 138 kV operating voltage.

D. PROPOSED SOLUTION

In order to resolve the load loss issues cited above, PPL Electric plans to convert a section of the existing South Akron – South Manheim #1 and #2 69 kV Transmission Line and the Dillerville #1 and #2 69 kV Taps to 138 kV operation. PPL Electric proposes to reinsulate these sections of line to meet PPL Electric's current 138 kV design standards. This work will be completed in part within existing PPL Electric right-of-way and in part on property owned in fee by PPL Electric.

The South Akron – South Manheim #1 and #2 69 kV Line will be extended approximately 1,360 feet and terminated into new dead-end structures within the 138 kV yard of the South Akron 230-138-69 kV Substation. The existing transmission spans into the South Akron 69 kV yard will be removed. This work will be completed on property owned in fee by PPL Electric.

In the final system arrangement, the existing and new line sections mentioned above will be known as the South Akron – Dillerville #1 and #2 138 kV Line. This line will be served from the South Akron 230-138 kV regional substation. See Figure 2 on page 8 for the proposed transmission system configuration.

After the completion of the 138 kV conversion, the final arrangement of the double – circuit South Akron – Dillerville #1 and #2 138 kV Line will provide sufficient transfer capabilities and bring PPL Electric into compliance with its RP&P guidelines. In the event of an outage, the load on the South Akron – Dillerville #1 and #2 can be transferred to the West Hempfield – Prince #1 and #2 138 kV Lines via the West Hempfield – Dillerville #1 and #2 138 kV Ties.

In addition, the 69-12 kV transformers at the distribution substations supplied by the South Akron – Dillerville #1 and #2 138 kV Line will be replaced and upgraded to 138-12 kV transformers as part of the 138 kV conversion. Two 25 MVA[2] 69-12 kV transformers at the Dillerville Substation have already been replaced with two 35 MVA 138-12 kV transformers. Also, two 10 MVA 69-12 kV transformers at the Roseville Substation have already been replaced with two 35 MVA 138/69-12 kV transformers.[3] In the upcoming phases of the 138 kV conversion, PPL Electric also plans to replace and upgrade two 20 MVA 69-12 kV transformers at Neffsville Substation and two 25 MVA 69-12 kV transformers at East Petersburg Substation with 35 MVA 138-12 kV transformers. The additional 120 MVA of transformer capacity will

[2] Million volt-amperes.
[3] The replacements are currently on the 69 kV high side tap position.

almost double the local transformer capacity available to supply the increasing electrical demand in this highly developed area of Lancaster County.

The total estimated cost for this third stage of the proposed conversion of the transmission system serving the core of the Lancaster region from 69 kV to 138 kV operation is $5.21 million, which includes $1.31 million for substation modifications and $3.90 million for the transmission work. This filing covers only the proposed transmission line modification, which is the only part of this phase that requires Commission approval, per its regulations. The proposed transmission line construction is scheduled to begin in January, 2012 in order to support a scheduled in-service date of November, 2013.

The 138 kV conversion is PPL Electric's long range plan for serving the heavily loaded core of the Lancaster region. This conversion will expand the existing 138 kV system and allow more operating flexibility between the West Hempfield and South Akron Substations.

Raising the operating voltage from 69 kV to 138 kV will double the capability of the existing transmission lines. In combination with the other stages of the conversion plan, this phase of the Project will allow PPL Electric to provide increased reliability and operating flexibility while meeting the increasing demand for electricity, and avoids establishing an additional major transmission corridor.

E. <u>FUNCTIONAL ALTERNATIVES</u>

No other reasonably economical functional alternatives were identified that would resolve the problems outlined above.

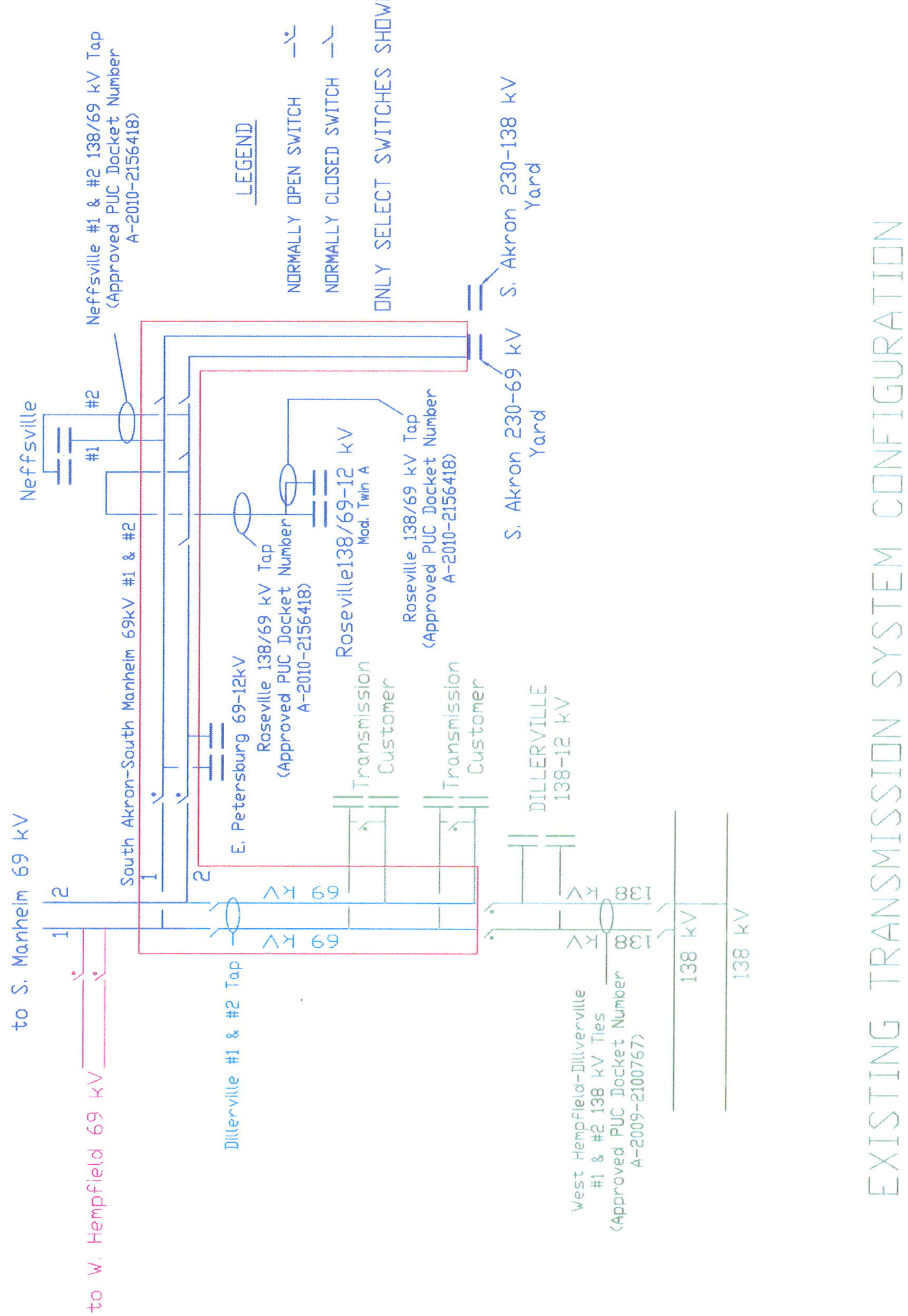

to S. Manheim 69 kV
to W. Hempfield 69 kV
South Akron-South Manheim 69kV #1 & #2
Neffsville
#1
#2
Neffsville #1 & #2 138/69 kV Tap
(Approved PUC Docket Number
A-2010-2156418)
LEGEND
NORMALLY OPEN SWITCH
NORMALLY CLOSED SWITCH
ONLY SELECT SWITCHES SHOWN
S. Akron 230-138 kV
Yard
S. Akron 230-69 kV
Yard
Roseville138/69-12 kV
Mod. Twin A
Roseville 138/69 kV Tap
(Approved PUC Docket Number
A-2010-2156418)
E. Petersburg 69-12kV
Transmission
Customer
Transmission
Customer
DILLERVILLE
138-12 kV
Dillerville #1 & #2 Tap
69 kV
69 kV
138 kV
138 kV
West Hempfield-Dillerville
#1 & #2 138 kV Ties
(Approved PUC Docket Number
A-2009-2100767)
EXISTING TRANSMISSION SYSTEM CONFIGURATION

FIGURE 1

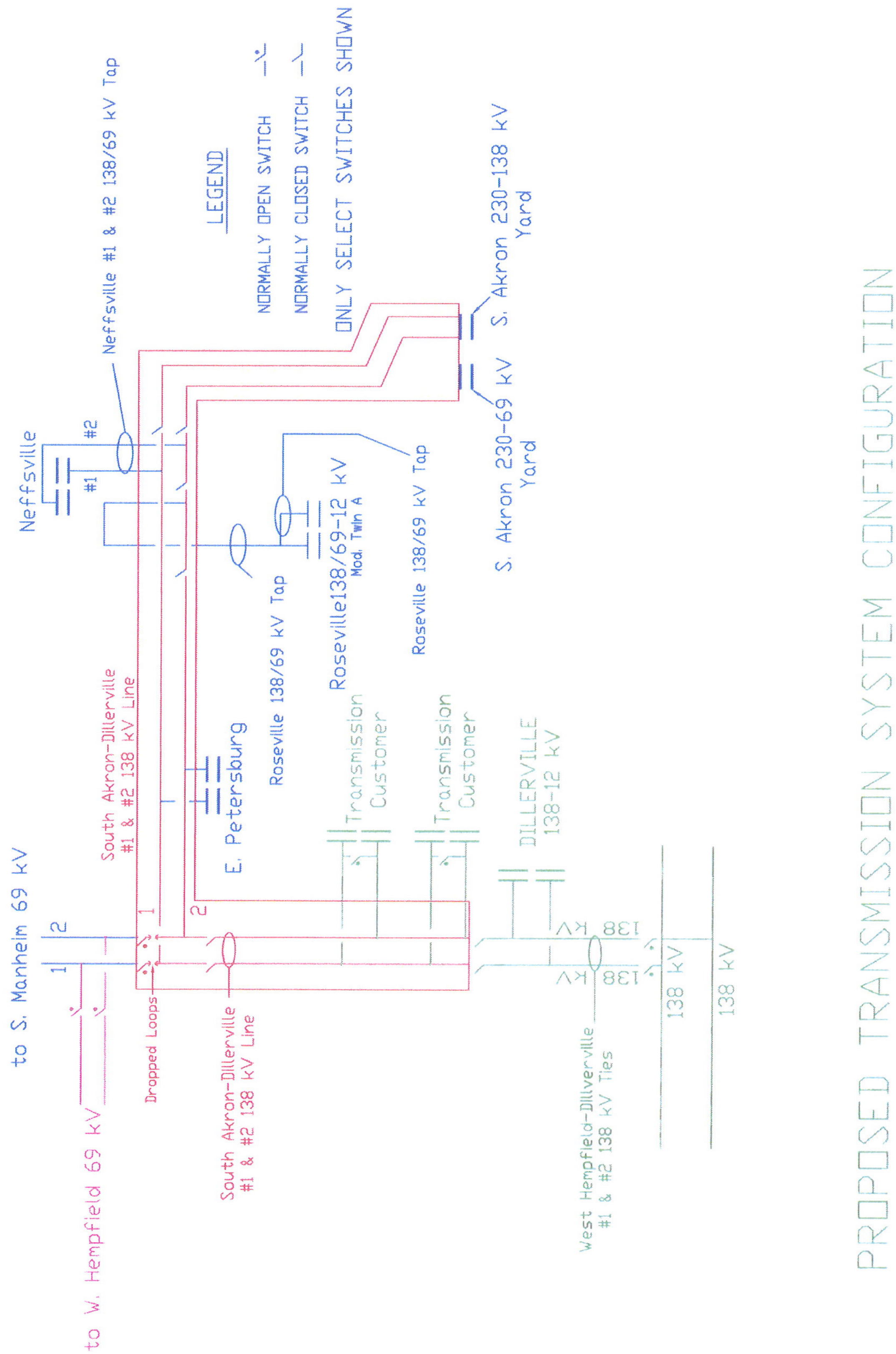
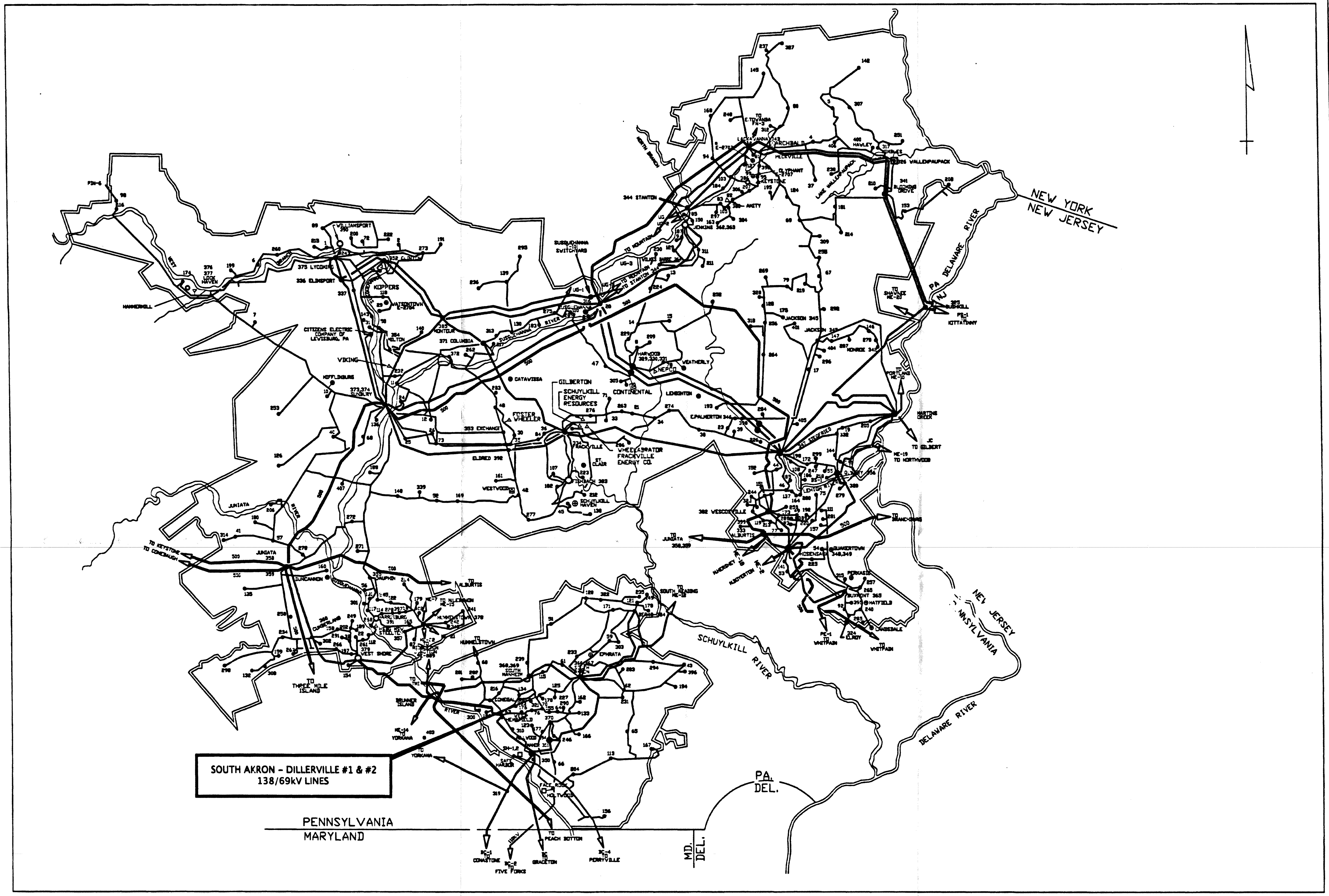

PROPOSED TRANSMISSION SYSTEM CONFIGURATION
LEGEND
NORMALLY OPEN SWITCH
NORMALLY CLOSED SWITCH
ONLY SELECT SWITCHES SHOWN
Neffsville #1 & #2 138/69 kV Tap
Neffsville
#1
#2
S. Akron 230-138 kV Yard
S. Akron 230-69 kV Yard
Roseville 138/69 kV Tap
Roseville138/69-12 kV
Mod. Twin A
Roseville 138/69 kV Tap
South Akron-Dillerville #1 & #2 138 kV Line
E. Petersburg
Transmission Customer
Transmission Customer
DILLERVILLE 138-12 kV
to S. Manheim 69 kV
to W. Hempfield 69 kV
Dropped Loops
South Akron-Dillerville #1 & #2 138 kV Line
West Hempfield-Dillverville #1 & #2 138 kV Ties
138 kV
138 kV
138 kV
138 kV

FIGURE 2

SUBSTATION LISTING

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

* - 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	REVIEWED	APPROVED
80	1/26/11	10012503	ADDED WEST HEMPFIELD-MANOR #2 230 kV LINE RELOCATION.	RRC		DJG
83	4/5/11	161723	ADDED SOUTH AKRON - DILLERVILLE #1 & #2 138/69kV LINES	MG	RWM	JBW
82	3/31/11	165192	ALLENTOWN-SIEGFRIED #1 & #2 138KV LINE & E.ALLENTOWN #1 & #2 138kV TAP REBUILD	MG	RWM	DG
81	2/1/11	10014287	ADDED OTTER CREEK - CONASTONE 230kV LINE RECONSTRUCTION	MG	RWM	DG

REFERENCE TITLE	NUMBER	REFERENCE TITLE	NUMBER

FRACTIONAL DECIMAL

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

ACCT- 805201
SCALE- NONE
BY- CDW
REVIEWED

ELECTRICAL SYSTEM MAP
SOUTH AKRON - DILLERVILLE #1 & #2
138/69 kV LINES

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

PPL DRAWING NO. D191830 | SHEET NO. 1 | REV. 83

D191830_5001.DWG

PC CAD

PPL EU FORM 4877 (7/07)

Attachment
2

ATTACHMENT 2
SOUTH AKRON-DILLERVILLE #1 AND #2 138 kV LINE
ENGINEERING DESCRIPTION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

MAP

ATTACHMENT 2
SOUTH AKRON-DILLERVILLE #1 AND #2 138 kV LINE
ENGINEERING DESCRIPTION

A. DESCRIPTION OF PROPOSED LINE

PPL Electric proposes to increase the operating voltage of a portion of the existing South Akron – South Manheim #1 and #2 69 kV Line and the Dillerville #1 and #2 69 kV Taps to 138 kV in support of the conversion from the 69 kV voltage level to the 138 kV voltage level of the transmission system serving the core of the Lancaster region. In addition, PPL Electric is proposing to construct a new section of double-circuit 138 kV transmission line into the 138 kV yard at the South Akron Substation. The new section of transmission line is required to connect the line to a 138 kV source of supply which is necessary to accomplish the overall 69 kV to 138 kV voltage increase. In the final 138 kV transmission arrangement, the above mentioned line sections will be renamed as the South Akron – Dillerville #1 and #2 138 kV Line.

This phase of the Project to convert the Lancaster service area to 138 kV operation is required to improve reliability of service and operating flexibility in the core of the transmission system which supplies the Lancaster region. In addition, the 69 kV to 138 kV conversion will provide additional capacity to meet increasing demand for electricity in the area.

Construction will be located in East Hempfield, Manheim, Warwick, and West Hempfield Townships, and the City of Lancaster, in Lancaster County. A plot plan for the transmission line project is provided in the Attachment 2 map pocket.

The new section of double-circuit 138 kV transmission line will be approximately 1,360 feet in length. It will be constructed to re-terminate the existing transmission lines into the 138 kV yard at PPL Electric's South Akron 230-138-69 kV Substation. The existing 69 kV lines into the South Akron 69 kV yard will be removed, and will be replaced by the new 138 kV lines. Re-terminating the South Akron – Dillerville Line into the 138 kV transformer at the South Akron Substation is the final step required to energize all other lines associated with the overall

Lancaster 69 kV to 138 kV conversion, and will be completed in the final phase of construction to accomplish the overall conversion in this area.

The new double-circuit 138 kV line construction will require the installation of six steel monopole structures which will be approximately 100 feet in height. Four of the new steel poles will be constructed on foundations and two will be direct embedded and guyed. The new section of double-circuit transmission line into the South Akron Substation will utilize six 556.5 thousand circular mills (kcmil)[1], 24/7 stranding, aluminum conductor steel reinforced ("ACSR") power conductors. One fiber optic overhead ground wire will be installed to provide both lightning protection for the proposed line and communication between PPL Electric Substations. A picture of a transmission structure similar to those that will be used for the new section of the line is provided in Figure 1 to this Attachment.

The sections of the existing South Akron – South Manheim #1 and #2 69 kV Line and the Dillerville #1 and #2 Taps associated with this phase are currently insulated for and operated at 69 kV. PPL Electric will continue to use existing structures where the line is being converted to 138 kV operation. These structures were designed and built exclusively for 69 kV operation, so they must be modified for 138 kV operation. A picture of a typical existing structure that will be modified in conjunction with the reconfiguration is provided in Figure 2 to this Attachment. To accomplish the voltage increase from 69 kV to 138 kV, these sections of the line must be reinsulated to meet PPL Electric's current 138 kV design standards. In addition, the upper arms which support the conductors must be extended approximately 4 feet on each side to achieve clearances between the conductors that meet PPL Electric's standards for 138 kV transmission lines. The conversion to 138 kV operation will require 10 new poles, which will be installed throughout the line sections to meet current National Electrical Safety Code (NESC) minimum ground clearance standards. These poles will resemble the poles shown in Figure 1. The six existing conductors, which are 556.5 kcmil, 24/7 stranding, ACSR power conductors, will remain in place. The two existing overhead ground wires will be upgraded to one new 3/8 inch

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[1] KCMIL wire size is the equivalent cross sectional area in thousands of circular mils. A circular mil is the area of a circle with a diameter of one thousandth (0.001) of an inch.

steel overhead ground wire and one new fiber optic ground wire to provide lightning protection for the line and communication between PPL Electric Substations.

The existing and proposed line sections will be designed to, and will generally exceed, NESC minimum standards. The design specifications and safety rules practiced by PPL Electric are explained in Attachment 4. The minimum conductor to ground clearance will be 30 feet for the new section of line into the 138 kV yard at the South Akron Substation. The minimum conductor to ground clearance along the existing sections of line, which are to be reinsulated, will be 22.5 feet. Both of these clearances occur at the maximum thermal conductor temperature of 125 degrees Celsius.

The designed minimum conductor clearances and conductor thermal ratings for the line are as follow:

TABLE 1
DESIGN MINIMUM CONDUCTOR CLEARANCES
FOR 556.5 KCMIL 24/7 STRANDING ACSR*

Condition	New Section Retermintating into the South Akron 138 kV Yard Clearance-to-Ground	Existing Sections to be Reinsulated Clearance-to-Ground
Normal load; average weather (16°C ambient, 60°F temperature)	34 feet	28.5 feet
Predicted extreme thermal load (125°C conductor, 257°F temperature)	30 feet	22.5 feet
Predicted NESC extreme wind load conditions (25 lbs., 16°C, 60°F temperature)	32 feet	25.5 feet
Predicted extreme weather conditions (1-inch ice, 4 lbs. wind, -10°C, 15°F temperature)	31.5 feet	24.5 feet
	* Clearances based on a maximum tension of 9,650 pounds and a ruling span of 465 feet	* Clearances based on a maximum tension of 7,000 pounds and a ruling span of 705 feet

TABLE 2
CONDUCTOR THERMAL RATING
556.5 KCMIL 24/7 STRANDING ACSR
(257°F) 125°C MAXIMUM CONDUCTOR TEMPERATURE

Condition	Ambient Temperature °C	Wind Speed Knots	Ampacity Amps
Summer Normal	35	0	815
Winter Normal	10	0	926
Summer Emergency	35	1 1/2	1,041
Winter Emergency	10	1 1/2	1,163

B. MAGNETIC FIELD MANAGEMENT

PPL Electric's Magnetic Field Management Program, summarized in Attachment 5, is applied to new and reconstructed transmission line projects. The company does not believe that the current scientific evidence demonstrates that magnetic fields cause any adverse health effects or pose a health or 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. PPL Electric's Magnetic Field Management Program has been developed to implement that policy decision. To reduce magnetic field exposures, the program generally prescribes the use of a line design that provides five feet higher ground clearance and reverse phasing of new double-circuit lines where it is feasible to do so at low or no cost.

Consistent with the program, PPL Electric will construct the new line section into the South Akron 138 kV yard for five feet higher ground clearance than NESC standards to reduce magnetic field exposures. A line design that provides five feet higher ground clearance will not be utilized along the existing line sections. Implementing PPL Electric's increased ground clearance along the entire existing line section would require the removal of the existing structures and installation of new structures at an additional cost of approximately $5 million. Reverse phasing will be utilized to reduce magnetic field exposures.

C. RIGHT-OF-WAY STATUS

This phase of the Project is located in part on property owned in fee by PPL Electric and in part within existing PPL Electric right-of-way. No additional right-of-way is required. Attachment 6 contains a list of the owners of property that is crossed by the proposed construction.

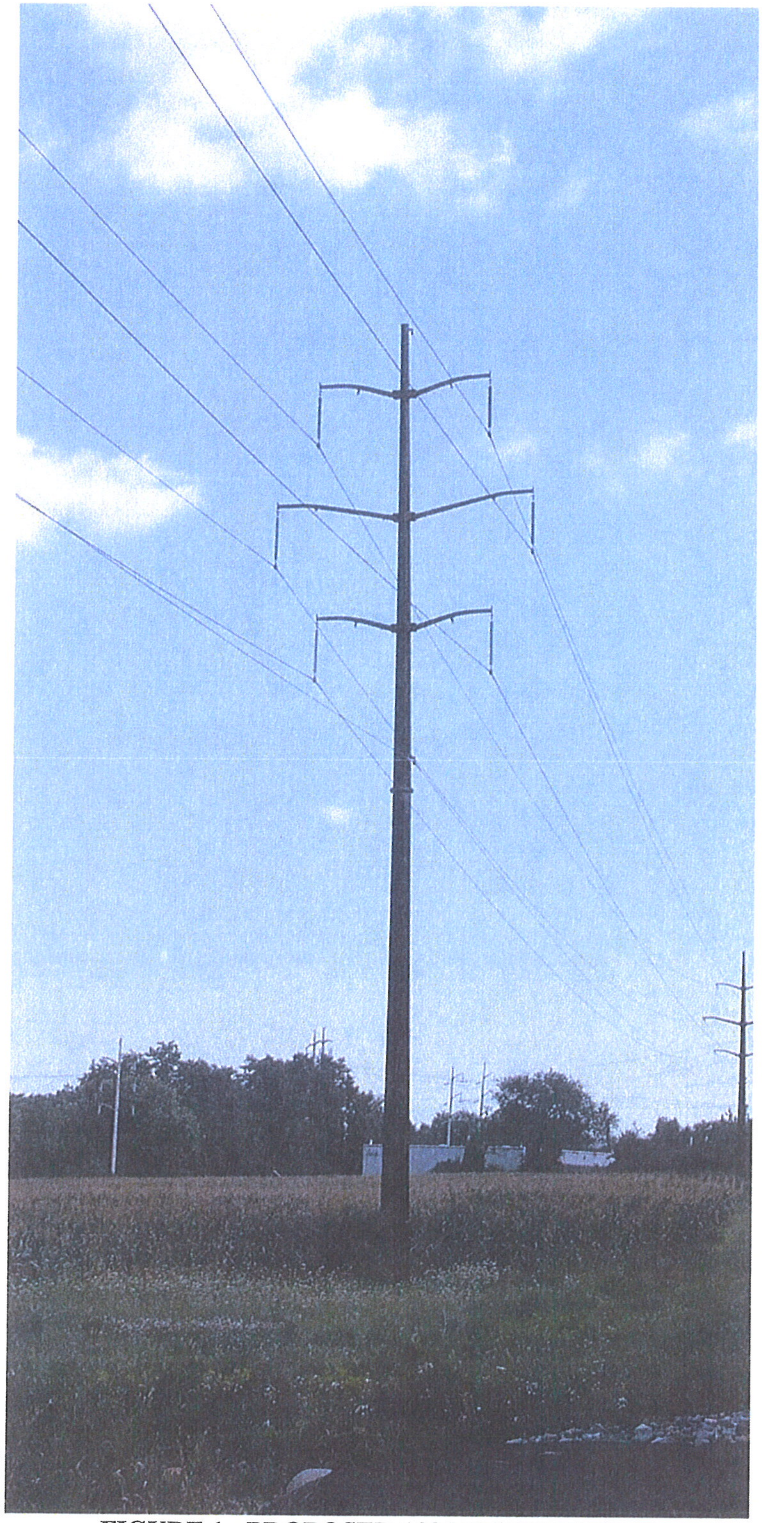


FIGURE 1 - PROPOSED 138 kV STRUCTURE
Average Height – 100 feet
Arm Length (Middle) – 11 feet
Arm Length (Top & Bottom) - 7 feet

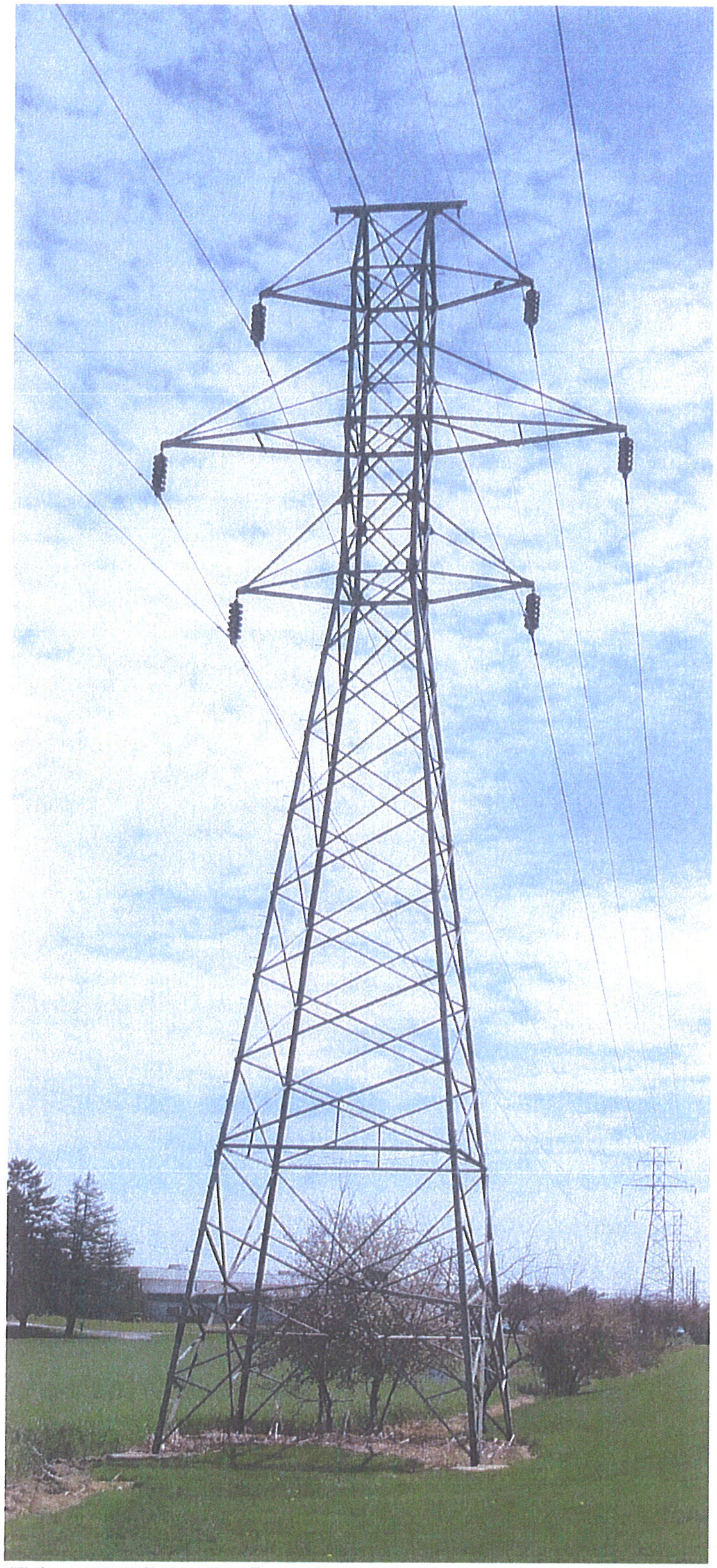
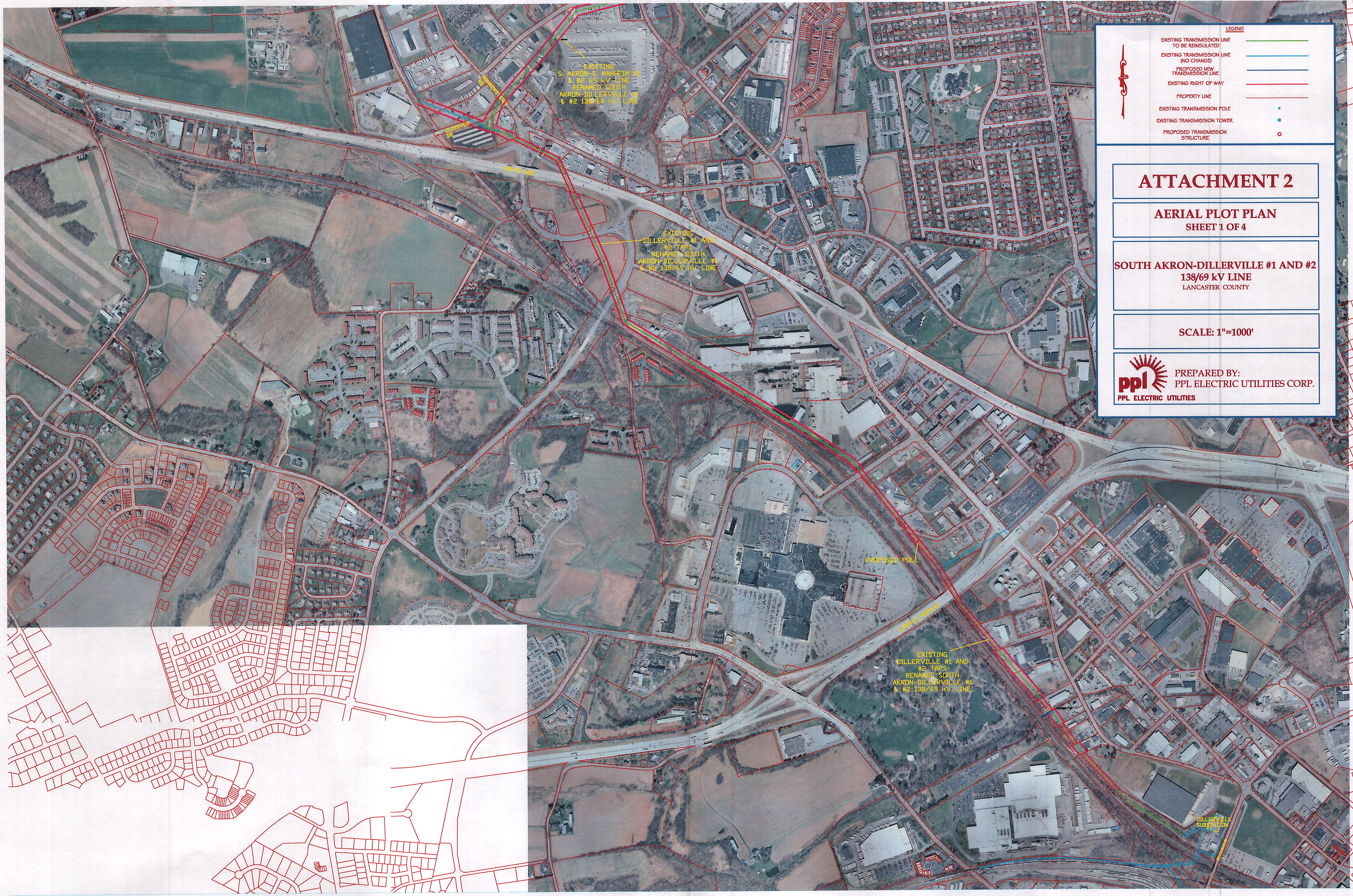
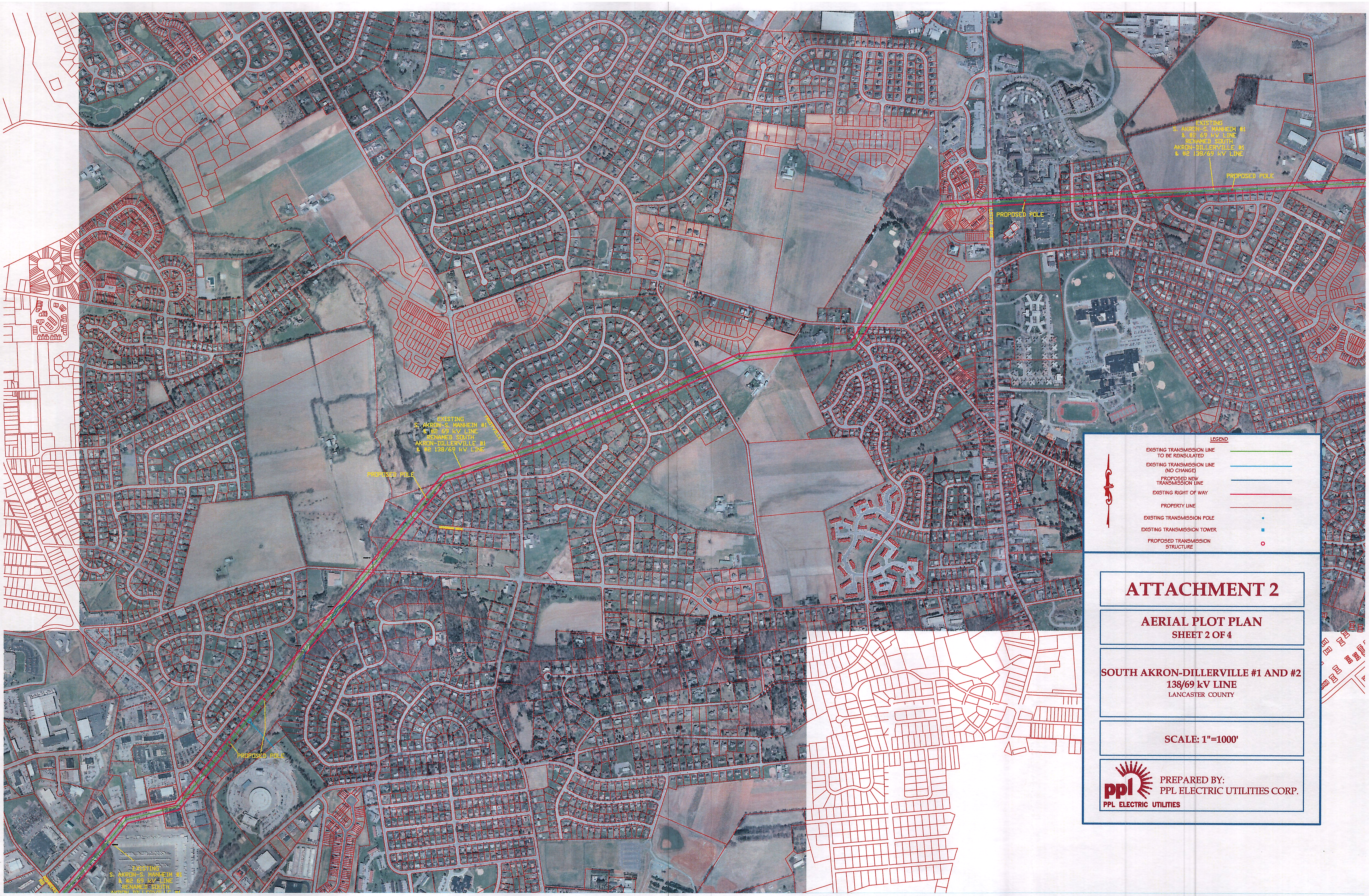
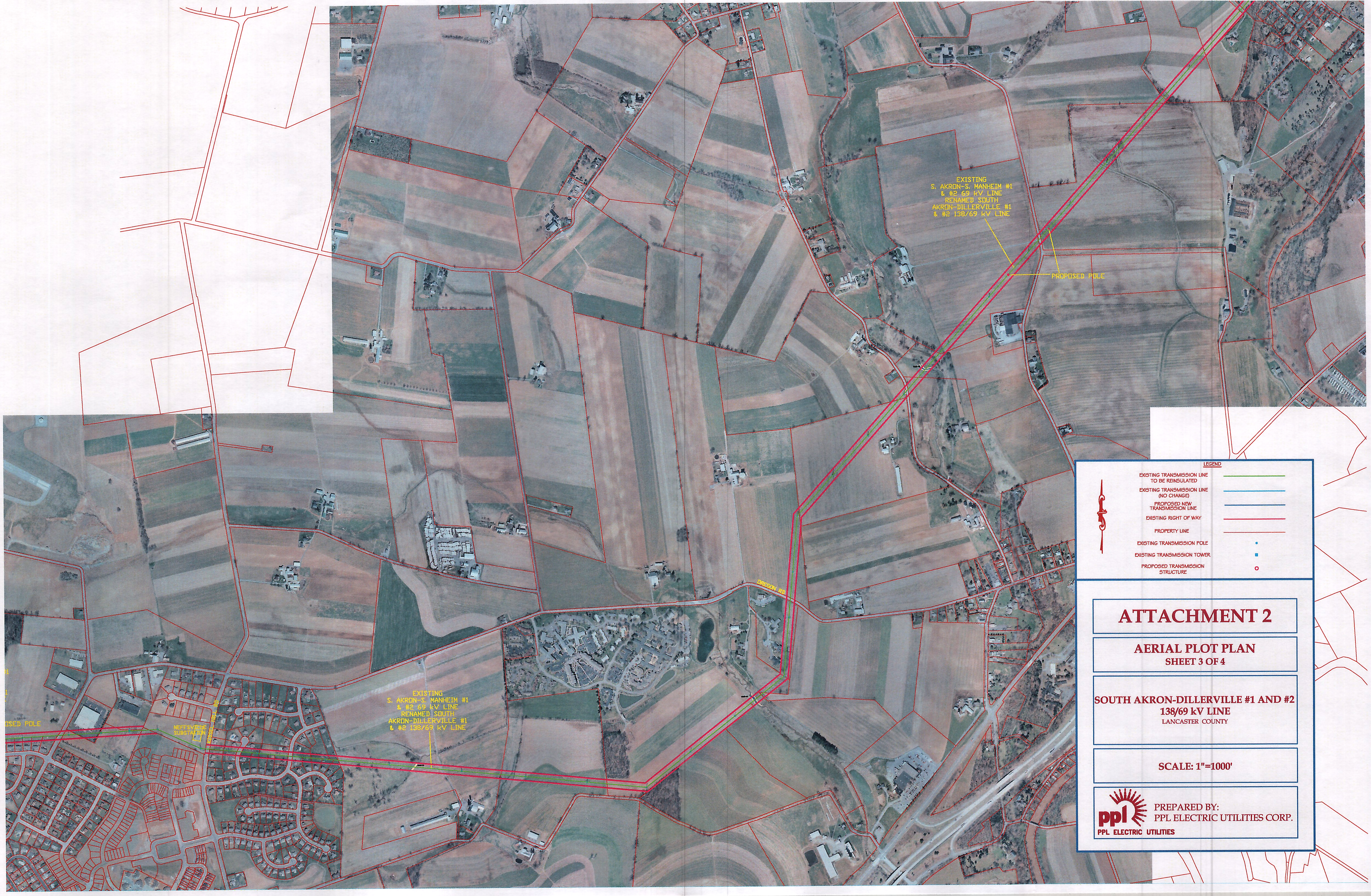


FIGURE 2 - TYPICAL EXISTING STRUCTURE TO BE REINSULATED
Average Height – 80 feet
Arm Length (Top) – 10 feet 2 inches
Arm Length (Middle) – 11 feet 5 inches
Arm Length (Bottom) – 6 feet 5 inches



LEGEND
EXISTING TRANSMISSION LINE TO BE REINSULATED
EXISTING TRANSMISSION LINE (NO CHANGE)
PROPOSED NEW TRANSMISSION LINE
EXISTING RIGHT OF WAY
PROPERTY LINE
EXISTING TRANSMISSION POLE
EXISTING TRANSMISSION TOWER
PROPOSED TRANSMISSION STRUCTURE
ATTACHMENT 2
AERIAL PLOT PLAN
SHEET 1 OF 4
SOUTH AKRON-DILLERVILLE #1 AND #2
138/69 kV LINE
LANCASTER COUNTY
SCALE: 1"=1000'
PREPARED BY:
PPL ELECTRIC UTILITIES CORP.
PPL ELECTRIC UTILITIES
EXISTING
S. AKRON-S. MANHEIM #1
& #2 69 kV LINE
RENAMED SOUTH
AKRON-DILLERVILLE #1
& #2 138/69 kV LINE
EXISTING
DILLERVILLE #1 AND
#2 TAPS
RENAMED SOUTH
AKRON-DILLERVILLE #1
& #2 138/69 kV LINE
PROPOSED POLE
LINCOLN HIGHWAY
EXISTING
DILLERVILLE #1 AND
#2 TAPS
RENAMED SOUTH
AKRON-DILLERVILLE #1
& #2 138/69 kV LINE
DILLERVILLE
SUBSTATION


EXISTING
S. AKRON-S. MANHEIM #1
& #2 69 kV LINE
RENAMED SOUTH
AKRON-DILLERVILLE #1
& #2 138/69 kV LINE
PROPOSED POLE
PROPOSED POLE
EXISTING
S. AKRON-S. MANHEIM #1
& #2 69 kV LINE
RENAMED SOUTH
AKRON-DILLERVILLE #1
& #2 138/69 kV LINE
PROPOSED POLE
PROPOSED POLE
EXISTING
S. AKRON-S. MANHEIM #1
& #2 69 kV LINE
RENAMED SOUTH
LEGEND
EXISTING TRANSMISSION LINE TO BE REINSULATED
EXISTING TRANSMISSION LINE (NO CHANGE)
PROPOSED NEW TRANSMISSION LINE
EXISTING RIGHT OF WAY
PROPERTY LINE
EXISTING TRANSMISSION POLE
EXISTING TRANSMISSION TOWER
PROPOSED TRANSMISSION STRUCTURE
ATTACHMENT 2
AERIAL PLOT PLAN
SHEET 2 OF 4
SOUTH AKRON-DILLERVILLE #1 AND #2
138/69 kV LINE
LANCASTER COUNTY
SCALE: 1"=1000'
PREPARED BY:
PPL ELECTRIC UTILITIES CORP.
ppl
PPL ELECTRIC UTILITIES


EXISTING
S. AKRON-S. MANHEIM #1
& #2 69 kV LINE
RENAMED SOUTH
AKRON-DILLERVILLE #1
& #2 138/69 kV LINE
PROPOSED POLE
NEFFSVILLE SUBSTATION
EXISTING
S. AKRON-S. MANHEIM #1
& #2 69 kV LINE
RENAMED SOUTH
AKRON-DILLERVILLE #1
& #2 138/69 kV LINE
LEGEND
EXISTING TRANSMISSION LINE TO BE REINSULATED
EXISTING TRANSMISSION LINE (NO CHANGE)
PROPOSED NEW TRANSMISSION LINE
EXISTING RIGHT OF WAY
PROPERTY LINE
EXISTING TRANSMISSION POLE
EXISTING TRANSMISSION TOWER
PROPOSED TRANSMISSION STRUCTURE
ATTACHMENT 2
AERIAL PLOT PLAN
SHEET 3 OF 4
SOUTH AKRON-DILLERVILLE #1 AND #2
138/69 kV LINE
LANCASTER COUNTY
SCALE: 1"=1000'
PREPARED BY:
PPL ELECTRIC UTILITIES CORP.
PPL ELECTRIC UTILITIES

ATTACHMENT 2

AERIAL PLOT PLAN

SHEET 4 OF 4

SOUTH AKRON-DILLERVILLE #1 AND #2
138/69 kV LINE
LANCASTER COUNTY

SCALE: 1"=1000'

ppl
PPL ELECTRIC UTILITIES

PREPARED BY:
PPL ELECTRIC UTILITIES CORP.

Attachment
3

ATTACHMENT 3
SOUTH AKRON-DILLERVILLE #1 AND #2 138 kV LINE
ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

ATTACHMENT 3
SOUTH AKRON-DILLERVILLE #1 AND #2 138 kV LINE
ENVIRONMENTAL ASSESSMENT

A. INTRODUCTION

PPL Electric is seeking Commission approval to make certain modifications to portions of the existing South Akron – South Manheim #1 and #2 69 kV Line and the Dillerville #1 and #2 69 kV Taps in order to increase the operating voltage to 138 kV to support the conversion from the 69 kV voltage level of the transmission system serving the central core of the Lancaster region. In addition, PPL Electric is proposing to construct approximately 1,360 feet of new double-circuit 138 kV transmission line into the 138 kV yard at the South Akron Substation. This new section of the transmission line is required to connect the Line to a 138 kV source of supply, which is needed to accomplish the overall 69 kV to 138 kV voltage increase. When construction has been completed, these line sections will be renamed the South Akron – Dillerville #1 and #2 138 kV Line.

This phase of the overall Project to convert the Lancaster service area to 138 kV operation is required as part of an integrated plan to resolve violations of PPL Electric's RP&P guidelines, increase reliability of service, and improve operating flexibility in the core of the Lancaster service area. The reconfiguration will also help to meet the increasing demand for electrical power in the area.

The proposed construction was reviewed with East Hempfield, Manheim, Warwick, and West Hempfield Townships, the City of Lancaster, and Lancaster County. The Townships, the City and the County have no objection. A list of involved governmental agencies, municipalities and other public entities is included as Attachment 7.

B. LAND USE

The construction is located in part on property owned in fee by PPL Electric and in part within existing PPL Electric transmission line right-of-way. Both the property owned in fee and the right-of-way contain existing electrical facilities. No additional property rights are required to complete this phase.

209 properties are traversed by portions of the proposed construction. PPL Electric proposes to operate this reconfigured portion of the existing line at 138 kV in the future. The new section of transmission line will be constructed entirely on property owned in fee by PPL Electric.

Land use in the area is mixed. Uses include agriculture, residences, woodlands, commerce, and industry. Land use impacts are anticipated to be minimal due to the fact that the construction is located in areas that contain existing PPL Electric facilities. Interference with existing land uses will be further minimized because, where possible, PPL Electric will use previously established access roads for construction.

No nearby communication towers, pipelines or other utilities will be affected by the proposed construction. The closest point of the Lancaster Airport (LNS) is approximately 0.60 miles from the construction. PPL Electric will file the appropriate documentation with both the Federal Aviation Administration and the PennDOT Bureau of Aviation to ensure that the proposed construction will not be a hazard to the airport's flight operations, but does not anticipate any problem due to the pre-existing electrical facilities in the vicinity.

C. CULTURAL RESOURCES

The proposed reconfiguration was reviewed by the Pennsylvania Historical and Museum Commission (PHMC). The PHMC has determined that there may be historic buildings, structures, and/or archaeological resources in the construction area. Correspondence from the PHMC, dated December 15, 2009 and February 12, 2010, indicates that the proposed activities associated with this construction should have no effect on these resources (File No. ER2010-0123-071-A and File No. ER2000-2355-071-L). No further investigations are required. If, however, PPL Electric becomes aware of any previously unidentified resources that would be affected by the construction, the Bureau for Historic Preservation will be contacted immediately.

D. NATURAL FEATURES

The proposed construction will not affect any unique geological, scenic, or natural areas. The Fruitville Quarry Fossil Site is located approximately 0.25 miles from the area where construction will occur. This feature will not be affected due to its distance from the construction, the extensive development between the feature and the construction, and the fact that PPL Electric is proposing limited modifications to existing facilities. No National Natural Landmarks, parks, recreational facilities, or natural areas are located near the construction area.

Tree clearing is not anticipated for this phase of the Project because this phase is being completed entirely within existing PPL Electric right-of-way and on PPL Electric fee-owned property, which are currently cleared of trees. In the event that it is decided that tree clearing is required to complete construction, PPL Electric will apply its "Specifications for Initial Clearing and Control of Vegetation On or Adjacent to Electric Line Right-of-Way Through Use of Herbicides, Mechanical and Hand Clearing Techniques" to mitigate any impacts.

PPL Electric has retained Mike Wood, of Woodland Designs, to delineate all wetlands and watercourses within the existing right-of-way. These features are shown on the Aerial Plot Plans in Attachment 2. PPL Electric will obtain all permits necessary from the Pennsylvania Department of Environmental Protection and the United States Army Corps of Engineers and will comply with all conditions placed on the permits. In addition, PPL Electric will acquire any required soil erosion and sedimentation control permits and comply with any conditions placed on those permits.

E. THREATENED AND ENDANGERED SPECIES

PPL Electric has coordinated with different state and federal agencies to obtain information regarding threatened and endangered species in close proximity to the construction. A review of the Pennsylvania Natural Diversity Inventory ("PNDI") records (PNDI Search ID 20435) indicates that there is a potential impact under the jurisdiction of the United States Fish and Wildlife Service ("USFWS").

Correspondence from the USFWS indicates that the construction is within the known range of the Bog Turtle, *Glyptemys muhlenbergii* (federally listed as threatened). The USFWS requested that all wetlands in and within 300 feet of the construction area be assessed for their suitability as bog turtle habitat (Phase I survey). PPL Electric retained Rick Mellon, of Mellon Biological Services, to complete the required survey and supply the appropriate information to the USFWS. Mr. Mellon completed the Phase I Survey and prepared the appropriate report (dated September 29, 2010) for submission to the USFWS. The report has been submitted to and reviewed by the USFWS. Correspondence from the USFWS dated December 3, 2010 concludes that the proposed construction will not affect the bog turtle. All conflicts with species of concern have been resolved with the appropriate agencies.

Attachment
4

LIST OF SUPPLEMENTAL ATTACHMENTS

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 and Other Public Entities

ATTACHMENT 4
SOUTH AKRON – DILLERVILLE #1 AND #2 138 kV 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, and maintenance of electric power lines. The NESC contains the basic provisions considered necessary for the safety of employees and the public. Although it is not intended as a design specification, its provisions establish minimum design requirements. PPL Electric Utilities Corp. (PPL Electric) has developed design specifications and safety rules which meet or surpass all 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	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	PPL Electric Design
Roads, streets, alleys	28 Ft.	53 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	28 Ft.	53 Ft.
Spaces accessible to pedestrians only	24 Ft.	53 Ft.
Railroad tracks	38 Ft.	53 Ft.

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

Periodic Maintenance Program on All Transmission Lines

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

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

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

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

Personnel Safety Rules

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

- Work procedures have been developed to allow work to be performed on energized facilities in a safe manner. When lines or apparatus are removed from service to be worked on, the Energy Control Process system is applied. This system provides that a red tag must be physically placed on the control handle of the de-energized equipment. The red tag may be removed only after proper authorization to energize the equipment. Various other tags are used for limited operations and informational purposes. Employees will not apply or remove a tag or change the status of tagged equipment unless authorized.

- Temporary safety grounds are used on de-energized facilities for employee safety during maintenance, construction, or reconstruction work. Safety grounds are wires connecting the de-energized facility to an electrical ground. If the facility should be energized, the safety grounds will divert the current directly to ground and reduce the likelihood of personal injury. The conductor size and attachment clamps of temporary safety grounds must be capable of conducting anticipated fault currents. Rubber gloves, rubber sleeves, and additional rubber protective equipment are used as required when applying or removing temporary safety grounds to or from the lines or apparatus to be grounded. An approved nonconductive working stick of sufficient length to allow workers to maintain the following required minimum clearances is used to test that the line has been de-energized and to apply temporary safety grounds:

Voltage-kV	Minimum Clearance
138	3'-7"
230	5'-3"
500	11'-3"

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

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

Attachment 5

MAGNETIC FIELD MANAGEMENT

PPL Electric Utilities Corporation

Attachment 5

DECEMBER 2004

TABLE OF CONTENTS

INTRODUCTION

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

PPL EU's View

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

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

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

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

EMF Are All Around Us

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

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

Electric Fields

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

Magnetic Fields

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

Figure 1

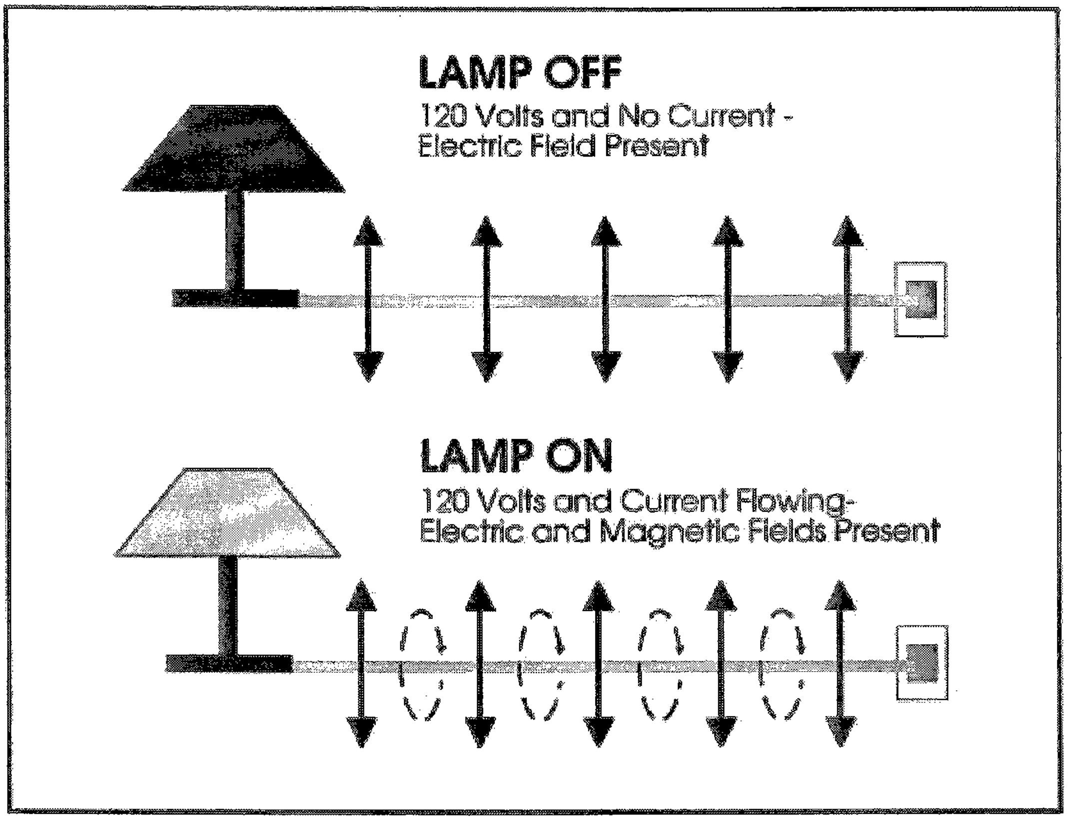

LAMP OFF
120 Volts and No Current -
Electric Field Present
LAMP ON
120 Volts and Current Flowing-
Electric and Magnetic Fields Present

Figure 2

Magnetic field strengths decrease with distance

Magnetic fields are measured in milligauss

Source: "EMF In Your Environment", U.S. Environmental Protection Agency 1992

	At 6 inches	At 1 foot	At 2 feet
Clothes dryer	2 to 10	* to 3	*
Microwave oven	100 to 300	1 to 200	1 to 30
Toaster	5 to 20	* to 7	*
Power drill	100 to 200	20 to 40	3 to 6
Can opener	500 to 1500	40 to 300	3 to 30
Mixer	30 to 600	5 to 100	* to 10
Hair dryer	1 to 700	* to 70	* to 10
Color television	Data not available	* to 20	* to 8

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

Measuring Magnetic Fields

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

Figure 3

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

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

DEVELOPMENT OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

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

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

VARIABLES THAT AFFECT MAGNETIC FIELDS

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

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

EFFECT OF PHASE CURRENT ON MAGNETIC FIELDS

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

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

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

EFFECT OF CONDUCTOR CONFIGURATION ON MAGNETIC FIELDS

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

EFFECT OF DISTANCE FROM THE MAGNETIC FIELD SOURCE

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

SUMMARY OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

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

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

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

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

MAGNETIC FIELD MANAGEMENT PROGRAM GUIDELINES

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

OVERHEAD LINES

NEW OR REBUILT TRANSMISSION LINES

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

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

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

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

Chart VI illustrates the compact design structure.

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

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

- Reverse phasing was adopted by PPL EU in March 1991 for double-circuit 138/69 kV transmission lines and in April 1992 for all other double circuit transmission lines. Reverse phasing is shown in Chart VII. Reverse phasing will reduce the magnetic fields when the current flow on both circuits is in the same direction. Calculated values contained here are based on balanced and equal phase currents on both circuits.

- Reverse phasing reduces the magnetic field of a double circuit 138 kV single pole transmission line from 29 mG to 9 mG (about 69 percent) at the edge of the 100-foot-wide right of way as shown on Chart III.
- Reverse phasing reduces the magnetic field of a double circuit 230 kV single pole transmission line from 49 mG to 16 mG (about 67 percent) at the edge of the 150-foot-wide right of way as shown on Chart VIII.
- Reverse phasing reduces the magnetic field of a double-circuit 500 kV single pole transmission line from 37 mG to 21 mG (about 43 percent) at the edge of the 200-foot-wide right of way as shown on Chart IX.

* When new or rebuilt double-circuit lines require tapping existing double-circuit lines, PPL EU will review the existing lines to determine if reverse phasing can be provided at low cost.
* Computer modeling is required to develop the optimum phasing and overall conductor arrangements for lines added to, or rebuilt in, multiple-line corridors.
  - Merely adding a reverse-phase double-circuit line to an existing transmission line corridor or reverse phasing a rebuilt line in the multiple-line corridor will not necessarily produce lower magnetic field levels at the edge of the corridor right of way.
  - The corridor must be computer modeled with all the lines, existing phase conductor locations and currents. Then, magnetic field calculations must be made varying the phase arrangements of the new or reconstructed line to determine the appropriate phasing arrangement.
  - Current flow direction on a line also must be considered. For example, a reverse-phased line should have the current flowing in the same direction on both circuits. If the current flow is in the opposite direction for one circuit, reverse phasing will not produce the lowest magnetic field and another phase arrangement that produces lower fields may need to be utilized.

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

138/69 kV Transmission Lines

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

230 kV Transmission Lines

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

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

500 kV Transmission Lines

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

RECONDUCTORING OR ADDING ADDITIONAL CIRCUITS TO EXISTING TRANSMISSION LINES

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

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

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

DISTRIBUTION LINES

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

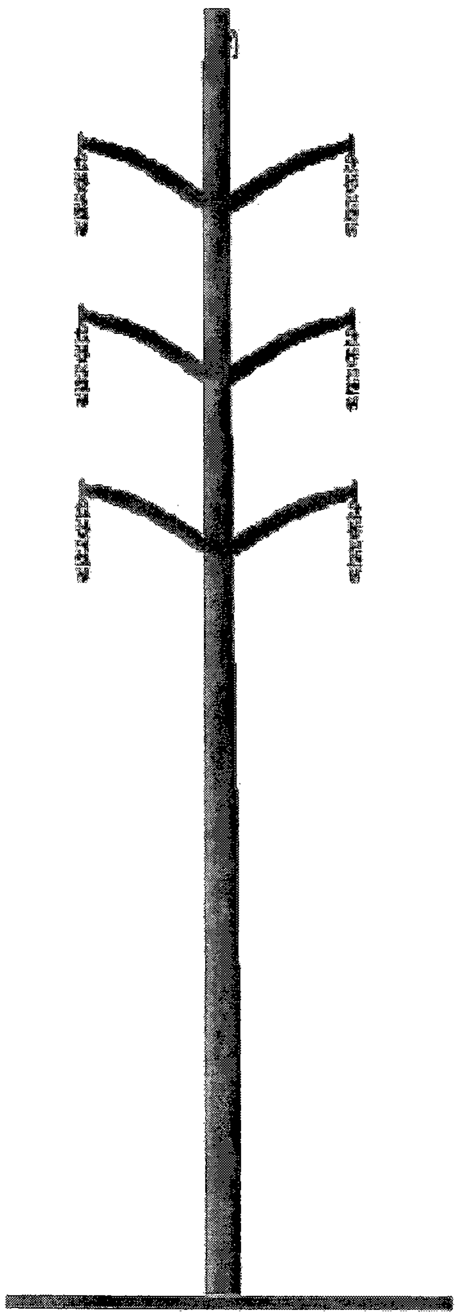
- Main lines are the most heavily loaded sections of a distribution line and therefore have the highest magnetic fields associated with them.
- Increasing the ground clearance by five feet reduces the magnetic field under the line from 14 mG to 11 mG using the standard eight-foot crossarm design. These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

UNDERGROUND TRANSMISSION LINES

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

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

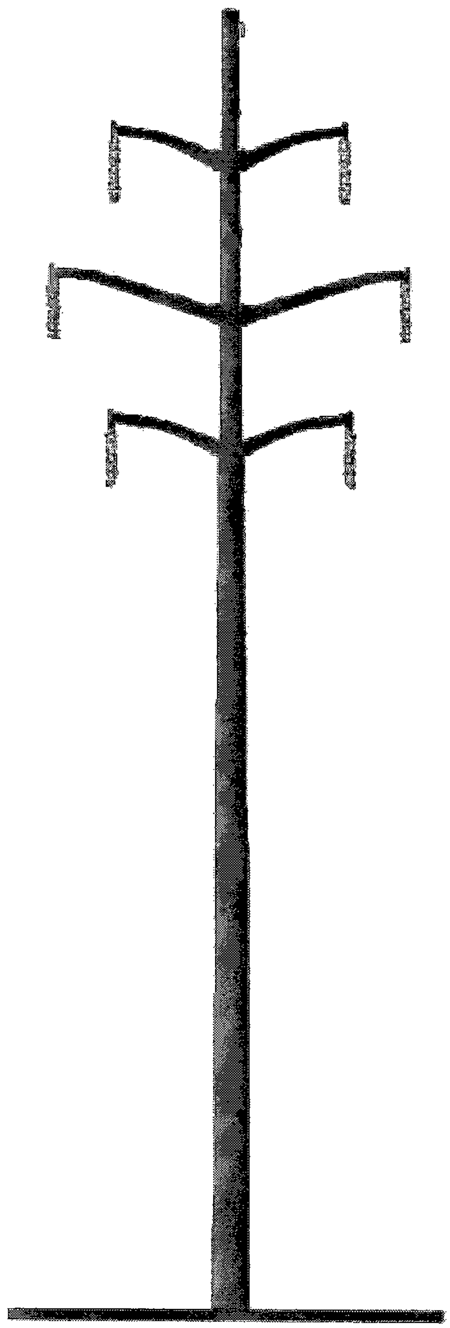
Short-Span Construction



- **More compact design**
- **Should not be used solely to reduce magnetic fields**
- **Typical conductor data:**

1 3/8" HS steel overhead ground wire - 7.3 feet sag
6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 10.0 feet sag
Average span - 400 feet

Long-Span Construction Remains PPL EU 138 kV Standard



- **Lower cost alternative**
- **Reduces magnetic fields due to higher structures**
- **Typical conductor data:**

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

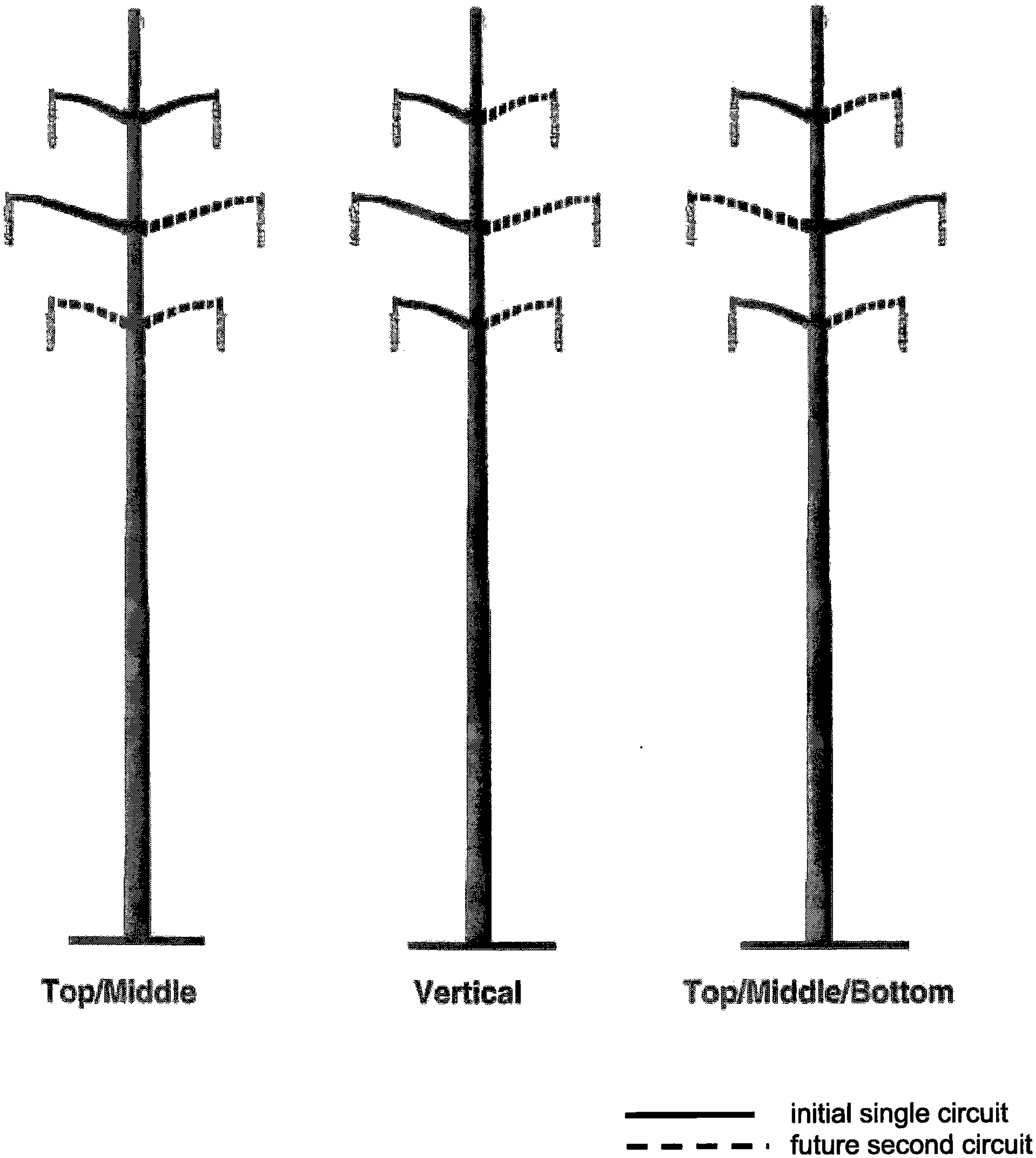
138/69 kV REVERSE-PHASE TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 400 AMPERES

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

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

CHART IV

Typical Single-Circuit Structure Designs

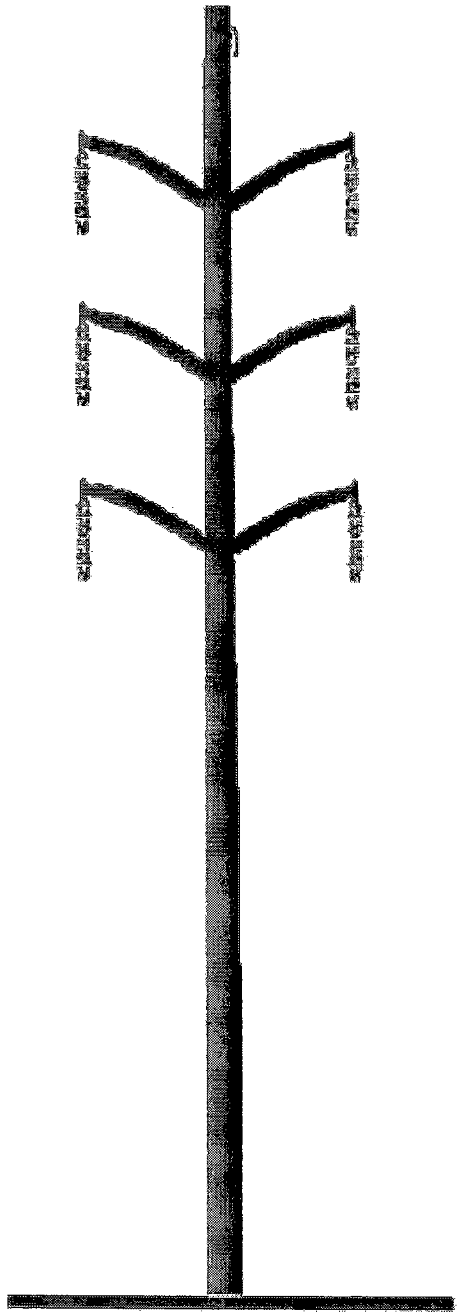


138/69 kV SINGLE CIRCUIT TRANSMISSION LINES CALCULATED MAGNETIC FIELDS AT 400 AMPERES

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

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

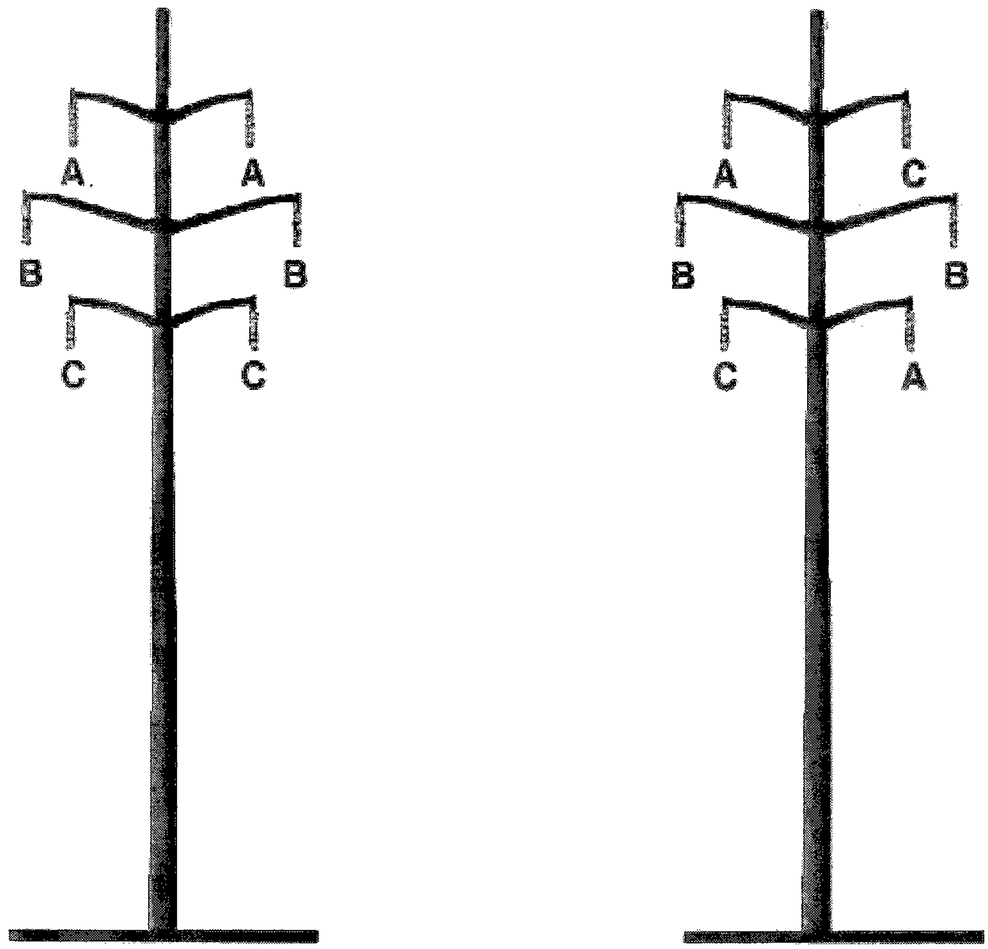
Compact Design Structure



- **Minimize magnetic fields due to compact design**
- **Not a low-cost alternative**
- **Typical conductor data:**

1 3/8" HS steel overhead ground wire - 9.0 feet sag
6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 9.0 feet sag
Average span - 300 feet

Reverse Phasing of Double-Circuit Transmission Lines



From: ⟶ ⟶ ⟶ ⟶ To:

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

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

CHART VIII

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

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

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

CHART IX

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

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

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

**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.

Siting/Magnetic Field Management.doc/mlt

Attachment
6

ATTACHMENT 6
SOUTH AKRON-DILLERVILLE #1 AND #2 138 kV LINE
LIST OF OWNERS OF PROPERTY WITHIN THE RIGHT OF WAY

Alcoa Inc
201 Isabella St.
Pittsburgh, PA 15212

Allen Berg LLC
930 Red Rose Court.
Suite 200
Lancaster, PA 17601

Allen Partnership
C/O Cindy Shertzer.
5270 Manheim Pk
East Petersburg, PA 17520

Stanley G & Dolores L Allison
1262-1268 Loop Rd.
Lancaster, PA 17602

Armstrong World Industries Inc
Tax Dept P O Box 3001.
Lancaster, PA 17604

Jeffrey L & John R Banta
16536 Henrys Drive.
Bozeman, MT 59715

Jeffrey L Banta & John R. Banta
16536 Henrys Drive
Bozeman, MT 59715

Robert M & Rosanne S M Basarab
475 Buch Ave.
Lancaster, PA 17601

Shawn P & Tonianne Bertel
231 Gardenia Court.
Lititz, PA 17543

Bollinger & Hess Group Llc
1770 Oregon Pike.
Lancaster, PA 17601

Miguel A Bonilla & Laura A. Bonilla
114 Autumn Dr
Lititz, PA 17543

William Boots & Melissa A. Boots
108 Winter Hill Rd
Lititz, PA 17543

Borough Of East Petersburg
6040 Main St.
East Petersburg, PA 17520

Patrick J & Cindy A Bostick
749 Rosemont Dr.
Lititz, PA 17543

Timothy M & Joy B Bradley
728 Rosemont Dr.
Lititz, PA 17543

Brethren Village
Po Box 5093.
Lancaster, PA 17601

Brethren Village
3001 Lititz Pk.
Lancaster, PA 17606

Lisa A Brosey
748 Rosemont Dr.
Lititz, PA 17543

A Omer Brubaker & Charmayne L. Brubaker
1075 Gypsy Hill Rd
Lancaster, PA 17602

Brubaker Motors Inc
Lititz Pike & Mcgovern Ave
Lancaster, PA 17602

Anna Lois Buckwalter & Mary Jane. Peffley
17032 Frederick Rd
Mt Airy, MD 21771

Gary J Burkholder & Janelle R. Burkholder
210 Cocalico Creek Rd
Ephrata, PA 17522

Mark W Burkholder & Katie S. Burkholder
253 Skyview Lane
Lititz, PA 17543

Edwin F & Marie R Burst
472 Wetherburn Dr.
Lancaster, PA 17601

C&V Family Ltd Partnership
29 Hessian Blvd.
Reading, PA 19607

Ronald A & Patricia A Cabala
467 Chowning Place.
Lancaster, PA 17601

Calder Door & Specialty Co
1296 Loop Rd Po Box 4601.
Lancaster, PA 17604

Craig S & Caroline R Cantor
5021 Martin Dr.
East Petersburg, PA 17520

Thomas D Capizzi
Heather A. Capizzi
600 Wallingford Rd
Lititz, PA 17543

Cocalico Creek Realty Lp
Po Box 339
Brownstown, PA 17508

Colyur Associates Llc
26 Cocalico Creek Rd.
Ephrata, PA 17522

Benjamin W & Evelyn E Cope
387 Koser Rd.
Lititz, PA 17543

Ryan T Coulson
Andrea L. Coulson
334 Darlington Court
Lancaster, PA 17601

Cpi Assoc
929 State Rt 501 South.
Newmanstown, PA 17073

Elizabeth H Craver
2346 Bob White Lane.
Lancaster, PA 17601

Robert T Cruz
Catherine P. Cruz
176 Petersburg Rd
Lititz, PA 17543

Decatur Investments
Po Box 5555.
Lancaster, PA 17606

Ravindra & Swapna R Deshpande
328 Copley Dr.
Lancaster, PA 17601

Martin A Diamond
Debra A. Diamond
409 Wagonwheel Rd
Lititz, PA 17543

Donald E Diem
Dianna L.Diem
425 Wagonwheel Rd
Lititz, PA 17543

David C & Cynthia A Dietrich
5011 Martin Dr.
East Petersburg, PA 17520

Jeffrey N & Dawn L Donough
108 Autumn Dr.
Lititz, PA 17543

Stephen W & Mary Jane. Dougherty
5009 Martin Dr
East Petersburg, PA 17520

James C Dumser
Shannon E. Dumser
2488 Raleigh Drive
Lancaster, PA 17601

Timothy Sr Efinger
Sandra L. Efinger
437 Wagon Wheel Rd
Lititz, PA 17543

Michael R Ellinger
Stephanie A. Ellinger
5029 Martin Dr
East Petersburg, PA 17520

Bliss N Endicott
128 April Lane.
Lititz, PA 17543

Gene L Sr & Mary L Engle
5025 Martin Dr.
East Petersburg, PA 17520

Judith S Faulkner
690 Steinman Court.
Lancaster, PA 17603

Stephen M & Angela A Faust
125 Hibiscus Ct.
Lititz, PA 17543

Penny L Fisher
Mark E. Fisher
732 Rosemont Dr
Lititz, PA 17543

Nancy A Flint
388 Copley Dr.
Lancaster, PA 17601

Harry J Fogarty
Jacqueline B. Fogarty
2620 Miller Rd
East Petersburg, PA 17520

Scott A Frey
Amy M. Frey
384 Copley Dr
Lancaster, PA 17601

Friendship Community
1149 E Oregon Rd.
Lititz, PA 17543

Charles W Jr & Dolores Ganse
5017 Martin Dr.
East Petersburg, PA 17520

Laverne R & Christine M Gibble
127 April Lane.
Lititz, PA 17543

James W & Jasmine D Gibbs
2880 Pebblebrook Dr.
Lancaster, PA 17601

Mason L Greenawalt
Krista J. Greenawalt
3019 Kissel Hill Rd
Lititz, PA 17543

Arthur J & Kay G Gresh
2334 Bob White Lane.
Lancaster, PA 17601

Matthew R Gross
Stephanie L. Gross
2489 Raleigh Drive
Lancaster, PA 17601

Wade M Hartz
1015 Log Cabin Rd.
Leola, PA 17540

David H Hays
Lynne H. Hays
461 Chowning Place
Lancaster, PA 17601

Frederick S & Mary H Helder
449 Chowning Place.
Lancaster, PA 17601

Jonathan L & Gail M Henry
348 Copley Drive.
Lancaster, PA 17601

Edward S Hess
Marian E. Hess
22 Calvary Drive
Lancaster, PA 17601

Margaret S Hess
C/O Margaret S Corle.
950 Log Cabin Rd
Leola, PA 17540

Russell J Hobson
Sarah C. Hobson
433 Wagon Wheel Rd
Lititz, PA 17543

Velma M Hoover
20 Cocalico Creek Rd.
Ephrata, PA 17522

Victoria L Hoshower
5007 Martin Dr.
East Petersburg, PA 17520

Hurst Family Estate Lp
2900 Oregon Pk.
Lititz, PA 17543

Louis B & Marcia A Hutchinson
239 Gardenia Court.
Lititz, PA 17543

Greystone Manor Farm Lp
2870 Oregon Pk.
Lititz, PA 17543

Irvin E Ditzler Revocable Livi
5013 Martin Drive
East Petersburg, PA 17520

James R Aulthouse Et Al
376 Copley Dr.
Lancaster, PA 17601

Jdoliver Llc
Po Box 4174.
Harrisburg, PA 17111

Betty L Jeddic
2395 Partridge Ln.
Lancaster, PA 17601

Charles M & Judith A Johnson
2900 Weaver Rd.
Lancaster, PA 17601

Douglas C & Lynn M Kann
5037 Martin Dr.
East Petersburg, PA 17520

Steven D Kann
5015 Martin Drive.
East Petersburg, PA 17520

Gordon L Kautz
Wendy E. Kautz
1278 Loop Rd #D
Lancaster, PA 17602

Kenneth E Griswold Et Al
2894 Weaver Rd.
Lancaster, PA 17601

Timothy A Kershner
Deborah Anne Kershner
405 Wagon Wheel Road
Lititz, PA 17543

Scott M & Jessica R Kilby
5027 Martin Dr.
East Petersburg, PA 17520

Amos K Jr & Arie E King
1150 E Oregon Rd.
Lititz, PA 17543

Irvin E Ditzler Revocable Livi
5013 Martin Drive
East Petersburg, PA 17520

Stephen F King
Sadie Mae King
233 Becker Rd
Leola, PA 17540

Kissel Hill Commons Loa
616 Paxton Place.
Suite 100
Lititz, PA 17543

Richard R & Nancy J Klein
315 Portland Place.
Lititz, PA 17543

Gerald L Kochel
Po Box 215.
Lititz, PA 17543

Raimonds & Sandra M Krievans
2875 Pebblebrook Dr.
Lancaster, PA 17601

Michael T & Randi E Kurtas
344 Copley Dr.
Lancaster, PA 17601

Landis Homes Retirement Commun
1001 E Oregon Rd.
Lititz, PA 17543

Jay E Landis
Sharon J. Landis
1270 E Oregon Rd
Lititz, PA 17543

Melvin C & Nancy L Landis
1001 Jake Landis Rd.
Lititz, PA 17543

Jacob S & Sarah E King
243 Becker Rd.
Leola, PA 17540

Larkspur Crossing Associates L
C/O Housing Development.
439 E King St
Lancaster, PA 17602

David J Larry & Heather L. Larry
5033 Martin Drive
East Petersburg, PA 17520

David A Laughner
Catherine M. Laughner
417 Wagonwheel Rd
Lititz, PA 17543

David E Layton
115 Autumn Dr.
Lititz, PA 17543

Lcm 5240 Lp
5260 Main St.
East Petersburg, PA 17520

Barbara W Linder
423 Ringneck Lane.
Lancaster, PA 17601

Harold James & Karen E Loke
312 Copley Dr.
Lancaster, PA 17601

Michael F Lombardo
Kelly M. Lombardo
364 Copley Drive
Lancaster, PA 17601

Kim M Long
724 Rosemont Dr.
Lititz, PA 17543

Loop Road Associates Lp
1336 Loop Rd.
Lancaster, PA 17601

Terry John & Pamela A Lort
2872 Pebblebrook Dr.
Lancaster, PA 17601

Darrin R Martin
Renee C. Martin
109 Autumn Dr
Lititz, PA 17543

Elmer R Martin
Grace Z. Hurst
940 Log Cabin Rd
Leola, PA 17540

Michael P Mcbride
Erica J Mcbirde.
445 Wagonwheel Rd
Lititz, PA 17543

Ernest L & Lynda A Mester
368 Copley Dr.
Lancaster, PA 17601

Scott A & Karen A Miller
129 Hibiscus Court.
Lititz, PA 17543

Kevin C & Rachel M K Moore
765 Rosemont Drive.
Lititz, PA 17543

Steven M Moore
Krystal L Moore.
112 Winter Hill Rd
Lititz, PA 17543

Moove In Partners 741 Lp
10 Bentzel Mill Rd.
York, PA 17404

Mount Calvary Evangelical Lutheran Church.
308 Petersburg Rd
Lititz, PA 17543

Raymond E & Lana B Murray
352 Copley Dr.
Lancaster, PA 17601

Paul W & Helen R Myers
5035 Martin Dr.
East Petersburg, PA 17520

New Prime Inc
Success Leasing Inc.
2740 N Mayfair
Springfield, MO 65803

Douglas W Newcomer
Linda C. Newcomer
441 Wagon Wheel Rd
Lititz, PA 17543

Douglas A & Toni Nolt
5005 Martin Dr.
East Petersburg, PA 17520

Norma E Hess Et Al
400 Becker Road.
Leola, PA 17540

Mcgovernville Investments Llc
Po Box 7868.
Lancaster, PA 17604

David Nye
109 Winter Hill Rd.
Lititz, PA 17543

Wilmer Oberholtzer
Ella Mae Oberholtzer
170 Cocalico Creek Rd
Ephrata, PA 17522

Ohio Farmers Insurance Company
1 Park Circle.
Westfield Center, OH 44251

P P & L Inc
Real Estate
2 N 9Th St
Allentown, PA 18101

Park City Center Business Trus
110 North Wacher Drive.
Chicago, IL 60606

Parkridge Crossing Home Owners
15 Meadow Lane.
Lancaster, PA 17601

Patrick L & Carol A Patterson
380 Copley Dr.
Lancaster, PA 17601

Karen M Peiffer
109 Hibiscus Court.
Lititz, PA 17543

Pennsylvania Lines Llc
C/O Norfolk Southern. Railway Co
110 Franklin Road
Roanoke, VA 24042

Thomas Iii Perkins
Donna L. Snyder
703 W Ridge Pk
Limerick, PA 19468

Khamsith & Bouason Phimmasone
235 Gardenia Court.
Lititz, PA 17543

Novelty Manufacturing Co
1330 Loop Rd.
Lancaster, PA 17601

Plowshares Lp
1650 Crooked Oak Dr.
Suite 300
Lancaster, PA 17601

David B Priester
Lisa I. Priester
413 Wagonwheel Rd
Lititz, PA 17543

Pat J Jr & Giovanna Principe
356 Copley Dr.
Lancaster, PA 17601

James W & Jo Ann Privetta
161 Summer Lane.
Lititz, PA 17543

Rama Realty
361 Petersburg Rd.
Lititz, PA 17543

Robert L Redcay
259 Brook Farms Rd.
Lancaster, PA 17601

Albert J & Dawn S Rehman
165 Summer Lane.
Lititz, PA 17543

David E Rice
Sheri B. Rice
421 Wagonwheel Rd
Lititz, PA 17543

Thomas.Risser & Janice Cooper Risser
938 Log Cabin Rd
Leola, PA 17540

F H Iii & Jenny E Rogers
332 Copley Dr.
Lancaster, PA 17601

Peter B & Anita M Rohrer
2544 Fruitville Pike.
Lancaster, PA 17601

Joseph D & Diane R Pleva
752 Rosemont Dr.
Lititz, PA 17543

Eric V Rotz
Tamara E. Rotz
336 Copley Drive
Lancaster, PA 17601

Kathe E Rowe
753 Rosemont Dr.
Lititz, PA 17543

Ryder Truck Rental Inc
C/O Property Tax Dept 3B.
Loc 0568
PO Box 025719
Miami, FL 33102

Samuel Miller & Son Inc
1501 Cloister Dr.
Lancaster, PA 17601

John W & Joan H Schreiber
478 Wetherburn Dr.
Lancaster, PA 17601

Schwanger Bros Co Inc
Po Box 4186.
Lancaster, PA 17604

Schwanger Realty Inc
500 W Roseville Rd.
Lancaster, PA 17601

Michael J & Melinda A Sellard
372 Copley Dr.
Lancaster, PA 17601

Carl H & Joan R Sinz
970 Disston View Dr.
R D 4
Lititz, PA 17543

Sme Holdings Lp
1730 Columbia Avenue.
Lancaster, PA 17603

B David & Kim R Smith
243 Gardenia Court.
Lititz, PA 17543

Charles B & Joyce F Snyder
5019 Martin Dr.
East Petersburg, PA 17520

Scott G Snyder
316 Copley Drive
Lancaster, PA 17601

Pietro & Kristen Spatafora
769 Rosemont Dr.
Lititz, PA 17543

Specon Inc Et Al
One Hess Plaza
Woodbridge, NJ 07095

Joseph A & Eileen F Stahl
910 Jake Landis Rd.
Lititz, PA 17543

Jacob F & Rachel K Stoltzfus
923 Log Cabin Rd.
Leola, PA 17540

Raymond F Stoltzfus
Ruth Ann. Stoltzfus
951 Log Cabin Rd
Leola, PA 17540

Carl R & Darlene E Stoner
105 Hibiscus Court.
Lititz, PA 17543

Kevin L Sultzaberger
Kimberly J. Sultzaberger
164 Summer Lane
Lititz, PA 17543

Susquehanna Bank
1570 Manheim Pk
Po Box 3300
Lancaster, PA 17604

Randy T Swanger
5023 Martin Dr.
East Petersburg, PA 17520

John M Thompson
Rebecca S. Thompson
1130 Creek Rd
Leola, PA 17540

Douglas W Jr & Snell
Kelly M. Snell
3027 Kissel Hill Rd
Lititz, PA 17543

Tran Cu Van & Minh Ngoc Thi
429 Wagonwheel Rd.
Lititz, PA 17543

Thomas P Troccoli
477 Wetherburn Dr.
Lancaster, PA 17601

Village Park Homeowners Association Inc.
2757 Cobblestone Lane
Lancaster, PA 17601

Daniel D Vokorokos
2340 Bob White Lane.
Lancaster, PA 17601

Vinh Vuong
Le Loan Kim
311 Portland Place
Lititz, PA 17543

Michael L Weaver
Kerri A. Weaver
324 Copley Dr
Lancaster, PA 17601

Brent I Wenger & Pamela D. Wenger
360 Copley Drive
Lancaster, PA 17601

Kyle E Wenger
Lynn R. Wenger
320 Copley Drive
Lancaster, PA 17601

Esther L Wenrich
1009 Creek Rd.
Leola, PA 17540

Michael C & Susan S Wildasin
5031 Martin Dr.
East Petersburg, PA 17520

Wildflower Commons
201 Starflower Vw.
Lititz, PA 17543

Township Of Manheim
1840 Municipal Dr.
Lancaster, PA 17601

Andrew Wong
Sue S. Wong
310 Portland Pl
Lititz, PA 17543

Adam M & Wood
Kelly M. Smith
136 April Lane
Lititz, PA 17543

Carl E Jr Witmer
160 Summer Lane
Lititz, PA 17543

Jeffry C Wright
Leslie M. Wright
340 Copley Drive
Lancaster, PA 17601

Yellow Freight Systems Inc
10990 Roe Ave.
Overland Park, KS 66201

Mary S Yohe
Thomas A. Yohe
2390 Partridge Lane
Lancaster, PA 17601

Robert D & Elizabeth M Young
469 Chowning Place.
Lancaster, PA 17601

Zimco Partners Lp
204 S Conestoga View Dr.
Akron, PA 17501

Jacob & Katie N Zimmerman
1073 Creek Rd.
Leola, PA 17540

Mahlon N Zimmerman
204 S Conestoga View Dr.
Akron, PA 17504

Ephraim G & Sarah S Zook
999 Disston View Dr.
Lititz, PA 17543

Attachment 7

ATTACHMENT 7
SOUTH AKRON-DILLERVILLE #1 AND #2 138 kV LINE
LIST OF INVOLVED GOVERNMENTAL AGENCIES, MUNICIPALITIES AND OTHER PUBLIC ENTITIES

1. 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

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

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

4. Lancaster County Planning Commission
   150 North Queen Street, Suite 320
   Lancaster, PA 17603
   Attn: James Cowhey, Executive Director

5. Lancaster County Board of Commissioners
   150 North Queen Street, Suite 715
   Lancaster, PA 17603
   Attn: Dennis Stuckey, Chairman

6. City of Lancaster
   120 North Duke Street
   P.O. Box 1599
   Lancaster, PA 17608-1599
   Attn: Richard Gray, Mayor

7. City of Lancaster
   120 North Duke Street
   P.O. Box 1599
   Lancaster, PA 17608-1599
   Attn: Pat Brogan, Chief of Staff

8. Lancaster City Planning Commission
120 North Duke Street
P.O. Box 1599
Lancaster, PA 17608-1599
Attn: Craig Lenhard, Secretary

9. Lancaster City Council
120 North Duke Street
P.O. Box 1599
Lancaster, PA 17608-1599
Attn: Louise Williams, President

10. Manheim Township Planning Commission
1840 Municipal Drive
Lancaster, PA 17601
Attn: Jeffrey Sturla, Chairperson

11. Manheim Township Board of Commissioners
1840 Municipal Drive
Lancaster, PA 17601
Attn: Lawrence Downing, President

12. East Hempfield Township Planning Commission
1700 Nissley Road
P.O. Box 128
Landisville, PA 17538
Attn: F. James Fullerton, Chairperson

13. East Hempfield Township Board of Supervisors
1700 Nissley Road
P.O. Box 128
Landisville, PA 17538
Attn: Brett Miller, Chairperson

14. Warwick Township Planning Commission
315 Clay Road
P.O. Box 308
Lititz, PA 17543-0308
Attn: Thomas Zug, Chairperson

15. Warwick Township Board of Supervisors
315 Clay Road
P.O. Box 308
Lititz, PA 17543-0308
Attn: W. Logan Myers III, Chairperson

16. West Earl Township Planning Commission
    157 West Metzler Road
    PO Box 787
    Brownstown, PA 17508
    Attn: Dean Weinhold, Chairperson

17. West Earl Township Board of Supervisors
    157 West Metzler Road
    PO Box 787
    Brownstown, PA 17508
    Attn: Harold Keppley, Chairperson