Before the
Pennsylvania Public Utility Commission

HOSENSACK - WESCOSVILLE 230 kV LINE REPLACEMENT

ATTACHMENTS IN SUPPORT OF THE
LETTER OF NOTIFICATION

Application Docket No. ____________

Submitted by: PPL Electric Utilities Corp.

SUMMARY

A Letter of Notification is being submitted by PPL Electric Utilities Corporation ("PPL Electric") pursuant to the Pennsylvania Public Utility Commission's ("Commission") regulations at 52 Pa. Code §§ 57.71 through 57.77 for approval to reconstruct the single-circuit Hosensack – Wescosville #3 230 kV Transmission Line. This transmission line is being reconstructed as part of PPL Electric's Vintage Conductor program, which was developed to address deteriorated facilities within PPL Electric's system. The facilities in the Vintage Conductor Program were initially constructed between the mid-1920's and the late 1930's. The Vintage Conductor Program is further described in Attachment 1.

The Hosensack – Wescosville #3 230 kV Project described in this, the third filing for the Vintage Conductor Program, will rebuild approximately 8.7 miles of the single-circuit transmission line. The transmission line begins near PPL Electric's Hosensack Substation located in Lower Milford Township, Lehigh County. The line continues north and terminates at PPL Electric's Wescosville Substation, which is located in Upper Macungie Township, Lehigh County. The project will be contained on the existing PPL Electric right-of-way that traverses portions of Lower Milford Township, Upper Milford Township, Lower Macungie Township, and Upper Macungie Township in Lehigh County, Pennsylvania. The proposed reconstructed line will be designed and constructed for one 230 kV circuit.

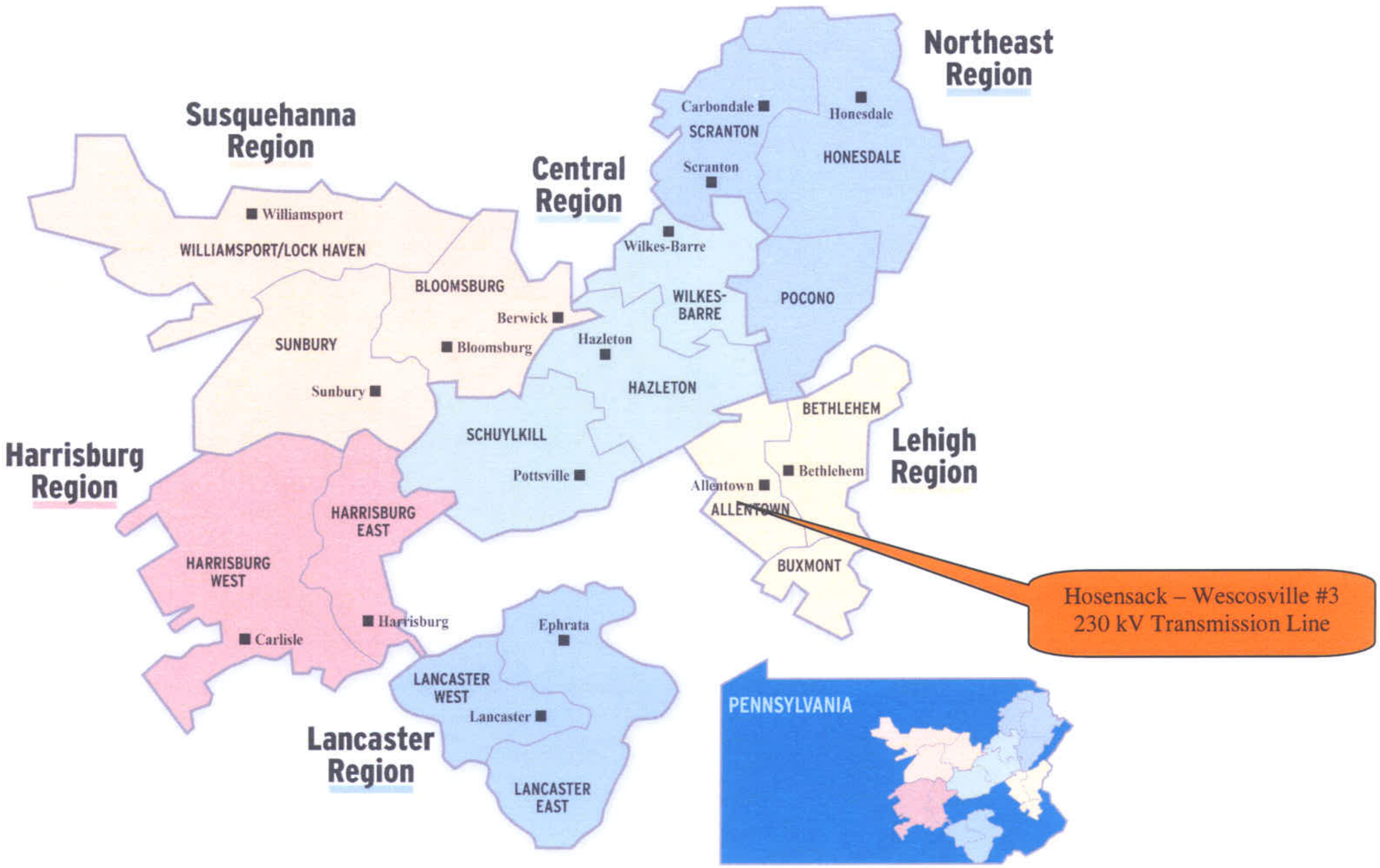
The reconstruction of this transmission line will include the removal of the existing lattice towers and conductors, which will be replaced with new single shaft steel poles, conductors, insulators and overhead ground wire. No new rights-of-way will be required because the proposed line will be rebuilt within the existing PPL Electric right-of-way. Due to the deteriorated condition of the Hosensack – Wescosville #3 Transmission Line, PPL Electric is expeditiously moving forward with this project before failure of this line occurs.

The total estimated cost of the proposed transmission work is approximately $15,670,000. This project has a scheduled construction start date of August 2012, in order to meet an in-service date of November 2013. PPL Electric is seeking approval at this time to take advantage of system operations that may allow for an earlier construction start date.

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

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

PPL ELECTRIC UTILITIES SERVICE TERRITORY



Attachment

1

ATTACHMENT "1"

HOSENSACK – WESCOSVILLE #3 230 kV TRANSMISSION LINE REPLACEMENT

NECESSITY STATEMENT

TABLE OF CONTENTS

LIST OF TABLES

ATTACHMENT "1"

HOSENSACK – WESCOSVILLE #3 230 kV TRANSMISSION LINE REPLACEMENT NECESSITY STATEMENT

A. INTRODUCTION

PPL Electric is requesting Commission approval to rebuild the eighty-three year-old Hosensack – Wescosville #3 230 kV Transmission Line. The proposed replacement involves a section of transmission line which begins near the Hosensack substation, located in Lower Milford Township, Lehigh County, and continues north to PPL Electric's Wescosville Substation located in Upper Macungie Township, Lehigh County, a distance of approximately 8.7 miles. A 1.06 mile section of this line was constructed in the 1960s, when PPL Electric constructed the existing Hosensack 230-69 kV Substation. A field review of this section found the towers and supporting components to be in good condition. Therefore, rebuilding this section is not necessary at this time. This project is part of PPL Electric's Vintage Conductor Program, which was developed to address deteriorated facilities in PPL Electric's transmission system. The proposed project will be designed to accommodate a single 230 kV circuit. As explained in detail below, reconstruction of the transmission line is required to maintain system reliability.

The estimated cost to design and replace the transmission line is $15,670,000. Construction is scheduled to begin in the fall of 2012 in order to meet the in-service date of November 2013.

A PPL Electric system map showing the existing transmission facilities with design voltage of 35 kV or greater is included in the Attachment "1" map pocket. Although this Necessity Statement provides a broad discussion of the Vintage Conductor Program, this filing addresses only the Hosensack – Wescosville #3 Transmission Line, which is located in Lehigh County, Pennsylvania.

B. OVERVIEW OF VINTAGE CONDUCTOR PROGRAM

The PPL Electric transmission system includes multiple 230 kV line segments that are approximately 80 years old. These line segments were installed in the mid-1920's through the

1930's. Lines that operate at 230 kV are part of the bulk electric system. These lines serve as major pathways for the flow of large amounts of electrical power: (a) from one bulk substation or switchyard to other bulk stations within the electric utility's territory, or (b) between one electric utility and another. At the bulk substations, power is transformed to lower voltage levels for delivery to residential, commercial, or industrial customers. PPL Electric owns approximately 1,000 miles of transmission lines that operate at 230 kV. The Hosensack – Wescosville #3 Transmission Line connects PPL Electric's Hosensack 230-69 kV Substation to its Wescosville 500-230-138-69 kV Substation.

The Vintage Conductor Program began when, as a result of a review process, PPL Electric's Transmission Engineering group informed the Transmission Planning group of the deteriorated facilities existing on the 230 kV line located between the Bushkill 230 kV switchyard and Wallenpaupack hydroelectric plant. The Transmission Engineering group subsequently identified other 230 kV lines dating to the same construction era with similarly designed structures and conductors.[1] Conversations between the Planning and Engineering groups resulted in the identification of eleven line segments that contained aged and deteriorated facilities. The identified segments, totaling approximately 140 miles, were grouped into a program that PPL Electric named the Vintage Conductor Program. The process of identifying aged and deteriorated facilities is on-going. Three more line segments have been identified for further analysis.

In 1983, PPL Electric tested a portion of this "vintage conductor" – specifically those line segments located between the Wallenpaupack, Blooming Grove, Bushkill, and Siegfried electric stations. At the time of this testing, the steel core of the "795" conductor was showing deterioration, but the greatest concern to PPL Electric personnel was the deterioration occurring at the conductor splices.

Consequently, most splices in the line between the Wallenpaupack and Siegfried stations were replaced. The Transmission Engineering group determined that the line conductor was expected to last another 10 to 15 years. The 15 year time frame has been exceeded, and no follow up

[1] 795 thousand circular mils (kcmil), aluminum conductor steel reinforced (ACSR), 54/7 stranding, and variations of that stranding.

examination or similar major repair work has been performed on the other line segments. PPL Electric, however, continues to perform aerial inspections of these facilities every four years, on average. Specific maintenance tasks are identified from the inspections. PPL Electric prioritizes, schedules, and completes these tasks in a timely manner.

In early 2010, PPL Electric hired an outside engineering consultant, DiGioia Gray and Associates,[2] to perform an independent field investigation and assessment of the line segments.[3]

The engineering consultant reported on the degree of deterioration of the structural components, foundations, insulators, line hardware, shield wire, grounding, signage, paint, and galvanizing. The status of right-of-way encroachment and adjacent land features were also reported.

A short length of conductor (loop) and its insulator string used to connect two spans of conductors at tension towers was removed and examined (laboratory and visual) from four of the eleven line segments. Overhead line conductor was not examined or tested to determine its physical condition or its tensile strength. Tensile strength testing would have required a line outage in order to physically remove multiple samples from the span (i.e.; conductor located between two adjacent towers) at numerous locations along the identified line segments. Furthermore, an examination of the conductor would be an unnecessary initial step if the other tower-line components (i.e.; structures, foundations, etc) were found to be significantly deteriorated, as was expected from the findings in 1983. Sampling of overhead conductor will only be initiated if deteriorated tower-line components can be remedied by rehabilitation.

DiGioia Gray & Associates identified a statistically significant number of structures for each line segment. The identified structures, and associated foundations and line equipment, were then inspected in the field by DiGioia Gray & Associates. Results of the evaluations were summarized in line-specific assessment reports.

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[2] DiGioia Gray & Associates of Monroeville, PA 15146

[3] Two of the line sections, specifically the Bushkill - Blooming Grove and Blooming Grove – Wallenpaupack line segments, were excluded from the field investigation performed by the engineering consultant because those segments are to be completely rebuilt as part of the proposed Susquehanna – Roseland 500 kV line project. A recent Commission decision approved the Susquehanna – Roseland project, and the associated rebuilding of these two line segments. Appeals from that decision are pending.

Based upon the issues that were identified in 1983, and the recent findings of the independent external engineering consultant, the identified line segments are now at an increased exposure to failing. This creates a safety concern for both the public and PPL Electric field personnel. Further, if this issue is left unresolved, the potential for degradation in grid reliability will exist, due to an increased risk to line equipment outages. PPL Electric determined that a program to systematically upgrade these line segments was required, and established the Vintage Conductor Program to perform the necessary upgrades.

The original nine segments included in the Vintage Conductor Program, which total approximately 90 miles, and the two projects that are included in the Susquehanna-Roseland 500 kV project are identified in Table 1. Review of PPL Electric's transmission system to determine whether additional segments need to be replaced is on-going.

TABLE 1
Vintage Conductor Program

Super Project No.	Project Name / Line Segment	Line Segment Miles	Original In-Service Date
9056	Manor – Graceton	14.52	1937
9057	Otter Creek – Conastone	11.98	1933
9054	Martins Creek – Siegfried # 2	10.69	1926
9049	Hosensack – Wescosville # 3	9.76	1928
9053	Whitpain – Buxmont	7.72	1928
9050	Shawnee – Bushkill	2.20	1926
9051	Fox Hill – Shawnee	8.27	1926
9052	Martins Creek – Monroe	16.14	1926
9055	Hummelstown – Middletown Junction # 1	7.00	1954
N/A	Bushkill – Blooming Grove (note 1)	21.80	1926
N/A	Blooming Grove – Wallenpaupack (note 1)	29.40	1926

N/A – not applicable.

(note 1) – Line segments to be upgraded as part of the Susquehanna-Roseland 500 kV Line project.

C. PROPOSED SOLUTION

The Hosensack - Wescosville #3 line is the only 230 kV source of electric power to the 230-69 kV transformer # 2 at Wescosville. Permanent removal of the Hosensack – Wescosville #3 line from service would weaken the 230 kV system in eastern Pennsylvania.

When this line is temporarily removed from service to perform line maintenance, during heavy load periods an unplanned outage of either the Wescosville 138-69 kV transformer # 1 or # 4 causes an overload on the remaining transformer. The Hosensack - Wescosville #3 line and the 230-69 kV transformer # 2 at Wescosville would normally relieve this overload condition. In addition, the 230-69 kV transformer # 2 is used to relieve an overload on the Wescosville 500-138 kV transformer # 3 during peak load periods under specific generation dispatches or abnormal sectionalizing.

Therefore, abandonment of the Hosensack – Wescosville #3 230 kV Transmission Line is not an option.

Technical solutions to resolving the deteriorated components inherent to the "Vintage Conductor" line segments would be to either:

(a) rehabilitate the components (i.e.; structures, foundations, conductors, insulators, and line hardware), or,

(b) completely rebuild those line segments.

PPL Electric prepared a cost analysis and determined that a complete rebuild of the Hosensack – Wescosville #3 Transmission Line was less expensive than rehabilitation. Specifically, the PPL Electric cost analysis, summarized in Table 2, concluded that rehabilitation costs would be 101 percent of the total rebuild cost for the Hosensack – Wescosville # 3 Transmission Line, making a total rebuild the more cost effective option.

TABLE 2
PPL Electric Cost Analysis of Rebuild vs. Rehabilitation

	Labor & Material Cost (x 1000)		Ratio of Costs; Rehabilitation to Rebuild
Scope	**Rebuild**	**Rehabilitation**	**Percent**
Labor and materials related to structures, foundations, insulators, line hardware and paint.	$10,054	$10,340	103
Common elements (includes labor and materials related to conductor, design and engineering, project management, acquisition of additional right-of-way, permitting, siting, PUC certification, environmental, and general overhead costs).	$12,668	$12,668	100
Total	$22,722	$23,008	101

In addition, Burns & McDonnell ("B&McD"), a consulting engineering firm, prepared an independent cost evaluation on an individual line segment basis and compared rehabilitation of conductor, structures, foundations, and associated line equipment against a complete rebuild. The results of the B&McD evaluation for the Hosensack – Wescosville #3 line were consistent with the PPL Electric cost evaluation.

The independent external engineering consultant, DiGioia Gray & Associates, also stated the following with regard to the Hosensack – Wescosville #3 line:

> Given that five of eight structures inspected with embedded steel foundations are in a severe state, we do not advise that this line be rehabilitated. Repairing the majority of structures for severe section loss at ground line is not economically feasible and would result in a reliability index significantly lower than a newly constructed transmission line.

In further support of the decision to completely rebuild rather than rehabilitate the Hosensack – Wescosville #3 230 kV Transmission Line, PPL Electric also considered the following additional issues that are more efficiently addressed by rebuilding:

- Bent or missing steel components on the existing towers require removal and/or replacement, or the installation of additional bracing, to correct the structual deficiency. Depending on the number of crews assigned to the project, that work would either be done one tower at a time, or multiple towers grouped together for the repair work. On the other hand, the rebuild option will require only the erection of a single mono-pole structure after a new concrete foundation has been poured and cured.

- All insulator sets at the top of each tower should be replaced due to their age, the condition of the insulating material within the insulator, and the heavy contamination with pollutants from long-term exposure.

- Line hardware and related attachment steel on each tower should be removed and replaced, due to wear on the material at the connecting points. Metal against metal degradation was observed during the field inspections.

- Splices in the conductor should be replaced, due to their age, outdated design, and early manufacturing processes that were used to make these devices in the 1920's and 1930's.

- Conductor should be replaced based on its age.

- Grounding at each structure or tower leg must be upgraded by adding counterpoise in order to meet current safety standards.

- The overhead shield wires require replacement due to age, condition, and possible repositioning in order to bring the tower-line structure up to current lightning standards. In its assessment reports, the independent external engineering consultant noted that some line segments do not have the appropriate shielding angle, which makes the tower-line more susceptible to lightning strikes.

Rebuilding the Line will result in addition benefits that are explained below. In addition, completely rebuilding the Hosensack – Wescosville # 3 line is less expensive for PPL Electric than attempting to rehabilitate the line.

Rebuilding the Hosensack – Wescosville # 3 Transmisison Line will result in a new structure that is capable of supporting a single-circuit line that would meet current National Electrical Safety Code ("NESC") standards with regard to mechanical loading, including improved ground clearances. New structures will have an expected life that will exceed that of reconditioned structures.

The new structures will enable PPL Electric to comply with its modern magnetic field policy, and will improve the magnetic field values within and at the edge of the right-of-way. The new single circuit line will be designed to use 795 kcmil ACSR conductor, which matches the existing 795 conductor. Because the sole purpose of this transmission line is to supply electric power to the 150 MVA 230/69 kV transformer # 2 at Wescosville, the minimum wire size of 795 ACSR that can be used on a 230 kV circuit was selected for this project. Using the smaller wire size instead of 1590 ACSR will result in cost savings on this project because of the reduced mechanical loading on the structures, foundations, and supporting hardware. The 795 kcmil ACSR conductor will provide an ampacity of 425 MVA summer normal.

Rehabilitation of the Hosensack – Wescosville # 3 Transmission Line will require longer construction periods to perform the numerous repairs on a tower by tower basis. Most of the structures on the Hosensack – Wescosville # 3 Transmission Line have four foundations, because of the use of steel lattice towers. Where major foundation repairs are required, the individual tower will require temporary structural support while each foundation is replaced. Two or more towers likely would be grouped together for foundation repair work. A period of weeks will need to pass as the old concrete is removed and new concrete is placed and cured prior to placing the mechanical load back onto the new foundations. Foundation replacement would impede the speed at which crews could move from one structure and its associated foundations to the next. The process of repairing the foundations would prolong the construction period significantly if PPL Electric had determined to rehabilitate the existing line.

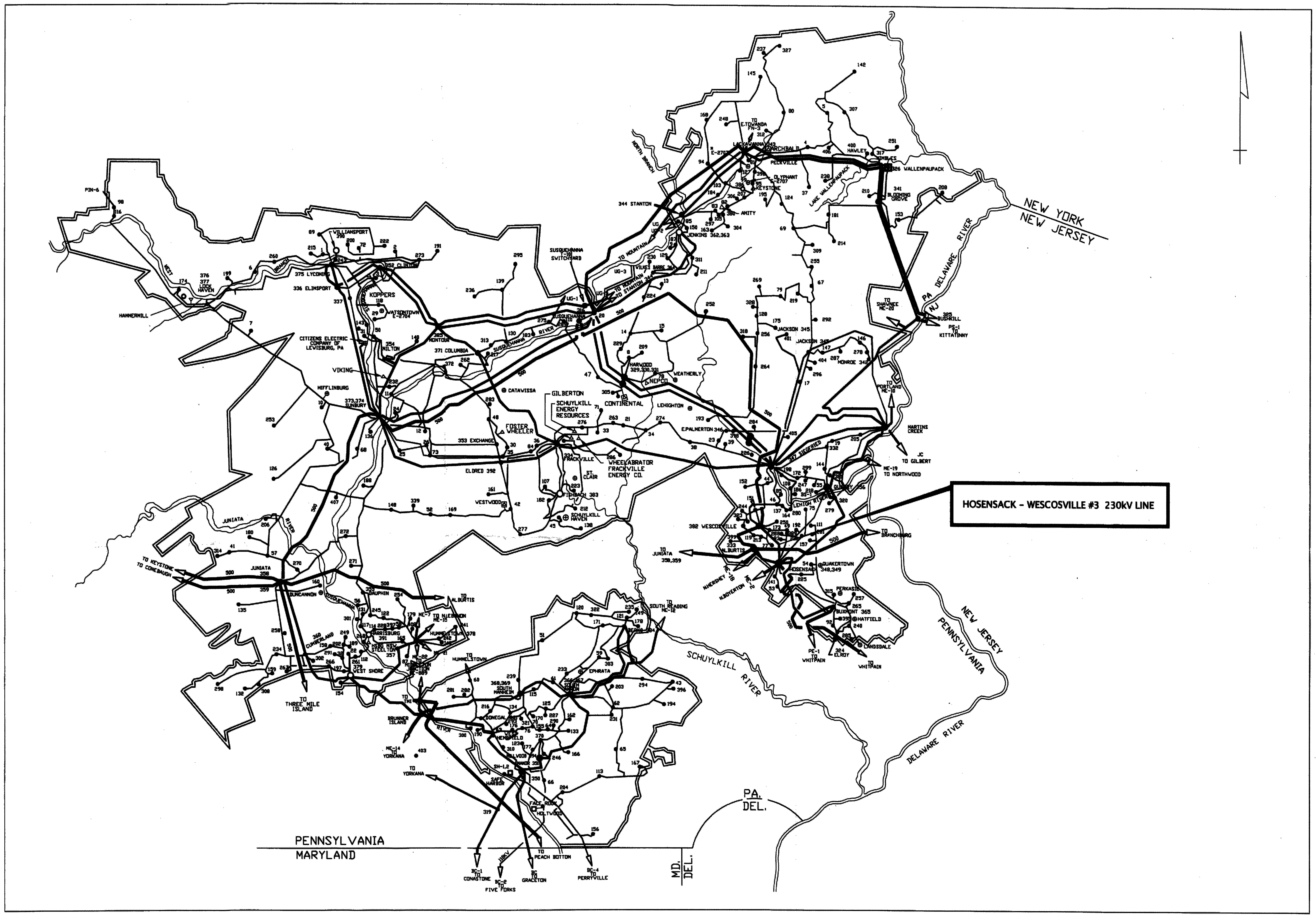
PPL Electric's current practice in rebuilding or reconductoring of lines is to install optical ground wire ("OPGW") instead of steel ground wire. Non-conductive strands of optical fiber material are surrounded by one or more layers of steel and/or aluminum wire to create the OPGW. This design change is employed so that protective relay schemes do not depend on less reliable hard-wired telephone circuits, or on power line carrier equipment that uses the line conductors for the communication path. The OPGW provides a relaying and communication path with improved reliability.

The completion date for each specific Vintage Conductor Program will be coordinated with the timing of the overall Asset Optimization Strategy ("AOS") Program, which is scheduled to conclude by 2020. Due to the physical condition of the Hosensack - Wescosville line segment, its in-service date has been established as November 2013. The in-service date of November 2013 will enable PPL Electric to budget, acquire resources, and schedule the rebuild of the Hosensack – Wescosville #3 Line segment with PPL Electric's system operators among the other line segments in the Vintage Conductor Program that also require rebuilding.

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 TREXLERTOWN
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
84	4/8/11	169004	ADDED ELROY - HATFIELD #1 & #2 138/69 kV LINE.	MG	RWM	DJG
83	4/5/11	161723	ADDED SOUTH AKRON - DILLERVILLE #1 & #2 138/69kV LINES	MG	RWM	JBW
86	4/15/11	10013847	ADDED HOSENSACK - WESCOSVILLE #3 230kV LINE REPLACEMENT	MG	RWM	DLH
85	4/13/11	169004	ADDED ELROY #2 500kV TIE LINE	MG	RWM	DG

REFERENCE TITLE | NUMBER | REFERENCE TITLE | NUMBER

#6000

ACCT- 805201
SCALE- NONE
BY- CDW
REVIEWED

ELECTRICAL SYSTEM MAP
HOSENSACK - WESCOSVILLE #3 230kV LINE

PPL ELECTRIC UTILITIES

APPROVED G. HAKUN III — DATE 7/17/85

PPL ELECTRIC UTILITIES

PPL DRAWING NO. D191830 — SHEET NO. 1 — REV. 86

PC CAD

Attachment

2

ATTACHMENT "2"

HOSENSACK – WESCOSVILLE #3 230 kV TRANSMISSION LINE REPLACEMENT

ENGINEERING DESCRIPTION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

ATTACHMENT "2"

HOSENSACK – WESCOSVILLE #3 230 kV TRANSMISSION LINE REPLACEMENT ENGINEERING DESCRIPTION

A. PROPOSED LINE DESIGN

PPL Electric proposes to rebuild 8.7 miles of the Hosensack – Wescosville #3 230 kV Transmission Line. This transmission line begins near the Hosensack Substation located in Lower Milford Township, Lehigh County, and continues north to PPL Electric's Wescosville Substation located in Upper Macungie Township, Lehigh County. As previously discussed in Attachment "1," this project is part of PPL Electric's Vintage Conductor Program, which was developed to address aged, deteriorated transmission facilities.

This project involves the removal of the existing transmission line, including the steel lattice towers and conductors, all of which were built in the late 1920's. The existing single circuit 230 kV transmission line is supported by lattice towers with an average height of approximately 90 feet and average span of approximately 1100 feet. The proposed rebuilt transmission line will be designed to accommodate a single circuit 230 kV line. The proposed new transmission line will consist mostly of single-shaft steel poles equipped with upswept steel arms (Figure 1). Angle structures may consist of single, two- or three-pole structures depending on the severity of the angle.

All poles will be installed on concrete foundations. Additionally, some angle structures may be guyed. Altogether, this project requires the installation of approximately 42 structures with an average height of 120 feet. The average span length will be 1100 feet. It is PPL Electric's intention to place the new poles adjacent to the existing lattice towers along the centerline of the right-of-way. However, to reduce environmental impacts, the location of some poles may be shifted or adjusted, which could result in more structures.

The rebuilt transmission line will be designed to meet, and generally exceed, National Electrical Safety Code ("NESC") minimum standards. Additional design criteria and safety rules practiced by PPL Electric are included in Attachment 4. Three power conductors and one optical ground wire ("OPGW) will be installed. The power conductors will be 795 KCMIL[1] 30/19 stranding ACSR.[2] The OPGW will be 0.752-inch diameter OPGW with 48 single mode fibers. In addition, a second overhead shield wire will be installed which will consist of ½-inch extra high-strength steel.

The minimum conductor-to-ground clearance will be 32 feet for the rebuilt transmission line. This minimum clearance occurs at a maximum sag, which occurs at the maximum thermal conductor temperature of 125°C or maximum ice loading. Table 1 shows the designed minimum conductor clearances and Table 2 shows the conductor thermal ratings of the proposed transmission line.

TABLE 1
DESIGN MINIMUM CONDUCTOR CLEARANCES
FOR 795 KCMIL 30/19 STRAND ACSR[3]

Condition	Single-circuit Design Clearance-to-Ground
Normal load, average weather (16°C ambient temperature)	40 feet
Predicted extreme thermal load (125°C conductor temperature)	32 feet
Predicted extreme weather conditions, 0°F (1-inch ice, 4 lbs. wind, -18°C)	38 feet

[1] A circular mil is the cross-sectional areas of a wire one mil in diameter, where 1 KCMIL = 0.5067 mm².
[2] Aluminum covered steel reinforced.
[3] Clearances based on a maximum tension of 16,880 pounds and a ruling span of 1,000 feet.

TABLE 2
CONDUCTOR THERMAL RATING
795 KCMIL 30/19 ACSR
125°C MAXIMUM CONDUCTOR TEMPERATURE

Condition	Ambient Temperature °C	Wind Speed Knots	Ampacity Amps
Summer Normal	35	0	1058
Winter Normal	10	0	1220
Summer Emergency	35	1.5	1350
Winter Emergency	10	1.5	1521

B. MAGNETIC FIELD MANAGEMENT

PPL Electric's Magnetic Field Management Program is summarized in Attachment 5 and will be applied to reconstruction and new line projects including this reconstruction of the Hosensack – Wescosville #3 230 kV Transmission Line. In order to reduce magnetic field exposures, the program generally prescribes a line design that provides 5 feet higher ground clearances than those required under the NESC, and reverse phasing of new double-circuit lines where it is feasible to do so at low or no cost. The implementation of additional modifications will be considered, provided those modifications can be made at low or no cost and will not interfere with the operation of the line.

Since the Hosensack – Wescosville #3 230 kV Transmission Line is being reconstructed for single circuit operation, reducing magnetic fields by reverse phasing is not possible. However, pursuant to PPL Electric's Magnetic Field Management Program, some reduction in magnetic field levels will be attained through the use of structures that are higher than the existing lattice towers.

C. RIGHT-OF-WAY STATUS

The entire length of the Hosensack – Wescosville #3 230 kV Transmission Line will be rebuilt within the existing 100-foot wide PPL Electric right-of-way, and, therefore, acquisition of additional rights-of-way is not anticipated. A list of all owners of property within the right-of-way is included as Attachment 7, and is also shown on the aerial photographs contained in Attachment "2" map pockets.

PROPOSED 230 kV SINGLE CIRCUIT STEEL POLE

FIGURE 1

POLE STATISTICS

Average Height – 120 feet

Arm Length (Top & Bottom) – 12 feet

Arm Length (Middle) – 17 feet

Overhead Groundwire Arm Length – 14.5

Conductor Spacing:

Overhead Groundwire to Top Phase – 20 feet

Phase to Phase – 13 feet

Right of Way Property Owners

1 - Penna Power & Light Co
2 - Most Rever John O Barres Std Jcl DD
3 - Most Rever John O Barres Std Jcl DD
4 - Most Rever John O Barres Std Jcl DD
5 - Most Rever John O Barres Std Jcl DD
6 - Most Rever John O Barres Std Jcl DD
7 - Yastishok Andrew Residuary Trust
8 - Lower Macungie Twp
9 - Ronald K Walsh
10 - Adrienne M & Thomas L Maio
11 - Edward A & Pamela A Kordeck
12 - Bret J Levi & Monica L Torrano
13 - Scott J Zolotsky
14 - Yastishok Andrew Residuary Trust
15 - Todd E Bricker
16 - Lower Macungie Twp
17 - Yastishok Andrew Residuary Trust
18 - Yastishok Andrew Residuary Trust
19 - Gretchen Pearl
20 - Matthew A & Jane E Nussbaum
21 - Yastishok Andrew Residuary Trust
22 - A G & V Panagopoulos
23 - Yastishok Andrew Residuary Trust
24 - Daniel & Roseann Gagliardi
25 - Barry W & Sandra L Kuder
26 - Michael & Robyn Koprowicz
27 - Tehodore Bigatel & Lyssa M Busolits
28 - Robert D & Sandra A Boag
29 - Yastishok Andrew Residuary Trust
30 - James J & Colette F Lenner
31 - Angelo M & Jacqueline Fernandez
32 - Yastishok Andrew Residuary Trust
33 - Yastishok Andrew Residuary Trust
34 - Yastishok Andrew Residuary Trust
35 - Yastishok Andrew Residuary Trust
36 - Francis J & Jean A Szabo
37 - Yastishok Andrew Residuary Trust
38 - Major Tyrone & K L Smith-Major
39 - Patrick J & Nicola A Slattery
40 - Albert F & Constance E Ernst
41 - Yastishok Andrew Residuary Trust
42 - Edward P & Lori A Staniewicz
43 - Keith E & Sandra L Eberwein
44 - Spencer L Hogan
45 - Larry I & Andrea T Evans
46 - Lower Macungie Twp
47 - Day-Timers Inc
48 - Marc H & Michele L Friedman
49 - Gregory P & Candice-Leigh Douglass
50 - Bert H Jr & Suellen C Blanton
51 - Donna M Batz & Dale G Raudenbush
52 - Edward T & Ann L Zablocki
53 - Michael A & Donna M Hersch
54 - Michael & Karen E Forziati
55 - John J & Dianne C Donofrio
56 - Robert J & Maureen A Calder
57 - Ioannis M Giannaris
58 - Michael R & Marla J Bleiler
59 - Bui Huy & Loan Phan
60 - Lower Macungie Twp
61 - Dale & Joan Snyder
62 - 2050 Brookside Road Lp
63 - Mannino Brothers Partnership
64 - Faith Evan Free Church
65 - Brendan & Katherine O'Brien
66 - Lower Macungie Twp
67 - Lower Macungie Twp
68 - Lower Macungie Twp
69 - Lower Macungie Twp
70 - Liv Hope Orthodox Presb Church
71 - Wild Cherry Knoll Lp
72 - Lower Macungie Twp
73 - Sauerkraut Lane LP
74 - David W & Lisa Helmer

500 250 0 500 1,000 Feet

1 inch = 550 feet

Map formatted for "D" (22"x34") size sheet. Ratio scale not valid for other page sizes.

NAD 1983 StatePlane Pennsylvania South
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Lehigh County Parcel Data 2009
2008 PAMAP Imagery - Lehigh County Mosaic
PPL provided custom data
URS Data
GCS North American 1983

N

Property Owners - Map Extent 1
Hosensack - Wescosville Transmission Upgrade Project

Lehigh County, Pennsylvania

Legend

- Right-of-Way
- Hosensack - Wescosville Existing Line
- Right of Way Property Owners

ppl
PPL Electric Utilities

Q:\GIS_Data\PPL\HOSENSACK\Projects\ROW_PropertyOwners\PPL Hosensack ROW PropertyOwners Extent 1_new.mxd

Right of Way Property Owners

75 - Macungie Road Lp
76 - Macungie Road Lp
77 - Contel Of Pennsylvania Inc
78 - Budd W & Wendy M Kahler
79 - Randal S & Susan F Bernhard
80 - John A & Tonya M Capizzi
81 - Mark A & Katherine A Lichtenwalner
82 - Ira Lehrich Construction Co Inc
83 - Pennsylvania Lines LLC
84 - Chelsea Sandwich Llc
85 - Chelsea Sandwich Llc
86 - Jason O Adams& Robert C Newman Jr
87 - Scott D Davis
88 - Michael Harned
89 - Walter F & Donna A Yext
90 - Kahlon Enterprises Llc
91 - Evelyn & Joseph Sadrovitz
92 - Linda K Schmick
93 - Herbert E Jr & Beverly A Seibert
94 - John Hinnerschietz
95 - John Hinnerschietz
96 - O'Donnell Family Trust
97 - Buckeye Pipe Line Company LP
98 - Todd M & Suzanne M Garloff
99 - Bryan Smith
100 - Stephanie L & Timothy G Hilmer
101 - Douglas Barcza & Mark J Feiertag
102 - Julia Two Corp
103 - Lobar Inc
104 - Thomas F Bull
105 - Johnathan Herbein
106 - Johnathan Herbein
107 - John E & Marlene I Herbein
108 - Frank & Pearl N Beck
109 - Sharlene Schellenberg
110 - Raymond J Iii & Katherine M Flaugh
111 - John A & L Pierangeli
112 - Tyler B & Tracy Eberts
113 - Thomas J Schellenberg
114 - George & Edeltrud R Madtes
115 - Stephen T Mogck
116 - Robert * Merideth Schmeltzle
117 - William G Jr Billger
118 - Robert P & Sandra L Hausknecht
119 - Kenneth P & Deborah M Schuler
120 - Richard L Jr & Bonita L Tremmel
121 - Jerome C & Bonnie K West
122 - Loriann & Henry Long
123 - Wade H Bailey
124 - David & Bonnie Jean Schaf
125 - Cherri Mogck
126 - Edward Jr & Sue Newett
127 - Nancy L O'Brien
128 - Todd R & Sallyann M Huddleston
129 - Rudolf R Jr George
130 - Dale Hetrick
131 - Donald R & Kathy M Hunt
132 - Ruth E & Michael D Ecker
133 - Vernon F Jr & Alma A Goodman
134 - Geoffrey C & Susan L Wainwright
135 - Donald P & Louisa A De Lorenzo
136 - Jeffrey A & Mali M Bartges
137 - Arlene F Wachter
138 - Gerald W Wachter
139 - Sarah M Garwood & Todd R Farnand
140 - Gerald W & Arlene F Wachter
141 - Angela K Buck
142 - Adam R & Jennifer B Kernechel
143 - County of Lehigh
144 - County of Lehigh

500 250 0 500 1,000 Feet

1 inch = 550 feet

Map formatted for "D" (22"x34") size sheet. Ratio scale not valid for other page sizes.

NAD 1983 StatePlane Pennsylvania South
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Lehigh County Parcel Data 2009
2008 PAMAP Imagery - Lehigh County Mosaic
PPL provided custom data
URS Data
GCS North American 1983

N

Property Owners - Map Extent 2
Hosensack - Wescosville Transmission Upgrade Project

Lehigh County, Pennsylvania

Legend

- Right-of-Way
- Hosensack - Wescosville Existing Line
- Right of Way Property Owners

ppl
PPL Electric Utilities

Q:\GIS_Data\PPL\HOSENSACK\Projects\ROW_PropertyOwners\PPL Hosensack ROW PropertyOwners Extent 2_new.mxd

Right of Way Property Owners

145 - Dennis & Linda Moyer
146 - County of Lehigh
147 - County of Lehigh
148 - Penn Eastern Rail Line Inc
149 - Peter & Julia Emerich
150 - Christine Blaine & Matthew Erney
151 - Peter A & Julie A Emerich
152 - Peter A & Julie A Emerich
153 - Forrest H Jr & Tina N Dottery
154 - Kathy Z Poole-Price
155 - John F Mitchell
156 - Ray W Walbert
157 - Tracy L Dreher
158 - Phyllis L Kline
159 - Richard C Lutz
160 - Stephanie & Jeremy Hoch
161 - David M Jr & Emilie A Lobach
162 - Jeffrey A & Diane K Wenner
163 - Susan & David Averill Bell
164 - Keith B & Margie K Wenner
165 - Jeffrey L & Deborah L Dershem
166 - Dean S Bruch
167 - Jeffrey L & Deborah L Dershem
168 - Linda R Fetzer et al
169 - Philadelphia Electric Co
170 - Linda R Fetzer et al

500 250 0 500 1,000 Feet
1 inch = 550 feet
Map formatted for "D" (22"x34") size sheet. Ratio scale not valid for other page sizes.

NAD 1983 StatePlane Pennsylvania South
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Lehigh County Parcel Data 2009
2008 PAMAP Imagery - Lehigh County Mosaic
PPL provided custom data
URS Data
GCS North American 1983

Property Owners - Map Extent 3
Hosensack - Wescosville Transmission Upgrade Project

Lehigh County, Pennsylvania

Legend

- Right-of-Way
- Hosensack - Wescosville Existing Line
- Right of Way Property Owners

ppl
PPL Electric Utilities

Q:\GIS_Data\PPL\HOSENSACK\Projects\ROW_PropertyOwners\PPL Hosensack ROW PropertyOwners Extent 3_new.mxd

Attachment

3

ATTACHMENT "3"

HOSENSACK – WESCOSVILLE #3 230 kV TRANSMISSION LINE REPLACEMENT SITING ANALYSIS AND ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

LIST OF TABLES

ATTACHMENT "3"
HOSENSACK – WESCOSVILLE #3 230 kV TRANSMISSION LINE REPLACEMENT
SITING ANALYSIS AND ENVIRONMENTAL ASSESSMENT

A. INTRODUCTION

PPL Electric plans to rebuild the vintage 1920's transmission structures and conductor system on the Hosensack-Wescosville #3 230 kV Line in order in prevent degradation in reliability, as well as eliminate potential safety concerns for the public due to deteriorated facilities. The project involves removing the vintage lattice tower structures along an 8.7-mile long corridor and replacing them with single-shaft steel poles. The project also involves upgrading the conductor system.

Although PPL Electric is seeking approval of the rebuild of the Hosensack-Wescosville #3 230 kV transmission line through this Letter of Notification, which does not require an analysis of alternative routes, PPL Electric deemed it prudent to conduct such a review. PPL Electric believes that the additional review is appropriate given the length of the line to be rebuilt and the varying geography the line crosses.

The existing Hosensack-Wescosville #3 230 kV right-of-way ("ROW") traverses high-density residential areas, commercial districts, and open farmlands. PPL Electric determined through a review of the surrounding landscape, as discussed in the following narrative, that any alternative route outside of the existing ROW would result in significantly greater impacts to both the social and natural environments, and increase project costs. Therefore, the existing Hosensack-Wescosville #3 230 kV ROW was selected as the best option for rebuilding the transmission line.

B. ALTERNATIVE ROUTE ANALYSIS

PPL Electric conducted a siting analysis to determine if a reasonable alternative route for the Hosensack-Wescosville #3 230 kV Transmission Line could be developed. Initial aspects of this process involved review of a broad study area to identify existing land use, evaluation of potential new residential, commercial, or other developments, and recognition of the natural and cultural elements within the study area. During this phase, major constraints to a potential alternative route, such as the high-density development on the east side of the Pennsylvania Turnpike, were identified and used to define the study area. Evaluation of the study area also noted potential alignment options along existing transmission line and pipeline ROWs, highway corridors, and undeveloped areas, such as stream valleys and agricultural areas.

Information from a study area field review assessment, conducted in the fall of 2010, was added to a high-resolution aerial map to aid with the alternative route appraisal. This field study information was primarily the location of new residential developments that had been built since the imagery was captured, but areas of low density residential located within steeply sloped forested areas were also identified as potential constraints. These residential constraints were located primarily in the northern and central sections of the study area. Additional Geographic Information Systems ("GIS") information, such as streams, wetlands, county and local parks, schools, and cultural resource features were also added to the map to further describe the existing landscape. These features help to define best opportunity and constraint areas for transmission line development. Many of the more environmentally sensitive areas were located within the southern section of the study area, near the Hosensack substation.

Potential routes identified during the field review were digitized on the map and assessed. Other routes that might be feasible based on review of the map were also generated. Most of the field and map reviews explored routes using other electric transmission line ROWs to provide connection from the Wescosville substation to the Hosensack substation. The impact associated with using these ROWs from an engineering perspective, and also from a social and natural environment perspective, would be significantly greater than using the existing ROW. Development of these alternative routes would require acquisition of new ROW easements from landowners, some of whom may not be receptive of the project. Assuming these easements were obtained, the ROW corridor would also need to be cleared of vegetation and new access roads would need to be created for the construction process and ongoing maintenance. In some cases, additional costs would also be necessary to modify existing transmission line structures to accommodate the co-location of the proposed line. Other route options involved paralleling existing pipeline ROWs. These routes eventually became constrained by the high-density residential development areas and restricted to rebuilding within the existing pipeline ROWs which may not be feasible from an engineering perspective. These options would also involve the additional social, natural, and engineering impacts associated with the need to acquire and create a new 150-foot ROW adjacent to the existing pipeline ROWs, where land was available. Similarly, the option of paralleling Route 222 was reviewed. Route 222 is a major highway that traverses east to west though the northern section of the study area. This option also became constrained by residential development and would involve acquisition of ROW for the full length of the line, which would result in increased impacts to natural features.

Very few overland routes were identified due to the high-density development in the northern and central sections of the study area. These potential routes tended to be convoluted and indirect due to the need to avoid individual residential units. To circumvent some residential areas, undeveloped stream valleys were assessed in certain locations. These streams were typically associated with the Little Lehigh Creek watershed, which has a Pennsylvania Department of Environmental Protection ("PADEP") designated use of High Quality-Cold Water Fishes. Use of these stream valleys would generate elevated environmental impacts and initiate a more intensive permitting process. Potential overland routes in the southern section, which has significantly less residential development, were constrained primarily by the existence of several large natural areas (i.e., Hosensack Marsh, Indian Creek Floodplain), preserved farmlands (conservation easement areas), and multiple cultural resources, primarily churches and cemeteries.

Ultimately while some potential alternatives were identified, none of these options were determined to be feasible due to the significant social, natural environment, and economic costs. All of the alternatives would require acquisition of substantial new ROW, require the permitting of new stream and wetland crossings, and be up to forty percent longer than the existing line.

Based on this evaluation of the alternative route options, PPL Electric concluded that the existing Hosensack-Wescosville #3 230 kV line ROW was the best option.

C. LAND USE

The Hosensack-Wescosville #3 230 kV Line runs in a north to south direction through the southwestern section of Lehigh County. The northern terminus in Wescosville lies to the immediate northwest of the intersection of I-476 and US-222. The southern terminus lies just east of Kings Highway (State Route 2027) near the Hosensack Substation. Townships where project activities will occur include Upper Macungie Township, Lower Macungie Township, Upper Milford Township, and Lower Milford Township. Aside from highways, other linear features in the study area include transmission lines, pipelines, and railroad networks. PPL Electric anticipates no impact on these features. The Queen City Airport is located 3.2 miles east of the rebuilt line, and the Company does not anticipate any impacts there. (Figure 1).

D. EXISTING LAND USE

As designated by the Lehigh Valley Planning Commission ("LVPC"), land use in the project study area consists of a mix of development types ranging from industrial to open space/natural features (LVPC 2010). Table 1, Existing Land Use Along ROW, provides a list of land use types and the percent identified within each township along the Hosensack-Wescosville #3 230 kV ROW. The northern half of the project study area is dominated by Urban Development in Upper Macungie and Lower Macungie townships with smaller Natural Feature areas (e.g. streams) that are crossed over by the transmission lines (Figure 2). The middle of the project study area includes small sections of industrial development. The southern section of the project study area is largely rural and/or agricultural in nature, with significant areas of undeveloped riparian habitat associated with the Hosensack Marsh complex (*See* Natural Features section). The southern portions of the project study area are dominated by Rural Development, Farmland Preservation, and Natural Features. According to the *Southwestern Lehigh County Area Parks,* *Recreation, and Open Space Plan* (Task Force 2008), "Lower Milford Township is 67% Agriculture & Vacant, and Upper Milford Township is 47% Agriculture & Vacant."

Table 1: Percent Existing Land Use Along ROW by Township

Municipality	LVPC Land Use Classification	Percent Land Use Type Along ROW
Upper Macungie	Urban Development	100%
Lower Macungie	Urban Development	85%
	Natural Features	15%
Upper Milford	Rural Development	39%
	Farmland Preservation	26%
	Urban Development	25%
	Natural Features	10%
Lower Milford	Natural Features	65%
	Farmland Preservation	35%

Comprehensive Land Use Plans and Zoning

In an effort to "promote growth in existing centers of population and adjacent to these centers appropriately where infrastructure exists... [and] the continuation of rural landscapes and compatible land uses in outlying areas, where infrastructure currently does not exist" (*Southwestern Lehigh County Area Parks, Recreation, and Open Space Plan* 2008), the townships that make up the project study area and the LVPC have developed zoning districts that define allowable uses within each district. These zoning districts reflect the historic nature of the southwestern portion of Lehigh County as an agricultural and open space hub mixed with areas of denser urban/suburban development and industrial centers (Figure 3). Table 2, Zoning Along ROW, indicates the types and percent of various zoning districts identified within each township along the Hosensack-Wescosville #3 230 kV ROW. Like the existing land use data, the northern sections of the project study area are more developed urban and suburban areas while the southern sections of the project study area remain primarily agricultural and rural in nature.

Population growth is expected to increase development pressure within portions of the project study area. Forecasts completed by the LVPC indicate that Upper and Lower Macungie Townships will both see significant population growth through 2030. Much of this population growth will likely come from continued suburban sprawl spreading out from Philadelphia. Townships and the County are trying to plan ahead to direct new development or redevelopment required to support this population growth around existing development centers in the northern half of the project study area. Table 3, Population Change, provides a summary of both previous years' US Census data and population forecasts for each township within the project study area.

Table 2: Percent LVPC and Municipal Zoning Along ROW by Township

Municipality	LVPC Zoning	Municipal Zoning	Percent Zoning District
Upper Macungie	Suburban Residential	Medium-Low Density Residential	100%
Lower Macungie	Suburban Residential	Suburban	72%
	Urban Residential	Urban	9%
	Retail Commercial	Commercial	8%
	Rural	Rural	8%
	Light Industrial	Industrial	3%
Upper Milford	Rural	Rural Agricultural	73%
	Urban Residential	Suburban Residential	19%
	Suburban Residential	Rural Suburban Residential	10%
	Heavy Industrial	Industrial	7%
Lower Milford	Rural	Agricultural Rural	100%

Table 3: Population Change by Township

Municipality	1900 Census	2000 Census	2010 Forecast	2020 Forecast	2030 Forecast	2000-2030 Change
Upper Macungie Twp	2,081	13,895	19,859	26,479	33,508	19,613
Lower Macungie Twp	2,920	19,220	28,020	33,424	42,193	22,973
Upper Milford Twp	2,712	6,889	7,504	7,804	7,974	1,085
Lower Milford Twp	1,233	3,617	4,094	4,852	5,907	2,290
Total	**8,946**	**43,621**	**59,477**	**72,559**	**89,582**	**45,961**

Agricultural Areas

In general, the Lehigh Valley is home to many historic agricultural areas that support eastern Pennsylvania. These agricultural districts are clustered in the southern sections of the study area. For example, much of the southern third of the project study area located within Upper and Lower Milford townships is designated by the LVPC as Farmland Preservation land (Figure 4). The existing transmission line runs north to south along the western edge of one designated area that comprises over 5,761 acres. Two other agricultural designations are also found primarily in the southern portions of the project study area – Agricultural Easements and Agricultural Security Areas. Two agricultural easements, both owned by a single family, are found in Upper Milford Township. These total over 250 acres. In addition, four agricultural security areas, one in Lower Macungie Township and three in Lower Milford Township, are also located within the project study area. The Lower Macungie agricultural security area is approximately 133 acres. The three agricultural security areas found in Lower Milford Township total 219 acres. Of all these areas, only portions of the three agricultural security areas in Lower Milford Township overlap with the land area designated as Farmland Preservation by the Lehigh Valley Planning Commission. Thus, it is evident that agricultural land use plays a major role in the southern sections of the project study area.

E. CULTURAL RESOURCES

Archaeological Assessment

The project area for the proposed transmission line passes through three physiographic provinces. The southern portion is within the Gettysburg-Newark Lowland Section of the Piedmont Province. Review of the Pennsylvania Historical and Museum Commission ("PHMC") Bureau for Historic Preservation ("BHP") Cultural Resources Geographic Information System ("CRGIS") reveals that only two archaeological sites are recorded in this province within one mile of the proposed transmission line, neither of which is directly on the line (Figure 5). The northern portion of the transmission line is within the Great Valley Section of the Ridge and Valley Province and the Reading Prong of the New England Province. This portion of the line traverses an area of intensive prehistoric jasper quarrying and is within the central, or quarry, zone of the Hardyston Jasper Prehistoric District. The line passes between two major recorded jasper quarries, Vera Cruz and Macungie. Over 40 archaeological sites are recorded in the CRGIS within one mile of the northern portion of the proposed transmission line. One site, 36LH117, is located in the transmission line corridor and, if feasible, will be avoided when selecting tower/pole locations. The site is recorded as a prehistoric jasper quarry and workshop. The eligibility of the site is undetermined due to insufficient data. Two previous archaeological surveys encompassed portions of the transmission line corridor. Studies for the proposed Route 222 relocation included the northern 4,000 ft of the proposed transmission line (ER No. 1990-0282-077). The survey area of the I-78 relocation project crossed the transmission line (ER No. 1981-0267-077). Neither survey identified sites within the transmission line corridor.

Distance to water has been found to be the best predictor of prehistoric archaeological site location. Therefore, areas within 150 m (500 ft) of a stream, spring, or wetland are considered to have a high probability for prehistoric sites. In areas of the Gettysburg-Newark Lowland Section that are more distant from water, the transmission line corridor is considered to have a low probability for prehistoric sites. In the Great Valley and Reading Prong Sections, areas that are in close proximity to a known quarry, even if distant from water, are considered to have a high probability for sites such as jasper workshops. Because of the intensity of quarrying in these two provinces, areas distant from both water and lithic quarries are considered to have a medium probability for prehistoric sites.

Pre-nineteenth century historic sites are generally located near streams. Historic-period maps will be consulted to identify areas of high probability for later historic archaeological sites. Locations of extant above-ground historic resources also have a high probability for historic archaeological deposits.

A consultation with the PHMC was held on January 28th, 2011 and indicated that Phase I archaeological survey is required. A strategy for Phase I archaeological survey was developed.

Given the relatively small area of impacts for each pole, surveys will be conducted only in high probability areas. High probability areas would consist of locations near streams and in areas likely to contain sites related to prehistoric jasper quarrying in the region. Shovel tests will be excavated to either side of the existing towers. A shovel test involves digging a small series of test holes to examine the soil for any potential cultural remains that are not visible on the surface. Should artifacts be identified, additional shovel tests will be performed to identify provisional site boundaries and artifact densities. Should it be determined later that pole construction would be required in an untested area a supplemental field survey will be conducted. A report of the archaeological survey will be prepared for PHMC in accordance with current guidelines. Should potentially significant archaeological sites be identified, a Phase II survey will be conducted to determine their eligibility for the National Register. If National Register-eligible sites are present within the APE and cannot be avoided, measures will be taken to mitigate the adverse effects of transmission line construction.

Historic Architectural Assessment

A desktop survey of historic architectural resources within the Hosensack Project area was completed that consisted of accessing the PHMC's CRGIS system to review available information on previously-recorded historic architectural sites on and near the transmission line alignment.

There are NRHP-listed and eligible resources located in the project area. The National Register-Listed Dillingersville Union School and Church in Lower Milford Township is located less than a mile to the east of the proposed transmission line route. It is possible that the new transmission line will be visible from this previously-recorded historic resource. The National Register-eligible Philadelphia and Reading Railroad Historic District, which traverses several municipalities, crosses the proposed transmission line route in two locations: primary rail system in Lower Macungie Township and a secondary line in Upper Milford Township.[1] It is unlikely that the transmission line will have an adverse effect on these linear resources. However, the

[1] PHMC key number 155708.

portion of these railroad lines that the transmission line crosses may need to be assessed for contributing elements once the pole locations and designs have been solidified. In addition, five individual historic resources located within a mile of the proposed transmission line have been previously determined eligible for the National Register of Historic Places. This list includes the Mechling Homestead in Lower Milford Township,[2] and the Thomas Shuler, George & Unger Farmstead,[3] J. Bastian House,[4] J. B. Wieland Hotel,[5] and the Tank Farm Road Bridge in Lower Macungie Township.[6]

A review by PHMC indicated that although historic buildings/structures/districts/objects may be located in the project area, in its opinion, the activity described with this proposed construction should have no effect on such resources. Letter dated January 4th, 2011, ER# 10-2324-077-A.

F. NATURAL FEATURES

The project area crosses several physiographic regions, geologic formations, soil associations, streams, and wetlands as it runs from north to south. These features are described in detail within the following sections. The Lehigh-Northampton Natural Areas Inventory (The Nature Conservancy 2005) further describes two areas of ecological importance within the project area – East Texas-Little Lehigh Creek and Swabia/Indian/Hosensack Watershed.

Physiographic Regions and Bedrock Geology

The project area traverses from north to south across three physiographic sections, the wide lowlands of the Great Valley Section, the higher, abrupt prominence of the Reading Prong Section (also referred to as South Mountain), and the rolling low hills of the Gettysburg-Newark Lowland Section. Bedrock geology found within the project area consists of the Allentown Formation and Leithsville Formation associated with the Great Valley Section, and various

[2] PHMC key number 86508,
[3] PHMC key number 86520,
[4] PHMC key number 96778,
[5] PHMC key number 96807,
[6] PHMC key number 97723.

components of the felsic to mafic gneiss, Hornblende gneiss, and Hardyston Formation associated with the Reading Prong and Gettysburg-Newark Lowland Sections (Berg 1980) (Figure 6). These formations consist of a mix of gneiss, dolomite, and quartzite as primary rock types. Limestone, sandstone, and shale are also found in various formations as secondary rock types.

Soils

According to the Soil Survey of Lehigh County (USDA 1963), four primary soil associations are found within the project area. These soil associations, from north to south, are as follows:

- Washington-Duffield Association: deep soils of valleys on limestone
- Chester-Brandywine Association: deep and moderately deep soils of South Mountain on granite, gneiss, and quartzite.
- Murrill Association: deep soils of the lower slopes of South Mountain.
- Fleetwood-Chester Very Stony Association: deep and moderately deep, stony soils of the ridges of South Mountain on quartzite and gneiss.

The Washington-Duffield Association comprises the northern half of the entire project area. The Chester-Brandywine Association is found in smaller bands throughout sections of the southern half of the project area. The Murrill Association runs in a narrow band in an east-west direction through the center of the project area. The Fleetwood-Chester Very Stony Association forms the smallest bands of soil associations within the southern half of the project area.

Surface Water Resources

The Hosensack-Wescosville Line crosses over six creeks as it runs from Wescosville in the north to Hosensack in the south. Three of these streams are named streams, and three streams are unnamed tributaries of named streams. All six of these streams have been classified by the PADEP under Title 25 Chapter 93 as Cold Water Fisheries (PADEP (a) 2010). Four of the six streams are also classified as High Quality Waters by PADEP. According to PADEP's e-

MapPA website, two of these High Quality Waters are also Trout Stocked Fisheries (PADEP (b) 2010). Table 4, Surface Water Classification, provides a summary of all streams found within the project area and their classifications (Figure 7). Definitions for each of these classifications are located below.

Table 4: Surface Water Classification

STREAMS		
Name	**Designated Use**	**Trout Stocked Fishery**
Little Lehigh Creek	HQ-CWF	Y
Swabia Creek	HQ-CWF	Y
Unnamed Tributary to Lehigh Creek	HQ-CWF	N
Leibert Creek	HQ-CWF	N
Unnamed Tributary to Hosensack Creek	CWF, MF	N

- CWF - *Cold Water Fishes*—Maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat.
- TSF - *Trout Stocked Fishes*—Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.
- HQ - *High Quality Waters*—Designation indicates that surface waters have quality which exceeds the level necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water as determined by §93.4b(a).
- MF - *Migratory Fishes*—Passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which move to or from flowing waters to complete their life cycle in other waters.

<u>Wetlands</u>

Based on review of the U.S. Fish and Wildlife Service's ("USFWS") National Wetland Inventory ("NWI"), the Hosensack-Wescosville Line also crosses several wetland systems as it runs from north to south (USFWS 2010). The majority of these wetland systems are found within the southern half of the study area, and some are major components of designated natural areas (*See* Natural Area Inventory section). Most of these wetlands are palustrine forested wetlands associated with riparian areas of streams. Palustrine emergent and palustrine scrub-shrub wetland systems are found interspersed throughout these stream riparian zones, as well. Throughout the study area scattered palustrine unconsolidated bottom, or small ponds, can also be found. Some of these ponds may be man-made.

The NWI provides a general overview of the potential wetlands that may be located within an area. For federal and state permitting purposes, wetlands and waterways within the project study area will be required to be delineated according to regulatory standards, surveyed, and illustrated on development plans. Impacts to these natural features may require mitigation. PPL Electric will obtain and adhere to the terms and conditions of all required permits.

Vegetation

Vegetative cover in the northern and central sections of the project area has been influenced by the dense residential and commercial development. Most of the natural vegetative cover has been removed or is dominated by maintained lawns. Old fields, upland forests, or narrow forested riparian corridors are infrequently noted within the project area. Primary field species include goldenrods (*Solidago* spp.), bush honeysuckles (*Lonicera* spp.), and multiflora rose (*Rosa multiflora*). Upland forested areas are composed primarily of hardwoods that include white ash (*Fraxinus Americana*), chestnut oak (*Quercus montana*), red oak (*Quercus rubra*), and pignut hickory (*Carya glabra*). The forested riparian corridors include silver maple (*Acer saccharinum*), black willow (*Salix nigra*), and American elm (*Ulmus americana*).

Vegetative cover in the southern portion of the project area is more expansive but has been influenced by agricultural development. Several sections of the ROW traverse fields of row crops, which include corn, soybeans, and hay, or over the few dairy or horse farms noted in the area. Much of the natural vegetation is in the form of upland forests or old fields and contains the same species noted for the northern and central sections. The southern section, however, has more diversity in habitats (swamps, marshes, floodplain forests), as well as vegetative species associated with the Swabia/Indian Creek/Hosensack Watershed.

G. THREATENED AND ENDANGERED SPECIES

Natural Areas Inventory

The Nature Conservancy's Lehigh-Northampton Natural Areas Inventory identified two sites within the project area of special concern (Figure 7). The first site, East Texas-Little Lehigh Creek, is located near the middle of the project area along the Little Lehigh Creek in the town of East Texas. Located just west of the ROW, this site is associated with the riparian zone along Little Lehigh Creek and is of importance due to the presence of a spikerush species, a state listed threatened species of concern. Transmission line construction activities should be able to avoid this area, so no impact is expected.

The second site is the Swabia/Indian Creek/Hosensack Watershed. This site is found within the southern portion of the project area. The watershed is much larger than the East Texas-Little Lehigh Creek, and includes several connected habitat types, including marshes, streams, forested riparian areas, and scrub-shrub wetlands. The Nature Conservancy, when investigating this watershed specifically identified the Hosensack Substation and associated powerline right of way as potentially being beneficial to threatened and endangered species found within this portion of the project area. This is evidenced in the following passage from *A Natural Areas Inventory of Lehigh and Northampton Counties, Pennsylvania*:

> "Another site within this watershed includes areas of marsh and shrub swamp. Part of the site has been disturbed by the construction of an electric power transfer station and associated powerline ROW. Some of the habitat created by these disturbances may be benefiting the rare species that occur

here. The site supports a fair to good example of an animal species of concern."

Table 5: Natural Area Inventory Data (modified from the *Lehigh and Northampton Counties NAI*)

Site Name	Special Species /Community Type	Last Seen
East Texas –Little Lehigh Creek	Matted Spike-rush (*Eleocharis intermedia*)	9/29/93
Swabia/Indian/ Hosensack Watershed (Formerly Hosensack Marsh, Indian Creek Floodplain, and Macungie Watershed)	Animal	6/5/97
	White-Trout Lily (*Erythronium albidum*)	4/20/01
	Animal	1996
	Northern Appalachian Circumneutral Seep NC	6/26/97

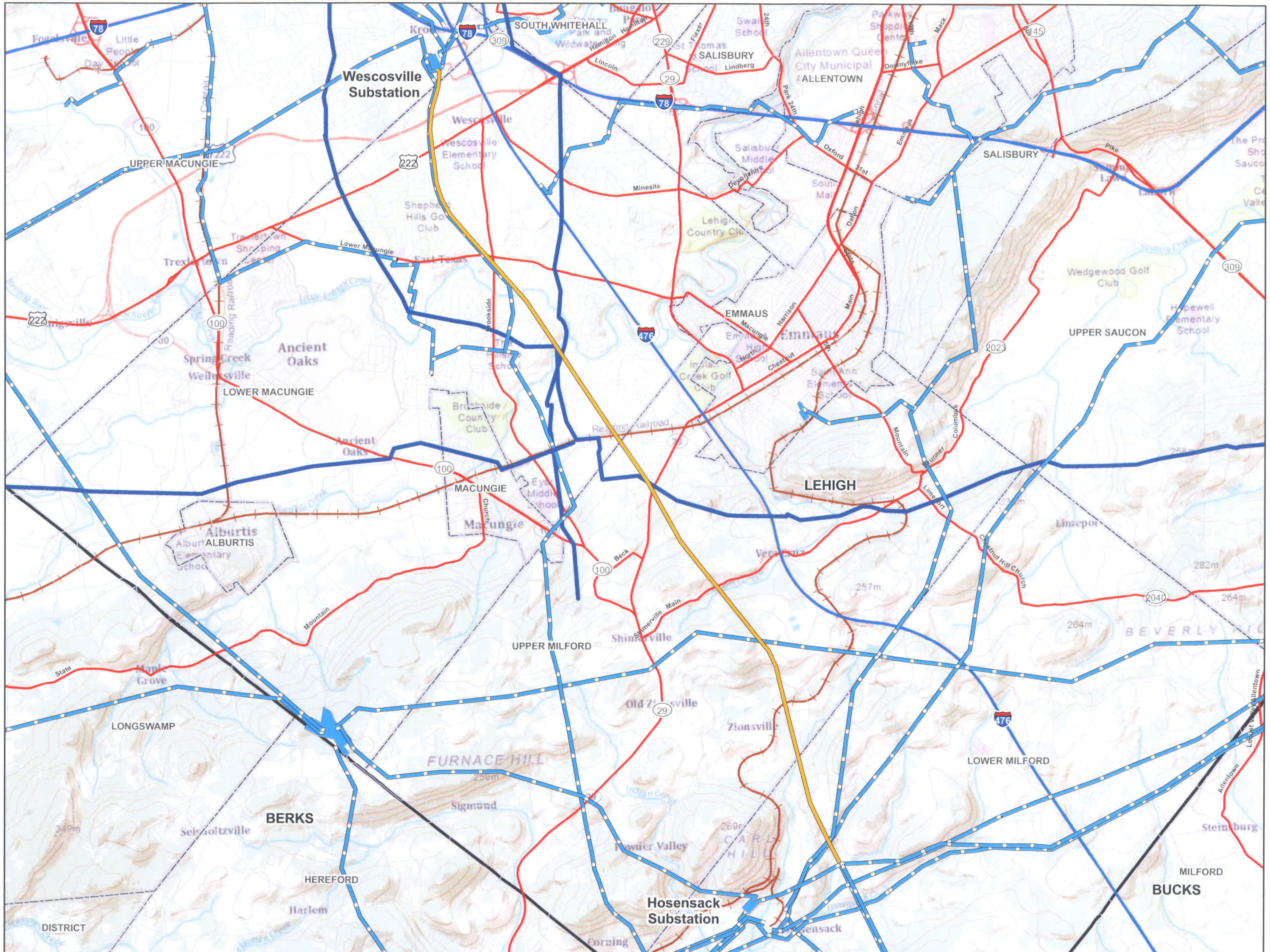
Pennsylvania Natural Diversity Inventory Review

A review of the Pennsylvania Natural Diversity Inventory ("PNDI") database was conducted for the project area (PNDI Number 20969). The Pennsylvania Fish and Boat Commission ("PAFBC") and Pennsylvania Game Commission ("PGC") noted that no impacts to fish or mammal species are anticipated. The USFWS noted the potential presence of the federally threatened bog turtle (*Glyptemys muhlenbergii*). This species prefers to live in shallow, spring-fed bogs, swamps, marshy meadows, and pastures with soft, muddy bottoms, and slow-flowing waters. Only USFWS qualified bog turtle surveyors can conduct the Phase I habitat or Phase II presence/absence surveys required by USFWS.

The review further indicated the potential presence of six plant species of concern identified by the Pennsylvania Department of Conservation and Natural Resources ("PADCNR"). The PADCNR requires that a qualified botanist conduct the survey of the project area for these species. These species and their habitats are listed in Table 6, PADCNR Species of Concern. Species followed by an asterisk (*) are currently unlisted in Pennsylvania and are not a target species for the required survey, but due to their ecological significance, PADCNR is recommending that they be voluntarily added to the survey to avoid potential impacts. All conflicts will be resolved prior to the start of construction.

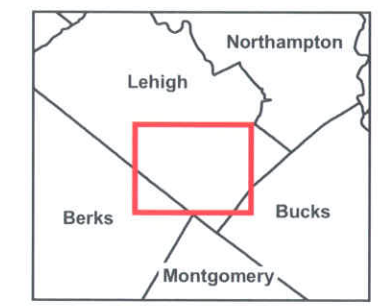
Table 6: PADCNR Species of Concern

Species	Scientific Name	Status	Habitat	Flowering Season
White milkweed	*Asclepias variegata*	Proposed PA Endangered	Dry woods	May - July
Matted spike rush	*Eleocharis intermedia*	PA Threatened	Marshes, wet meadows, stream banks of calcareous soils	Mid-late summer
Swamp dog hobble	*Leucothoe racemosa*	Proposed PA Threatened	Wet woods and thickets	Late May - Early June
Winged loosestrife	*Lythrum alatum*	Proposed PA Endangered	Swamps, wet meadows, marshy shorelines and ditches	June - Early September
White trout lily*	*Erythronium albidum*	Currently Unlisted	Moist Woods and rich slopes, especially on limestone	April - May
Tall tick trefoil*	*Desmodium canadense*	Currently Unlisted	Wooded roadside banks and open woods	June - August



Legend

- Hosensack-Wescosville #3 230 kV Line
- Gas/Pipelines
- Transmission Lines
- Railroad
- Limited Access Highway
- US & State Highways
- Local or City Street
- Municipalities
- Counties



Key Map
Not to Scale

N

NAD 1983 StatePlane Pennsylvania
FIPS 3701
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Transmission Line Data from PowerMAP & PPL
Street & Railroad Data from ESRI

0 2,500 5,000 10,000 Feet

1 inch = 5,000 feet

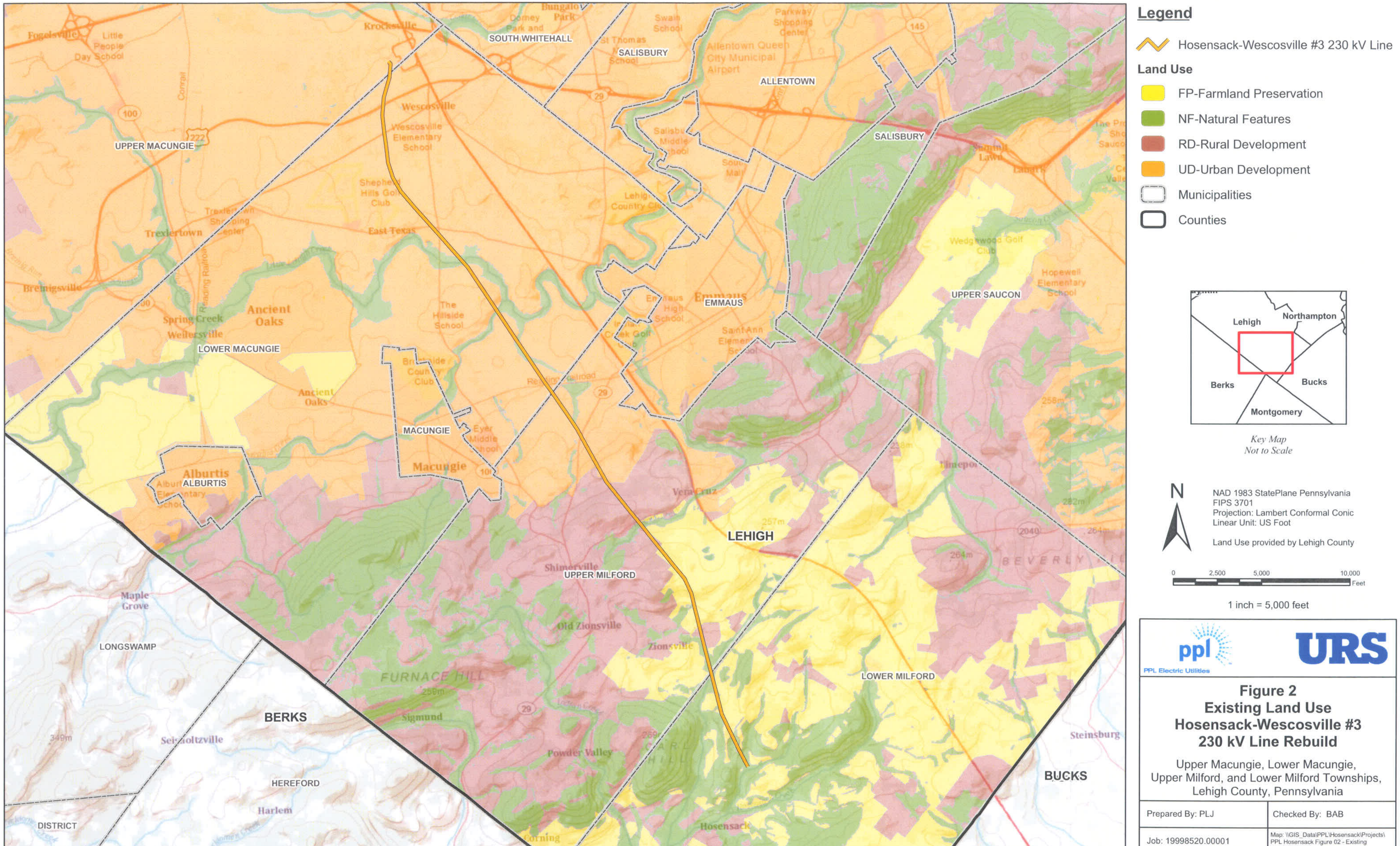
ppl PPL Electric Utilities

URS

Figure 1
Linear Features
Hosensack-Wescosville #3
230 kV Line Rebuild

Upper Macungie, Lower Macungie,
Upper Milford, and Lower Milford Townships,
Lehigh County, Pennsylvania

Prepared By: PLJ	Checked By: BAB
Job: 19998520.00001	Map: \\GIS_Data\PPL\Hosensack\Projects\PPL Hosensack Figure 01 - Linear Features.mxd



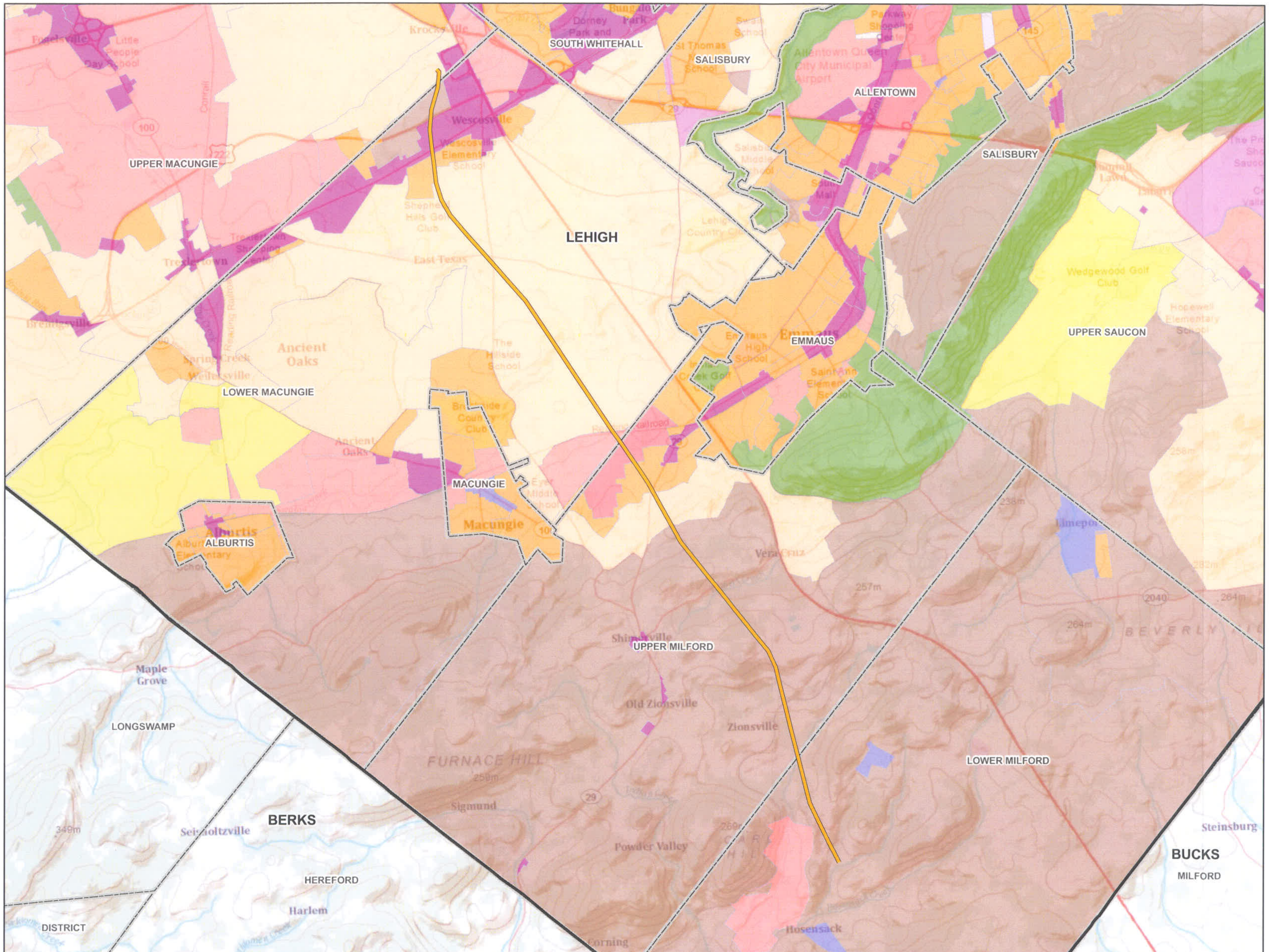
PPL Electric Utilities

URS

Figure 2
Existing Land Use
Hosensack-Wescosville #3
230 kV Line Rebuild

Upper Macungie, Lower Macungie,
Upper Milford, and Lower Milford Townships,
Lehigh County, Pennsylvania

Prepared By: PLJ	Checked By: BAB
Job: 19998520.00001	Map: \\GIS_Data\PPL\Hosensack\Projects\PPL Hosensack Figure 02 - Existing Land Use.mxd

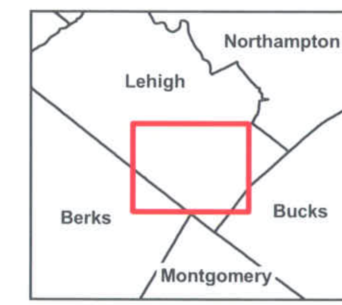


Legend

Hosensack-Wescosville #3 230 kV Line

Zoning

- Agricultural Preservation
- Environmental Protection
- Heavy Industrial
- Light Industrial
- Mixed Uses
- Office/Business
- Retail Commercial
- Rural
- Suburban Residential
- Urban Residential
- PA Municipalities
- Counties



Key Map
Not to Scale

N

NAD 1983 State Plane Pennsylvania South FIPS 3702 Feet
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Zoning data provided by Lehigh County

0 2,500 5,000 10,000 Feet

1 inch = 5,000 feet

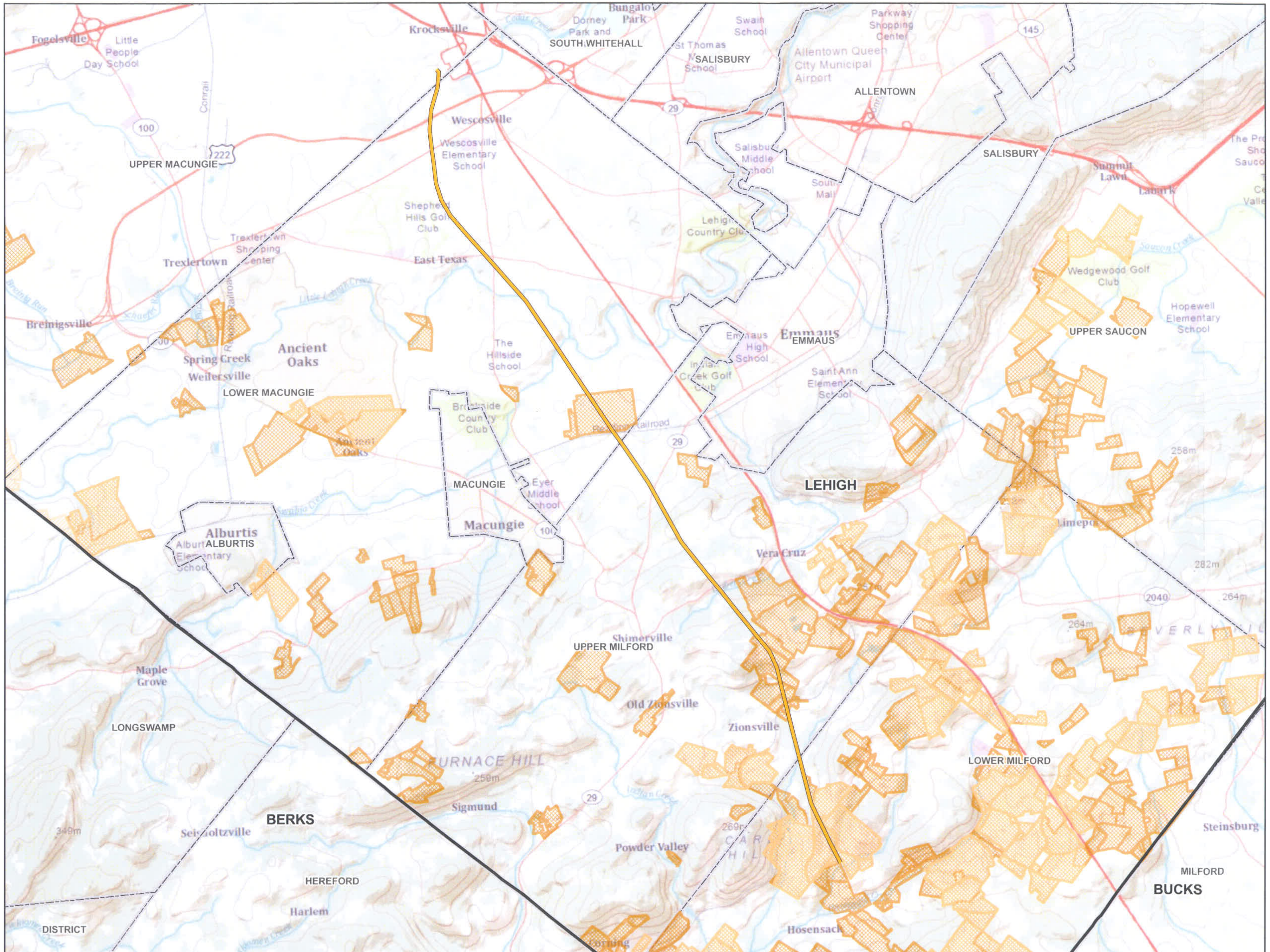
PPL Electric Utilities

URS

Figure 3
Zoning
Hosensack-Wescosville #3
230 kV Line Rebuild

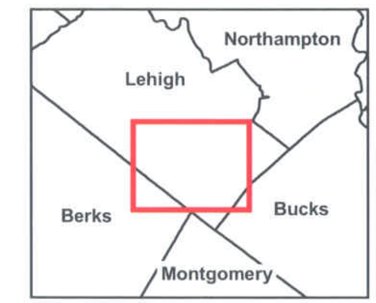
Upper Macungie, Lower Macungie, Upper Milford, and Lower Milford Townships, Lehigh County, Pennsylvania

Prepared By: PLJ	Checked By: BAB
Job: 19998520.00001	Map: \\GIS_Data\PPL\Hosensack\Projects\PPL Hosensack Figure 03 - Zoning.mxd



Legend

- Hosensack-Wescosville #3 230 kV Line
- Agricultural Conservation Easements
- Agricultural Security Areas
- Municipalities
- Counties



Key Map
Not to Scale

N

NAD 1983 StatePlane Pennsylvania
FIPS 3701
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Agricultural Easement & Security Area
Data provided by Lehigh County

0 2,500 5,000 10,000 Feet

1 inch = 5,000 feet

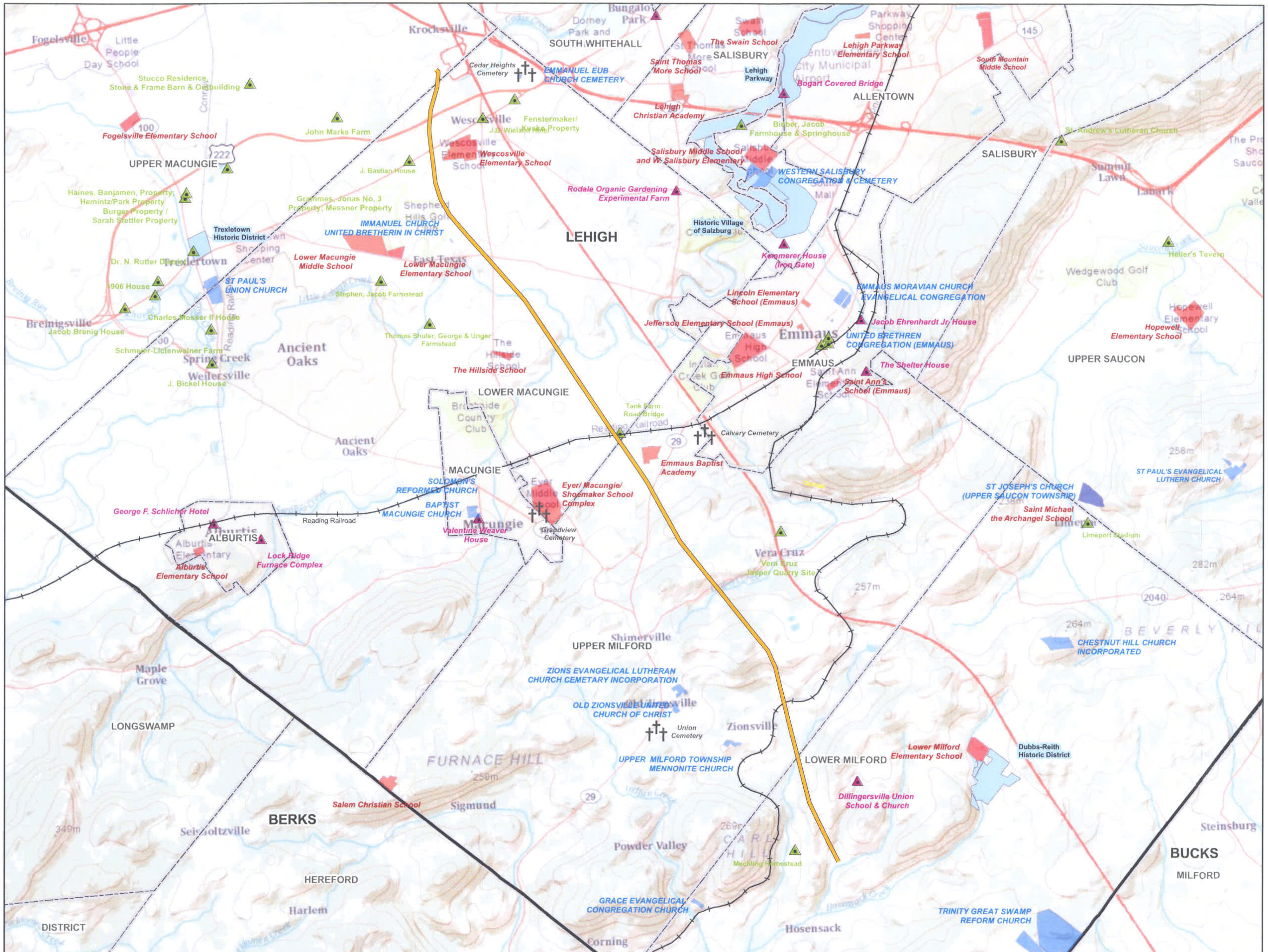
ppl PPL Electric Utilities

URS

Figure 4
Agricultural Resources
Hosensack-Wescosville #3
230 kV Line Rebuild

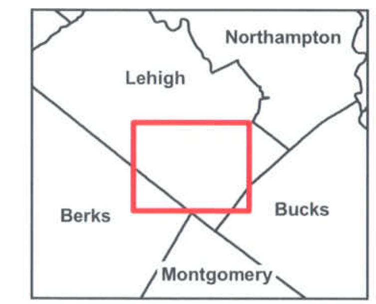
Upper Macungie, Lower Macungie,
Upper Milford, and Lower Milford Townships,
Lehigh County, Pennsylvania

Prepared By: PLJ	Checked By: BAB
Job: 19998520.00001	Map: \\GIS_Data\PPL\Hosensack\Projects\PPL Hosensack Figure 04 - Agricultural Resources.mxd



Legend

- Hosensack-Wescosville #3 230 kV Line
- Cemetery
- Listed Historic Structures
- Eligible Historic Structures
- Eligible Historic Districts
- School
- Church
- Historic Railroads
- Municipalities
- Counties



Key Map
Not to Scale

NAD 1983 StatePlane Pennsylvania
FIPS 3701
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Lehigh County-Historic Structures (eligible/listed),
Historic Raillines (eligible),
Historic Districts (eligible/listed)
ESRI 93 Cemeteries

N

0 2,500 5,000 10,000 Feet

1 inch = 5,000 feet

ppl PPL Electric Utilities

URS

Figure 5
Cultural Resources
Hosensack-Wescosville #3
230 kV Line Rebuild

Upper Macungie, Lower Macungie,
Upper Milford, and Lower Milford Townships,
Lehigh County, Pennsylvania

Prepared By: PLJ	Checked By: BAB
Job: 19998520.00001	Map: \\GIS_Data\PPL\Hosensack\Projects\PPL Hosensack Figure 05 - Cultural Resources.mxd

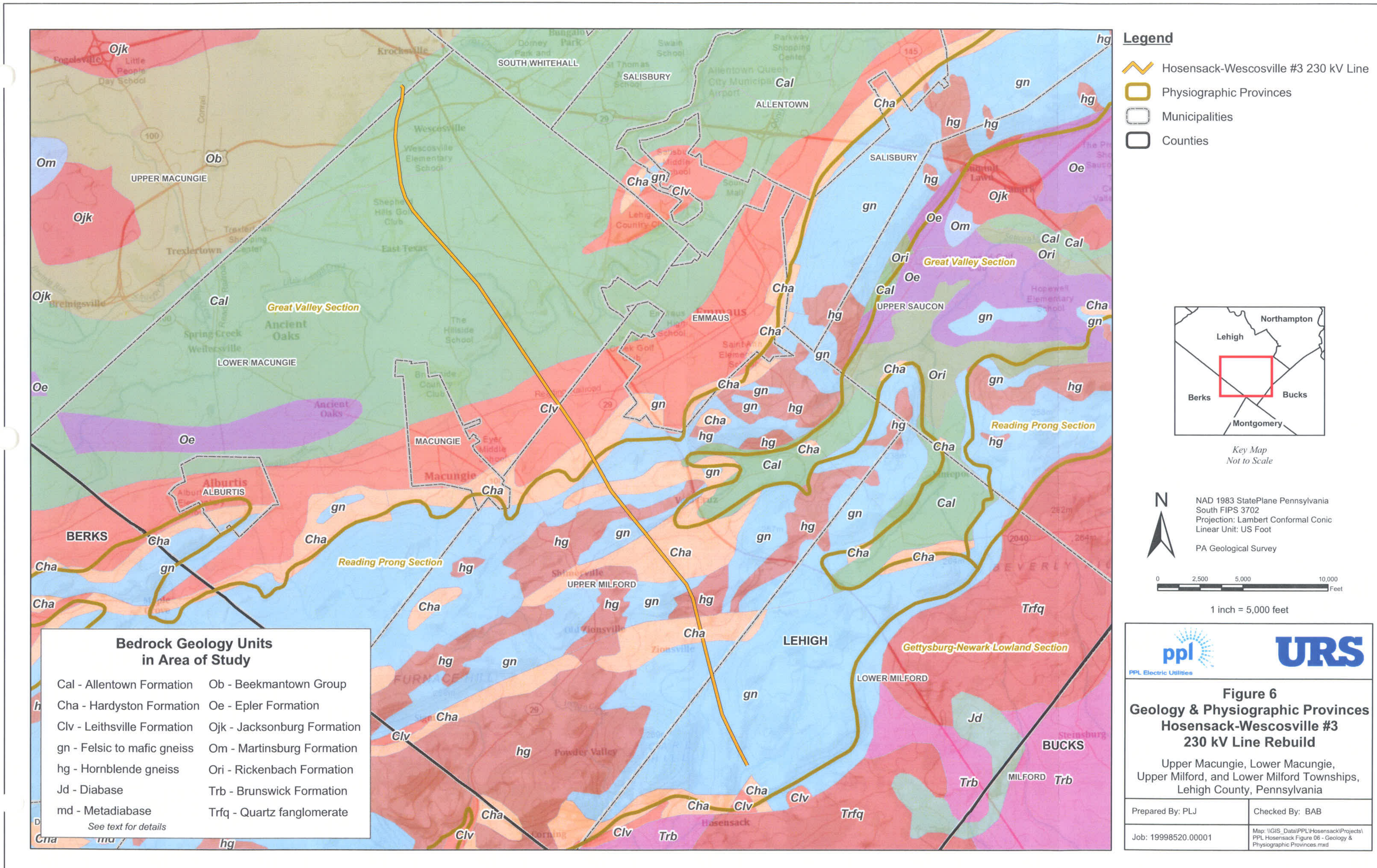
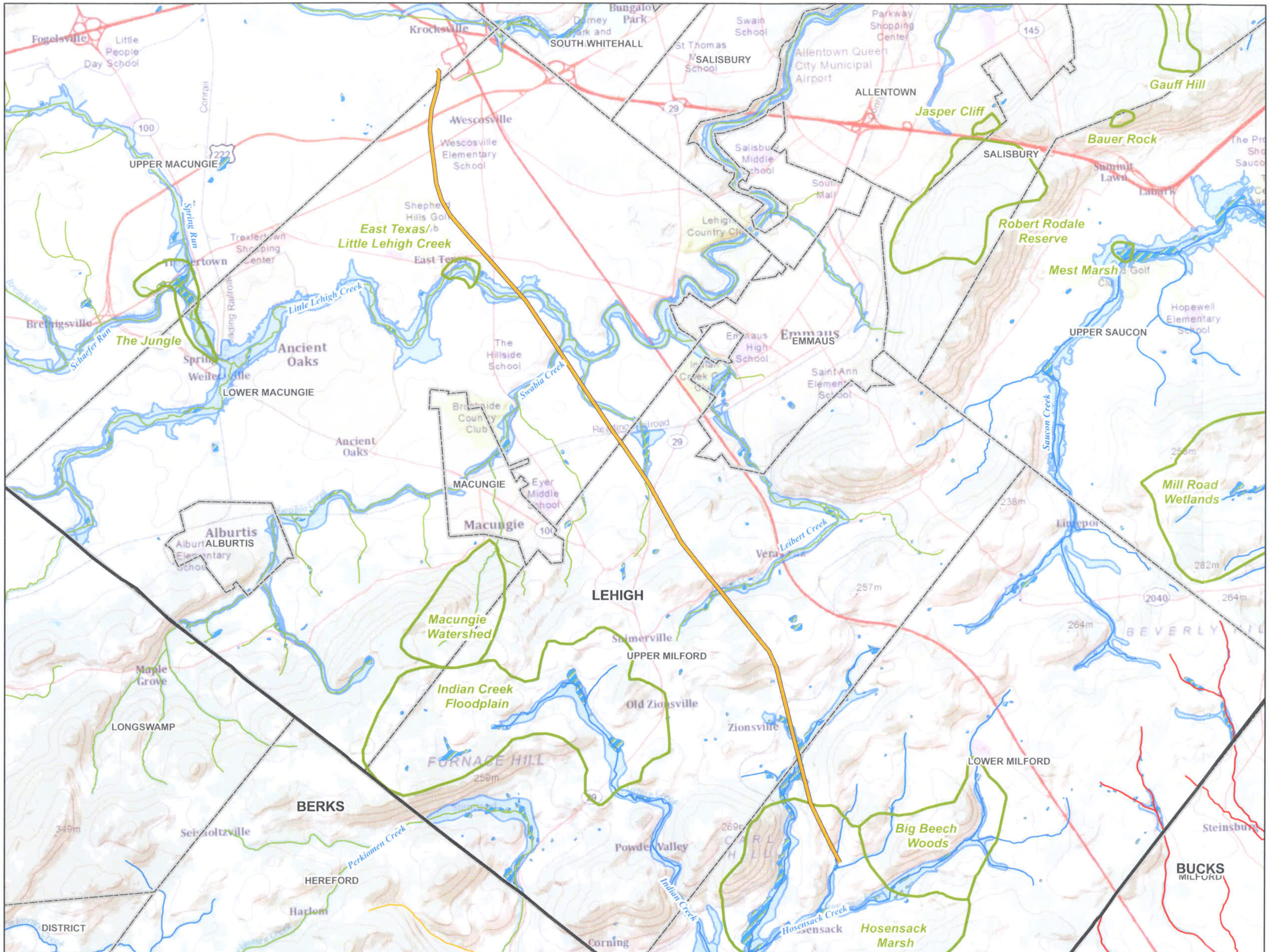


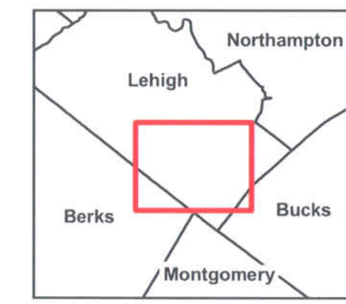
Figure 6
Geology & Physiographic Provinces
Hosensack-Wescosville #3 230 kV Line Rebuild

Upper Macungie, Lower Macungie, Upper Milford, and Lower Milford Townships, Lehigh County, Pennsylvania



Legend

- Hosensack-Wescosville #3 230 kV Line
- Streams - Designated Use
  - CWF(COLD WATER FISHES)
  - HQ-CWF(HIGH QUALITY-COLD WATER FISHES)
  - HQ-TSF(HIGH QUALITY-TROUT STOCKING)
  - TSF(TROUT STOCKING)
- Wetlands
- 100-year Floodplains (A and AE)
- TNC Natural Areas
- Municipalities
- Counties



Key Map
Not to Scale

N

NAD 1983 State Plane Pennsylvania
South FIPS 3702 Feet
Projection: Lambert Conformal Conic
Linear Unit: US Foot

Wetlands and Floodplains provided
by Lehigh County.
PASDA Chapter 93 Designated Use Streams

0 2,500 5,000 10,000 Feet

1 inch = 5,000 feet

ppl
PPL Electric Utilities

URS

Figure 7
Natural Features
Hosensack-Wescosville #3
230 kV Line Rebuild

Upper Macungie, Lower Macungie,
Upper Milford, and Lower Milford Townships,
Lehigh County, Pennsylvania

Prepared By: PLJ	Checked By: BAB
Job: 19998520.00001	Map: \\GIS_Data\PPL\Hosensack\Projects\PPL Hosensack Figure 07 - Natural Features.mxd

Attachment

4

ATTACHMENT 4

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

230 kV

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

500 kV

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

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

Periodic Maintenance Program on All Transmission Lines

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

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

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

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

Personnel Safety Rules

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

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

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

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

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

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

Attachment

5

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

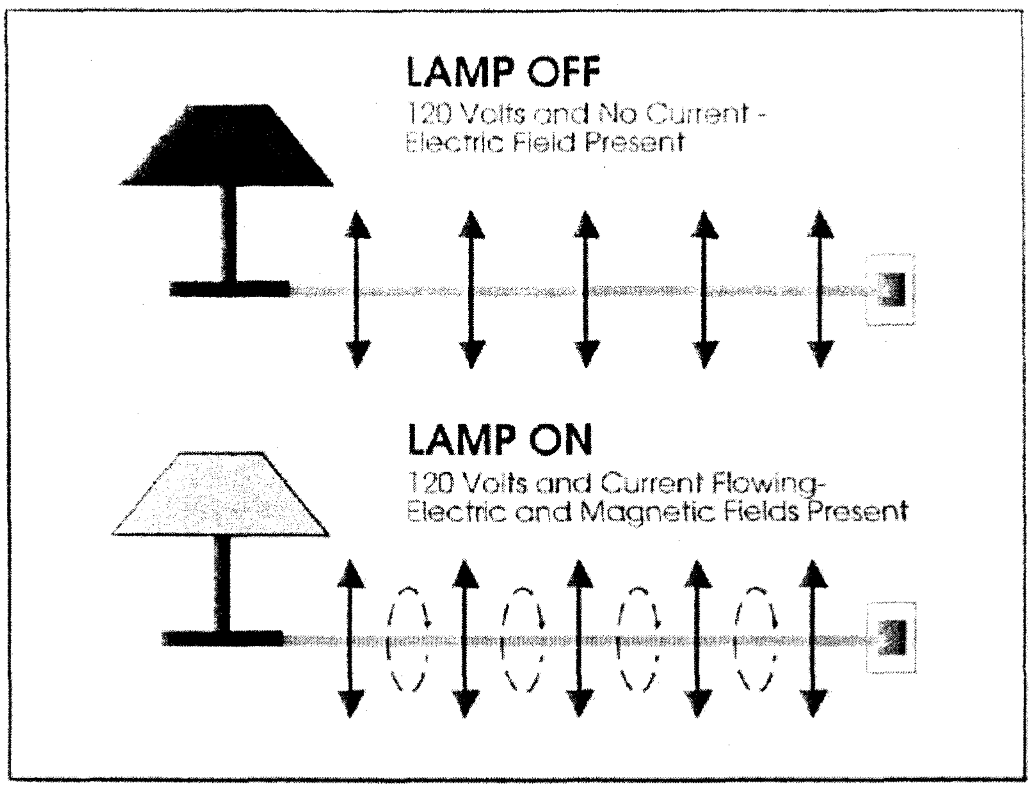

LAMP OFF
120 Volts and No Current -
Electric Field Present
LAMP ON
120 Volts and Current Flowing-
Electric and Magnetic Fields Present

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.

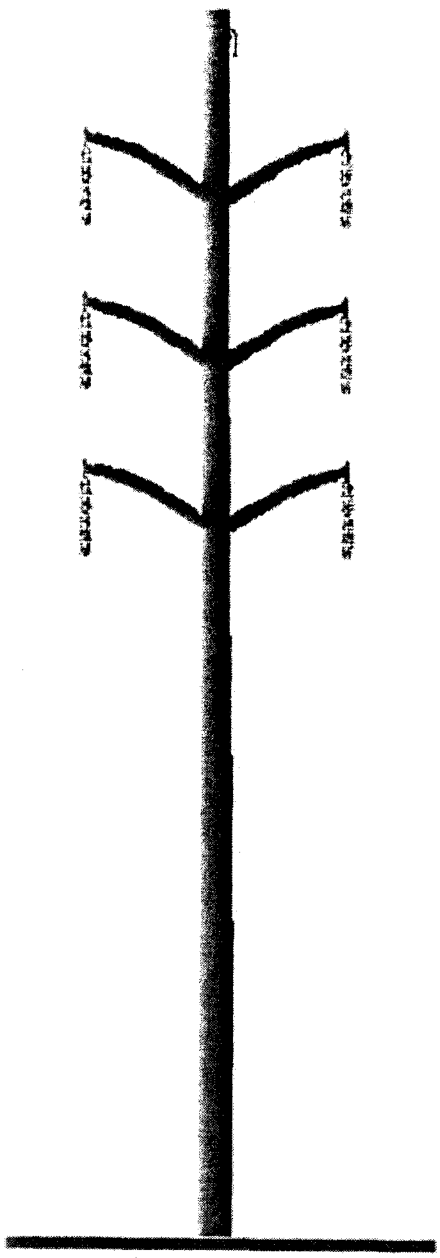
- Main lines are the most heavily loaded sections of a distribution line and therefore have the highest magnetic fields associated with them.
- Increasing the ground clearance by five feet reduces the magnetic field under the line from 14 mG to 11 mG using the standard eight-foot crossarm design. These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

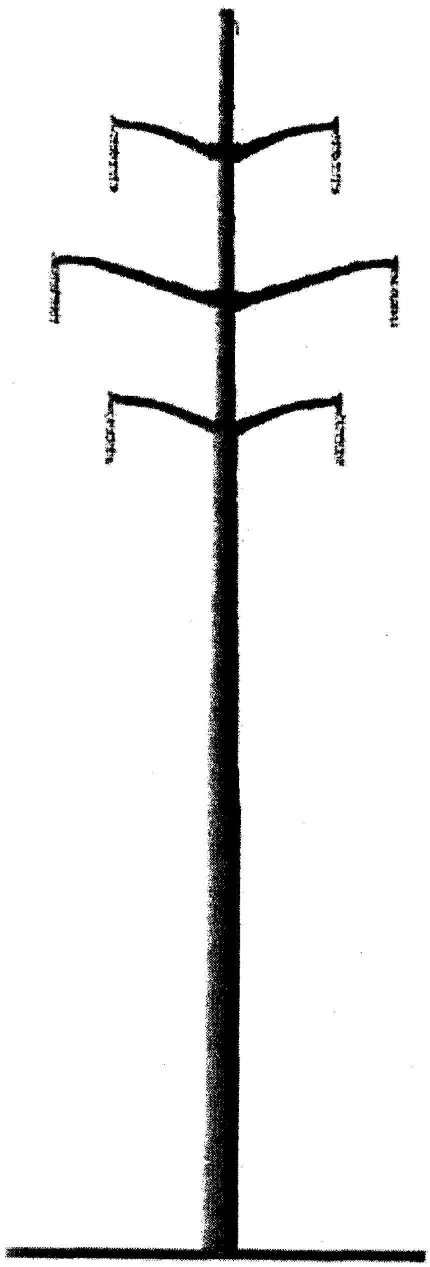
Short-Span Construction



- **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:**

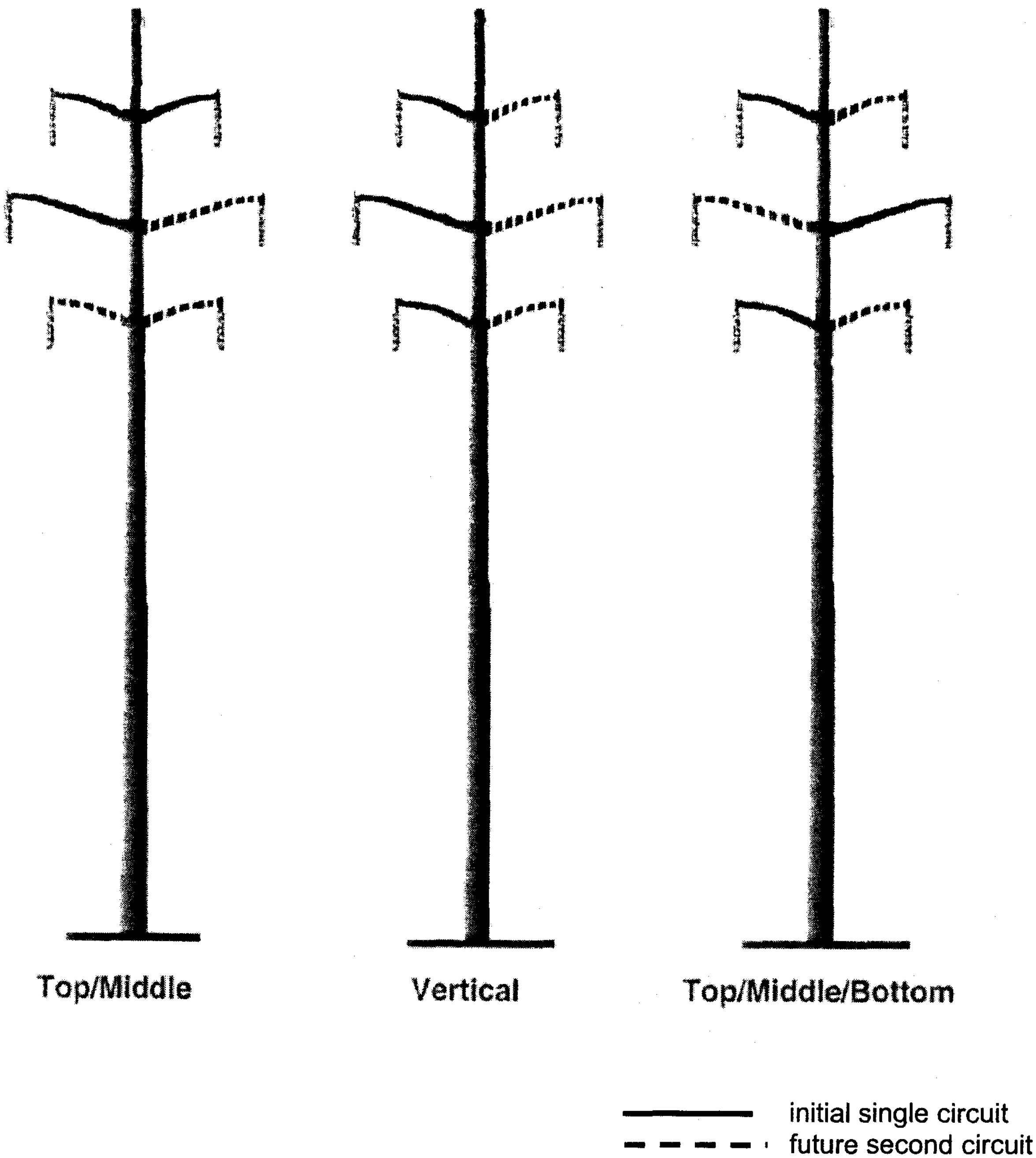
1 3/8" HS steel overhead ground wire - 17.3 feet sag
6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 23.0 feet sag
Average span - 600 feet

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.

Typical Single-Circuit Structure Designs

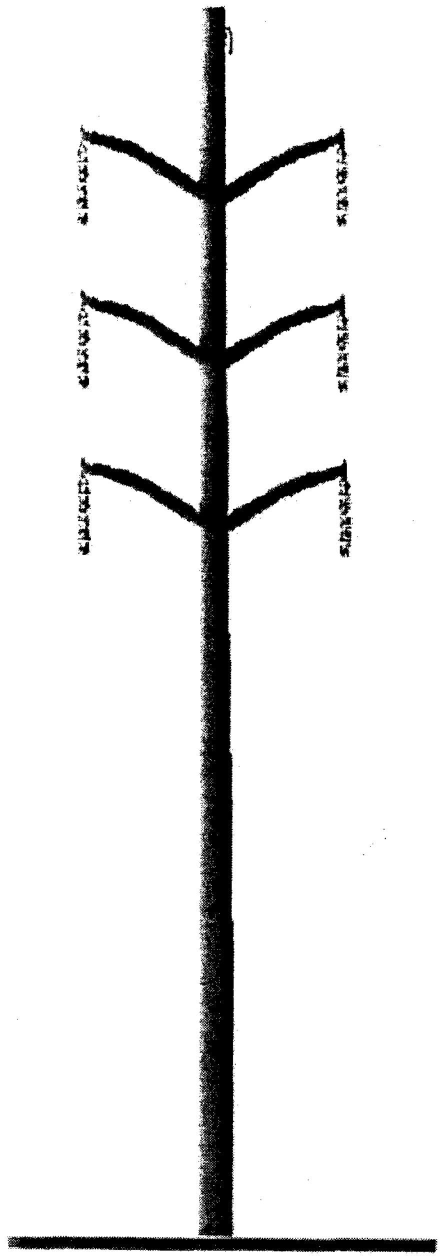


**138/69 kV SINGLE CIRCUIT TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 400 AMPERES**

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

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

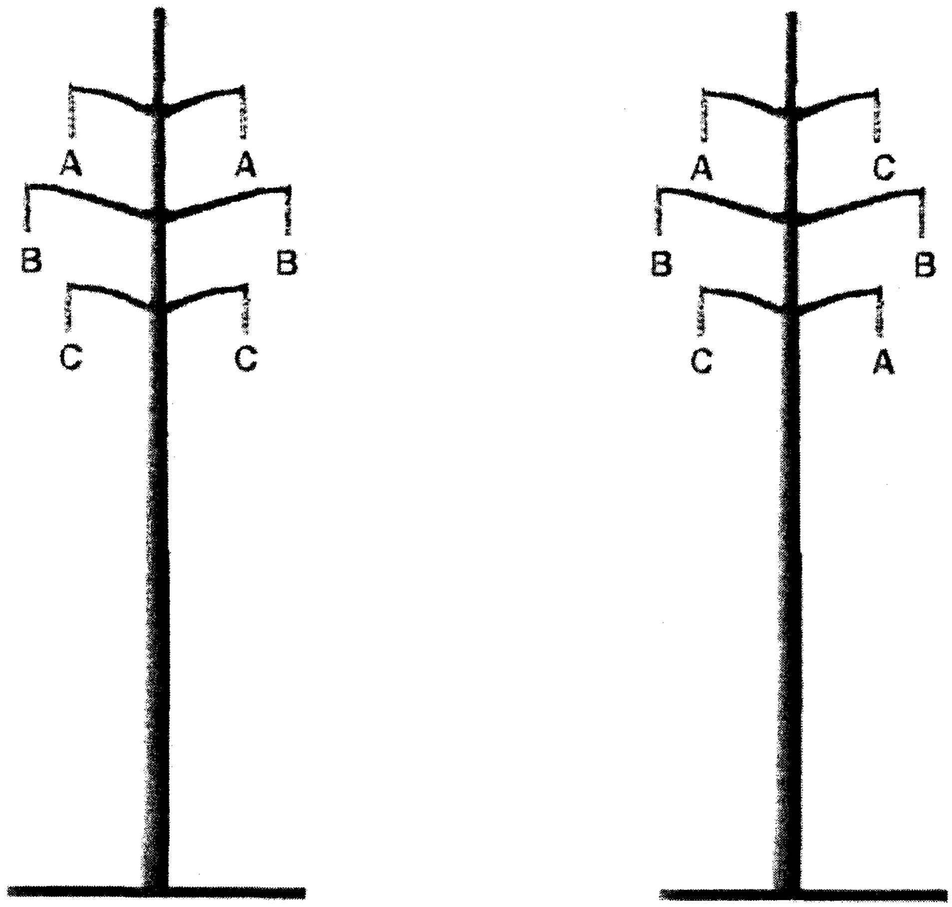
Compact Design Structure



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

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

Reverse Phasing of Double-Circuit Transmission Lines



From: ⟶ ⟶ ⟶ ⟶ **To:**

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

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

CHART VIII

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

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

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

CHART IX

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

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

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

CHART X

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

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

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

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

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

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

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

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

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

12 kV DISTRIBUTION LINES
CALCULATED MAGNETIC FIELDS AT 300 AMPERES

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

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

Attachment

6

ATTACHMENT "6"

LIST OF INVOLVED GOVERNMENTAL AGENCIES, MUNICIPALITIES AND OTHER PUBLIC ENTITIES

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

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

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

Upper Macungie Township Board of Supervisors
8330 Schantz Road
Breinigsville, PA 18031
Attn: Kathy Rader

Lower Macungie Township
Mr. Bruce Fosselman, Manager
3400 Brookside Road
Macungie, PA 18062

Lower Milford Township
Ms. Ellen Koplin, Manager
7607 Chestnut Hill Church Road
Coopersburg, PA 18036

Upper Milford Township
Mr. Dan DeLong, Manager
5671 Chestnut Street
PO Box 210
Old Zionsville, PA 18068

Lehigh Valley Planning Commission
Mr. Mike Kaiser, Executive Director
961 Marcon Boulevard, Suite 310
Allentown, PA 18109

Lehigh County Commissioners
Mr. Dean Browning, Chair
17 South Seventh Street
Allentown, PA 18101

Lehigh County
Mr. Don Cunningham, Executive
17 South Seventh Street
Allentown, PA 18101

Attachment

7

ATTACHMENT "7"

HOSENSACK -WESCOSVILLE #3 230 kV LINE REPLACEMENT

LIST OF INVOVED PROPERTY OWNERS

PPL Electric Utilities
2 N 9Th St.
Allentown, PA 18101-1139

Rever John O Barres
Bishop of the Roman Catholic Diocese
PO Box F
Allentown, PA 18105-1538

Andrew Residuary Trust Yastishok
Mary & Mark Yastishok Co-Trustees
6500 Chapmans Rd.
Allentown, PA 18106-9200

Lower Macungie Twp
3400 Brookside Rd.
Macungie, PA 18062-1428

Ray W. Walbert
6851 Kings Highway S
Zionsville, PA 18092

Richard C. Lutz
6922 Vera Cruz Rd S
Zionsville, PA 18092-2051

Jeremy D & Stephanie M Hoch
6931 Vera Cruz Rd S
Zionsville, PA 18092

David M Jr. & Emilie A Lobach
6932 Kings Hwy S
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Allentown, PA 18106

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1274 Shiloh Rd.
Allentown, PA 18106

Joseph & Silvana Ciccarello
1288 Shiloh Rd
Allentown, PA 18106

Gretchen Pearl
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Allentown, PA 18106

Matthew A & Jane E Nussbaum
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Allentown, PA 18106

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1362 Shiloh Rd.
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Daniel & Roseann Gagliardi
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Allentown, PA 18106-8747

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Allentown, PA 18106

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1492 Shiloh Rd.
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1072 Morning Star Dr.
Allentown, PA 18106-8761

Albert F & Constance E Ernst
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Macungie, PA 18062

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1720 Lamplighter Dr.
Macungie, PA 18062-9076

Michael A & Donna M Hersch
1734 Lamplighter Dr.
Macungie, PA 18062-9076

Michael & Karen E Forziati
1750 Lamplighter Dr.
Macungie, PA 18062-9076

John J & Dianne C Donofrio
1770 Lamplighter Dr.
Macungie, PA 18062-9076

Robert J & Maureen A Calder
1786 Lamplighter Dr.
Macungie, PA 18062-9076

Ioannis M Giannaris
1800 Lamplighter Dr.
Macungie, PA 18062-9076

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Allentown, PA 18106-8749

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937 Oplinger Rd.
Allentown, PA 18106-9702

Mannino Brothers Partnership
1985 Brookside Rd.
Macungie, PA 18062-9730

Faith Evan Free Church
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Allentown, PA 18106-9754

Brendan J & Katherine O'Brien
5090 Lower Macungie Rd
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Liv Hope Orthodox Presb Church
816 Chestnut St
Emmaus, PA 18049-2020

Wild Cherry Knoll LP
4445 Harriet Ln
Bethlehem, PA 18017-8418

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Matthew J. & Sharon A Rowlands
4964 Waterfall Dr.
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Mark A & Katherine A Lichtenwalner
4939 Indian Creek Rd.
Macungie, PA 18062-9778

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PO Box 223
Emmaus, PA 18049-0223

Pennsylvania Lines LLC
C-O Norfolk Southern Railway Co.
110 Franklin Rd. SE
Roanoke, VA 24042-0028

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Macungie, PA 18062-9076

Sauerkraut Lane LP
937 Oplinger Rd.
Allentown, PA 18106-9702

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Waltham, MA 02454-9161

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1826 Lamplighter Dr.
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Macungie Road LP
937 Oplinger Rd.
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Box 395
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Day-Timers Inc
PO Box 6
East Texas, PA 18046-0006

Contel of Pennsylvania Inc
C-O GTE North Incorporated
PO Box 152206
Irving, TX 75015-2206

Davis Scott D Et Al
C-O Davis Construction & Steel
Erec
4870 Raymond Ct
Emmaus, PA 18049-1033

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Macungie, PA 18062-9745

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Emmaus, PA 18049-1009

Michael Harned
4893 Buckeye Rd.
Emmaus, PA 18049-0344

Julia Two Corp.
1708 Locust St.
Philadelphia, PA 19103-6107

George & Edeltrud R Madtes
4831 Beck Rd.
Emmaus, PA 18049-5204

Joseph L & Evelyn M Sadrovitz
4875 Buckeye Rd.
Emmaus, PA 18049-1032

Douglas S & Mark J Feiertag
Barcza
4280 Chestnut St.
Emmaus, PA 18049-5368

Stephen T Mogck
4811 Beck Rd.
Emmaus, PA 18049-5204

Kahlon Enterprises LLC
4911 Buckeye Rd.
Emmaus, PA 18049-1015

Lobar, Inc.
1 Old Mill Rd.
PO Box 50
Dillsburg, PA 17019-0050

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4781 Beck Rd.
Emmaus, PA 18049-5202

Linda K Schmick
4927 Buckeye Rd.
Emmaus, PA 18049-1015

Johnathan Herbein
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Emmaus, PA 18049

William G Jr. Billger
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Emmaus, PA 18049-5201

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Emmaus, PA 18049-4017

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4710 Beck Rd.
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Bernard R & Betty J O'Donnell
Trstees
4836 Buckeye Rd.
Emmaus, PA 18049-1031

Frank & Pearl N Beck
C-O Beck Brothers
4555 Chestnut St.
Emmaus, PA 18049-5360

Richard L Jr & Bonita L
Tremmel
4745 Shimerville Rd.
Emmaus, PA 18049-4951

Hinnerschietz John Et Al
C-O Hinnerschietz Recon Inc
4892 Buckeye Rd.
Emmaus, PA 18049-1003

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Bailey Wade H Et Al
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Nancy L. O'Brien
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