

Before the
Pennsylvania Public Utility Commission

EFFORT MOUNTAIN #1 & #2 138 kV TAPS

EXHIBITS AND APPENDICES IN SUPPORT OF THE
CERTIFICATION APPLICATION

Application Docket No. _____

Submitted by: PPL Electric Utilities Corp.

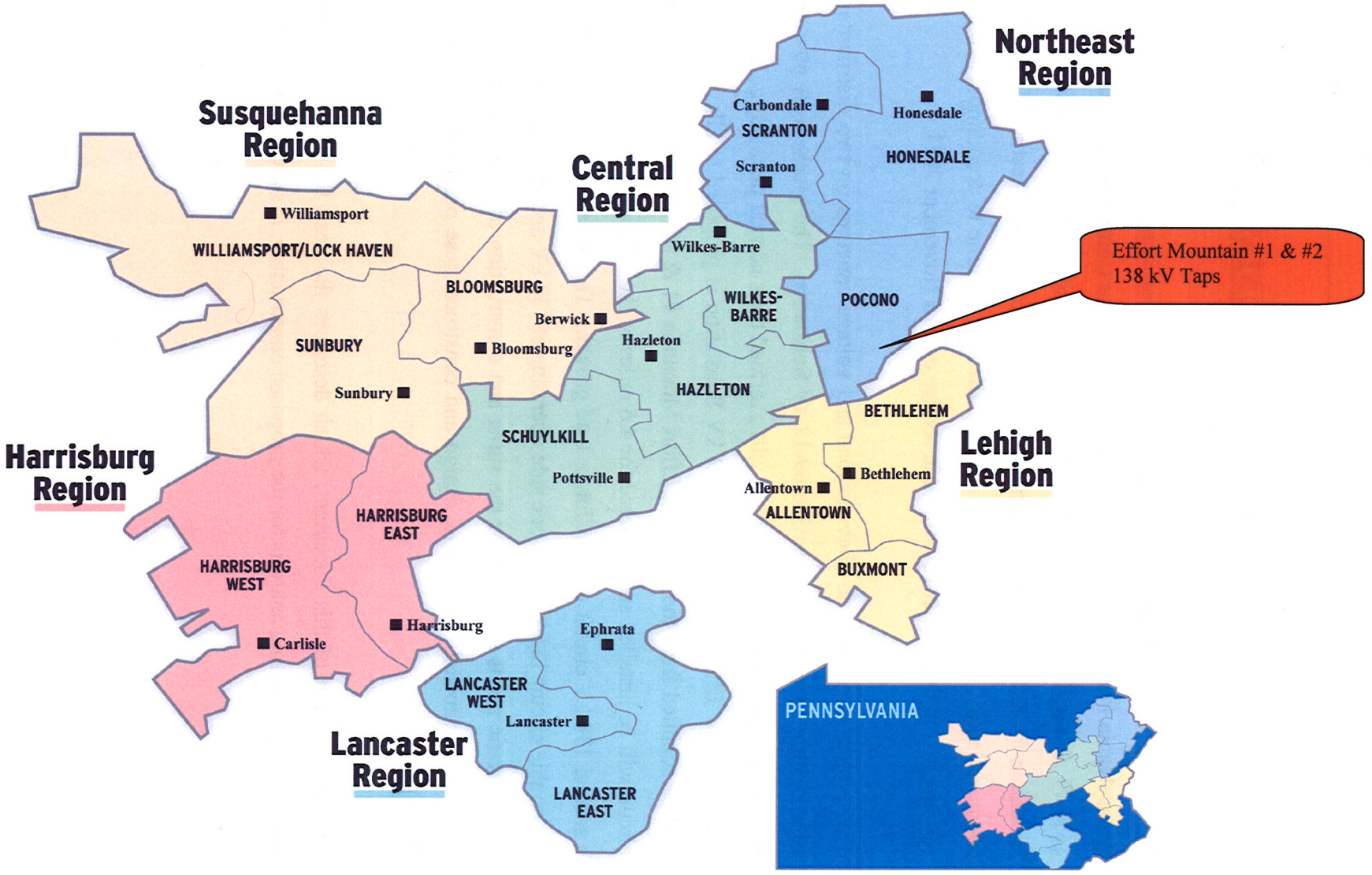
EXECUTIVE SUMMARY

This filing is submitted by PPL Electric Utilities Corporation (PPL Electric) pursuant to the Pennsylvania Public Utility Commission's (PUC or the Commission) regulations at 52 Pa. Code §§57.71 through 57.77 for PUC approval to site and construct a new 5.7 mile long Effort Mountain #1 & #2 138 kV Tap Transmission Line located in Chestnuthill and Polk Townships, Monroe County. This Application is being filed at this time to accommodate commencement of construction in October 2010 with an in service date of November 2011.

This project is required to alleviate load and voltage concerns on two distribution circuits from PPL Electric's existing Meckesville 69-12 kV Substation. The Meckesville 69-1 and Meckesville 69-2 12 kV lines have overloaded or will overload their normal planning guidelines by the fall of 2011. A new Effort Mountain 138-12 kV Substation is proposed to alleviate these concerns. It will be supplied from the proposed Effort Mountain #1 & #2 138 kV Taps. Initially one 138 kV circuit will be installed and operated for 4.6 miles of the selected route, but it will be designed for a second 138 kV circuit to meet future load growth. The remaining 1.1 miles will be constructed for double circuit 138 kV with one side operating at 138 kV and the other side operating at 12 kV. PPL Electric needs approval for the siting and construction of a double circuit transmission line tap. The estimated cost to site, design and construct these overhead transmissions facilities is $5,721,000.

The organization of this document, which describes the need for the project and discusses the engineering and siting analysis for the proposed construction, is shown in the Table of Contents.

PPL ELECTRIC UTILITIES SERVICE TERRITORY



PPL ELECTRIC UTILITIES CORPORATION
EFFORT MOUNTAIN PROJECT #1 & #2 138 kV TAPS

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Exhibit
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EXHIBIT A:
PUC REGULATION CROSS-REFERENCE MATRIX

Pennsylvania Code Section*	PUC Regulation Requirement	Location in Application	Associated Tables/Figures
57.72 (c)(3)	Description of Proposed Route	• Exhibit D	• Figures D-15, D-16
57.72 (c)(4)	A general description of the proposed route of the HV line.	• Exhibit D	• Figures D-15, D-16
57.72 (c)(5)	A general statement of the need of the proposed HV line in meeting identified present & future demands for service, how the proposed line will meet that need, and engineering justifications	• Exhibit B • Exhibit E	• Table B-1 • Figures B-1 through B-4
57.72 (c)(6)	A statement of the safety considerations which will be incorporated into the design, construction, and maintenance of the proposed HV line.	• Exhibit E	• N/A
57.72 (c)(7)	A description of the studies which had been made as to the projected environmental impact of the HV line as proposed and of the efforts which have been and will be made to minimize the impact of the HV line upon the environment and upon scenic and historic areas.	• Exhibit C • Exhibit D	• Tables C-1, C-2, D-3 • Figures C-1 through C-8 • Figures D-3 through D-11
57.72 (c)(8)	A description of the efforts of the applicant to locate and identify archeologic, geologic, historic, scenic, or wilderness areas within 2 miles of the proposed right-of-way and the location and identity of the areas	• Exhibit C • Exhibit D	• Tables D-3, D-5 • Figures D-3 through D-8
57.72 (c)(9)	The location and identity of airports within 2 miles of the nearest limit of the right-of-way of the proposed HV line.	• Exhibit C • Exhibit D	• Figures C-8, D-3
57.72 (c)(10)	A general description of reasonable alternative routes to the proposed HV line, including a description of the corridor planning methodology, a comparison of the merits and detriments of each route, and a statement of the reasons for selecting the proposed HV line route.	• Exhibit D	• Tables D-5, D-6, D-7 • Figures D-1, D-2, and D-9 through D-16

EXHIBIT A:
PUC REGULATION CROSS-REFERENCE MATRIX

Pennsylvania Code Section*	PUC Regulation Requirement	Location in Application	Associated Tables/Figures
57.72 (c)(11)	A list of the local, state, and federal governmental agencies which have requirements that shall be met in connection with the construction or maintenance of the proposed HV line and a list of documents which have been or are required to be filed with those agencies.	• Exhibit G	• N/A
57.72 c(12)	The estimated cost of construction of the proposed HV line and the projected date for completion.	• Exhibit B • Exhibit D	• N/A
57.72 c(13)(i)	A depiction of the proposed route on aerial photographs and topographic maps of suitable detail.	• Exhibit C • Exhibit D	• Figures D-15, D-16
57.72 c(13)(ii)	A description of the proposed HV line, including the length of the line, the design voltage, the size, number, and materials of conductors, the design of the supporting structures and their height, configuration and materials of construction, the average distance between supporting structures, the number of supporting structures, the line to structure clearances and the minimum conductor to ground clearance at mid-span under normal load and average weather conditions and under predicted extreme load and weather conditions.	• Exhibit E	• Tables E-1 and E-2 • Figures E-1 through E-5
57.72 c(13)(iii)	A simple drawing of a cross section of the proposed right-of-way of the HV line.	• Exhibit E	• Figure E-5
57.72 c(13)(iv)	A system map which shows in suitable detail the location and voltage of existing transmission lines and substations of the applicant and the location and voltage of the proposed HV line and associated substations	• Exhibit B • Exhibit E	• Figure B (map) and B-1 through B-3

*Pennsylvania Code 57.71 –57.75 relates to "Commission Review of Siting and Construction of Electric Transmission Lines". Sections described within Exhibit A pertain specifically to those items required to be included for an application filing.

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1.0 Introduction

PPL Electric Utilities Corporation (PPL Electric), in order to maintain reliable electric service to its customers, is required to monitor and when appropriate reinforce both its Transmission and Distribution power systems. The electrical system in the Sun Valley/Jonas area is heavily loaded and has been subject to an above average number of outages. Moreover, as loads continue to grow, these distribution lines are currently and/or are projected to exceed their normal and/or emergency thermal guidelines. To address this problem, PPL Electric has developed an overall reinforcement plan for the Sun Valley/Jonas area. A central part of this plan, and the subject of this filing, requires building approximately 5.7 miles of new 138 kV transmission line which will provide service to a new 138-12 kV substation. Completion of this project will relieve overloading conditions on the neighboring Meckesville 69-12 kV substation and its 12 kV circuits which serve the Sun Valley/Jonas area and permit the company to continue to provide reliable service to customers in this area.

The estimated cost to site, design and construct this transmission project is approximately $5,721,000. The total estimated cost of Effort Mountain Substation project including transmission, distribution, and substation work is $8,755,000. Construction of this project is scheduled to begin in October 2010 to meet an in-service date of November 2011. A PPL Electric system map showing existing transmission facilities and the proposed new facilities with a design voltage of 35 kV or greater is included in the **B-Map pocket**. This filing seeks approval for the proposed new 138 kV transmission taps that will be located in Chestnuthill Township and Polk Township, Monroe Country. To provide a full understanding for the need for this project, supplemental information is included for the proposed Effort Mountain 138-12 kV Substation and related distribution facilities. In addition, by separate contemporaneous filing, the company is seeking a finding that the substation cubical building is reasonably necessary for the convenience or welfare of the public.

2.0 System Planning Process

System Planning is the process which assures that both the Transmission and Distribution power systems can supply electricity to customers in a reliable and economic manner. This process assures that these systems:

- are able to supply load reliably during summer and winter peak conditions;

- provide service at an acceptable voltage level throughout the daily load cycle.

The proper reinforcement of Transmission and Distribution supply facilities requires a set of defined planning standards. PPL Electric's planning standards are set forth in the Reliability Principles and Practices (P&P) manual. PPL Electric developed the Reliability P&P to ensure adequate and appropriate levels of service consistent with good utility practice. The principles upon which these planning guidelines are based recognize:

- the necessity of maintaining proper balance between service reliability and the cost of providing that service; and
- that large-scale, long term, or frequent interruptions are to be avoided due to the adverse effects on the general public.

In accordance with these guidelines, the power distribution system is planned so that, under normal operating conditions:

- loadings on all facilities are within normal guidelines;
- adequate voltage levels are maintained as specified by the PUC at 52 Pa. Code 57.14;
- loadings on underground network facilities are within single contingency limitations.

At times, reinforcement of distribution facilities requires the expansion of the regional transmission system. Such is the case when a new distribution supply substation is necessary to adequately service load in compliance with the Reliability P&P manual. This filing, for example, seeks approval for a new transmission tap which is required to energize the new substation, which in turn is required to relieve overloading on the distribution system in the Sun Valley/Jonas area.

The distribution planning process begins with a review of line loadings at each substation across the system. Summer and winter peak loads are projected for four future years based on current year's load and the six previous years' loads. The load profile, duration of peak loads, and load level are analyzed at circuit and substation level. These analyses identify the distribution facilities that exceed the planning guidelines. Following the identification of problems on a circuit or at a substation, various options to reinforce the area of concern are considered. The options are weighed in terms of how and over what time period they address load and reliability concerns and at what cost. These options are considered over a 10 – 20 year time frame. The option that best resolves

load and reliability issues for the time frame considered and that is economically optimal is then chosen to be constructed in a timely manner to mitigate overload concerns on the system.

3.0 Existing Supply

The area of concern in this Application currently receives its distribution service from the Meckesville 69-12 kV Substation. The Meckesville Substation has two 69-12 kV transformers with ratings of 11.2 MVA and 15 MVA[1] . Currently two 12 kV lines distribute electricity to meet the substation's load. The Meckesville 69-1 12 kV line extends south from the substation and serves more than 2,350 customers. The Meckesville 69-2 12 kV line extends east from the substation and serves more than 2,700 customers. The functional arrangement of the distribution facilities in the area is shown in **Figures B-1 and B-2**.

The Meckesville 69-12 kV Substation is supplied from a single circuit 69 kV line which taps both the East Palmerton-Wagners #1 and #2 69 kV lines. The substation is normally supplied from the East Palmerton-Wagners #1 line. The East Palmerton-Wagners #2 69 kV line can be used as an alternate supply to the substation during maintenance or unplanned outages of the East Palmerton - Wagners #1 line.

[1]All ratings and loads in this filing are expressed in Megavolt Amperes (MVA)

4.0 Definition of the Problem

Load growth due to housing developments in the Sun Valley/Jonas area has placed greater demand on the existing electrical facilities. Load growth on the existing Meckesville 69-2 12 kV Line has averaged more than 5% per year which is more than double the PPL system average of 2.5% (see **TABLE B-1**). Since 2004 the number of customers served from the Meckesville 69-1 line has increased by 300 customers, an average of 3% per year, and Meckesville 69-2 line has increased by 650 customers, an average of 6% per year. As a result of this load growth, the electrical system is heavily loaded and has been subject to an above average number of outages. In fact, this area is one of the poorest performing areas in PPL Electric's system. As explained in more detail below, as load continues to grow, these distribution lines are currently and/or are projected to exceed their normal and/or emergency thermal guidelines. To meet the expected future power requirements of this area, PPL Electric has performed a planning analysis to determine the most appropriate long range system reinforcement plan for the area.

This reinforcement plan addresses the limited capability of the existing Meckesville 69-12 kV Substation and the 12 kV lines supplied from it. Specifically, the Meckesville 69-1 12 kV line uses a 336 XLP conductor, which has normal/emergency/thermal planning guidelines of 10 MVA/12 MVA/12.8 MVA. The winter 2011 load on the Meckesville 69-1 line is projected to be 10.2 MVA which exceeds the normal planning guideline. The Meckesville 69-2 12 kV line uses a 477 XLP conductors, which has normal/emergency/thermal planning guidelines of 11 MVA/13 MVA/17 MVA. The winter 2008 load on the Meckesville 69-2 line was 13.4 MVA which exceeded the emergency planning guideline. The winter 2011 load on the Meckesville 69-2 12 kV lines is projected to be 15.2 MVA. The Meckesville 69-2 is projected to approach the thermal guideline in 2013. Exceeding the normal guidelines is a deviation from the planning guidelines in the Reliability P&P manual (see **TABLE B-1**).

Continuing to operate the Meckesville 69-1 and 69-2 12 kV lines beyond their planning ratings will overheat the lines and anneal the conductor which could result in an outage of the facilities. Due to the arrangement of the lines (see **Figure B-1**), (There are only two ties, and the ties have very limited transfer capability), a failure of the Meckesville 69-1 line would leave more than 1,100 customers out of service for an extended period of time until the line is repaired or replaced. Likewise, failure of the Meckesville 69-2 12 kV line would interrupt service to approximately 2,000 customers for extended periods of time due to limited transfer capability.

The transfer capability is limited at peak times because the loads on neighboring circuits, to which load otherwise could be transferred, also are approaching emergency planning guidelines. If addition load was transferred to the neighboring lines, their emergency planning guidelines would be exceeded. Loading circuits over the emergency ratings will overheat the lines and anneal the conductor which could result in failure.

Similar conditions would exist in the event of a transformer failure at the Meckesville 69-12 kV Substation. In the event of a loss of a Meckesville 69-12 kV transformer, not all the load can be transferred away to neighboring substations because their loads are approaching their maximum capacity. Therefore, a transformer failure et the Meckesville Substation would lead to an extended outage for more than 3,000 customers until repairs could be made.

Additionally, maintenance of the Meckesville Substation cannot be performed during most of the year due to lack of adequate transfer capability. When load is transferred away, voltage on the lines

to which the load is transferred cannot be adequately maintained. Therefore, due to load and voltage concerns, the entire load on neither the Meckesville 69-1 nor the Meckesville 69-2 lines can be transferred to other substations.

TABLE B-1: HISTORICAL AND PROJECTED PEAKLOADS

Facility	Conductor Size / Transformer Nameplate Rating	Planning Guideline (MVA) Normal / Emergency	Actual Winter Load Checks[2] (MVA) Cold[3] 2004	Mild[4] 2005	Cold 2006	Normal[5] 2007	Normal 2008	Average Yearly Load Growth[6] (MVA/year) (%/year)	Projected Winter Peak (MVA) 2009	2010	2011	2012
Meckesville 69-01 12 kV line	336 AL	10.0 12.0	9.8	8.3	9.4	9.5	9.9	0.1 (1%)	10.0	10.1	10.2 (4.7)	10.3 (4.8)
Meckesville 69-02 12 kV line	477 AL	11.0 13.0	10.9	11.0	12.4	12.4	13.4	0.6 (5%)	14.0	14.6	15.2 (6.8)	15.8 (7.1)
Meckesville 12kV Transformers	1-11.2 1-15	25.0[1]	20.1	19.1	21.7	21.7	23.2	0.7 (3%)	23.9	24.6	25.3 (11.5)	26.0 (11.9)
Gilbert 78-4 12kV line	477 AL	11.0 13.0	12.4	8.9	9.1	9.2	9.5	0.2 (2%)	9.7	9.9	10.1 (9.1)	10.3 (9.2)
Effort Mountain XX-01 12 kV line	477 AL	11.0 13.0									(8.4)	(8.7)
Effort Mountain XX-02 12 kV line	477 AL	11.0 13.0									(6.5)	(6.6)

Legend
( ) With Effort Mountain Substation, tap and proposed reinforcements
[1] Represents the 6 hour rating of smaller transformer plus emergency transfers
[2] Represents the peak loads for winter season i.e. 2004 winter season is from December 2004 through March 2005.
[3] Relatively cold winter temperatures
[4] Relatively mild winter temperatures
[5] Relatively normal winter temperatures
[6] Load growth was calculated by taking the average of the year to year percent growth from 2004 to 2008
MVA= Megavolt Amperes
AL= Aluminum conductor
Exceeds Normal Planning Guidelines
Exceeds Emergency Planning Guidelines

5.0 Proposed Solution

To improve the integrity of the distribution system and address the load and reliability concerns in the area, PPL Electric proposes a new 138 kV transmission tap to a new 138-12 kV substation in the Jonas/Sun Valley area. The new distribution substation, named Effort Mountain 138-12 kV Substation, will relieve the line loading on the Meckesville 69-1 and 69-2 12 kV lines. The new substation will also relieve the neighboring Gilbert 78-4 line. One line from Effort Mountain Substation will go to the north and serve a portion of the Indian Mountain Lakes development thereby relieving the Meckesville 69-2 line. This new line will serve approximately 1,400 customers. The second line from Effort Mountain Substation will go to the south and serve the residential developments along Jonas Rd and State Route 534 and relieve the Meckesville 69-1 and Gilbert 78-4 lines. This new line will serve approximately 1,500 customers. See **Figures B-3 and B-4** for a functional arrangement of the distribution facilities in the area with the proposed solution.

Transferring load from the Meckesville 69-1, 69-2, and Gilbert 78-4 12 kV lines to the new Effort Mountain 138-12 kV Substation will reduce the number of customers served from these lines. The location of the new Effort Mountain 138-12 kV Substation will provide a source more central to the load it will serve. Locating the substation central to the load it serves will increase reliability and operating flexibility. It will also reduce the number of customers affected by a line outage and reduce restoration times. Additionally, creating more 12 kV circuits from the proposed Effort Mountain substation will reduce the length of line per existing circuit, thereby reducing the amount of exposure for all three existing lines.

The transmission tap that will serve the new Effort Mountain 138-12 kV Substation, will be known as the Effort Mountain #1 & #2 138 kV Taps. This tap, which is the subject of this filing, will be designed for future 138 kV double circuit operation, but will initially operate as a single circuit 138 kV line. The new Effort Mountain 138-12 kV Substation must be connected to the regional 138 kV system via a transmission tap. The existing Siegfried-Jackson #1 138 kV line will be tapped to supply power for the new Effort Mountain Substation. The Siegfried-Jackson 138 kV line was chosen due to its proximity to the proposed site for the new Effort Mountain Substation and because it is a high capacity transmission line capable of handling additional load as the proposed substation load expands. The new tap will be approximately 5.7 miles in length.

6.0 Functional Alternatives

PPL Electric examined several functional alternatives to the proposed project. Initially, the company reviewed the possibility of enhancing the capabilities of the existing facilities in the area. This option involved building two new lines out of Meckesville substation to relieve the 69-1 and 69-2 lines. Due to limited routes exiting the substation the new lines would have to be attached to the existing poles of the 69-1 and 69-2 lines. This is an expensive construction method and does not improve reliability due to fact that two distribution circuits installed on the same poles are susceptible to outages on both lines. Adding additional load to Meckesville substation will overload the substation transformers. Therefore the transformers at Meckesville would need to be replaced with larger units to accommodate the load growth. An additional substation to the east of the existing Meckesville substation would still be needed in the future. After the new substation is built the two new lines out of Meckesville would no longer be needed and would represent a stranded asset. This option was rejected because upgrading the existing facilities does not provide the reliability benefits, load relief, and operating flexibility that a new substation would provide.

In terms of new facilities, the company also considered building two substations at different locations. Under this alternate solution, a new substation would be built north of the existing Meckesville 69-2 12 kV line and an additional substation would be built approximately 1.5 miles south of the proposed Effort Mountain 138-12 kV substation.

The first substation, to the east of the existing Meckesville substation, would relieve the heavily loaded Meckesville 69-2 12 kV line. New 12 kV lines from this new substation would also provide a tie with the Meckesville 69-2 12 kV line. This new substation would be supplied by extending the existing Meckesville 69 kV tap which is supplied from the East Palmerton-Wagners #1 69 kV radial line. The East Palmerton-Wagners #1 69 kV line is currently loaded to approximately 75% of its normal rating during the winter peak load period. Building a new distribution substation that is supplied from this line is not preferred because this adds more load to an already heavily loaded transmission line. In addition, voltage at the end of the East Palmerton-Wagners #1 69 kV line is approaching PPL Electric's Reliability P&P standard of 62 kV. Adding more load to this line would further degrade the voltage. Building a new 138 kV tap off the Siegfried-Jackson # 1 138 kV line to the proposed Effort Mountain 138-12 kV Substation is preferred because it utilizes a high capacity transmission line which is capable of accepting future load increase as the substation expands.

Further, the Siegfried-Jackson #1 138 kV line is a network line that will provide a more reliable source than the East Palmerton-Wagner #1 69 kV which is a radial line. See the PPL Electric system map provided in the **B-Map Pocket**.

The second substation, to the south of the Meckesville 69-2 line, would relieve the heavily loaded Meckesville 69-1 12 kV line. This new substation would be supplied by tapping the Siegfried-Jackson #1 138 kV line. Load from the Meckesville 69-1 12 kV line would be transferred to new 12 kV lines at the new substation. This would reduce the number of customers fed from the Meckesville 69-1 12 kV line and create an additional tie for this line.

PPL Electric rejected this "two substation" alternative for the reasons explained above and because over 7.7 miles of transmission facilities would be needed as well as a second new substation and additional distribution facilities. The estimated total cost of this alternative is $12,000,000. The total cost of the preferred solution described in Section 5.0 above is estimated to be $8,755,000. The preferred alternative provides greater reliability, load relief, and operating flexibility, while building fewer facilities at a lower cost.

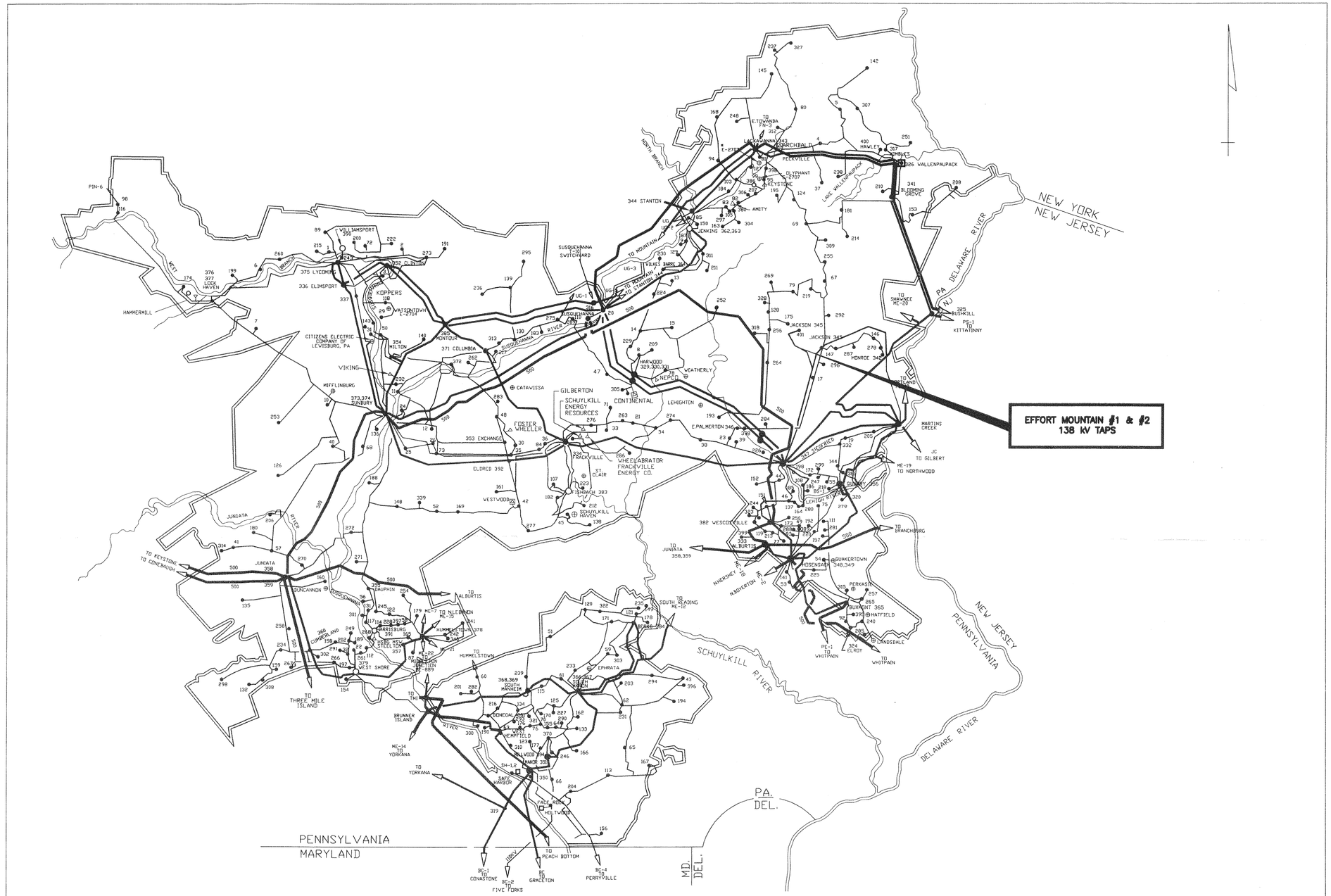
Exhibit B-Figures

PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED WITHOUT WRITTEN AUTHORIZATION FROM PPL ELECTRIC UTILITIES.

SUBSTATION LISTING

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

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



INTERCONNECTIONS

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

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

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

NO.	DATE	ACCT.		BY	REVIEWED	APPROVED
60	8/24/09	161694	ADDED MONROE-JACKSON #2 138KV TRANS. LINE & STROUDSBURG #1 & #2 138KV TAPS.	RRC		JW
59	7/28/09	161667	ADDED ROSEVILLE 138/69KV TAP & NEFFSVILLE #1 & #2 138/69KV TAPS.	RRC		JW
62	10/26/09	169021	ADDED EFFORT MOUNTAIN #1 & #2 138 kV TAPS.	RRC		DH
61	10/1/09	161640	JACKSON SUBSTATION 138 kV CONNECTING LINES	RRC		JW

REFERENCE TITLE | NUMBER | REFERENCE TITLE | NUMBER

#6000

PPL ELECTRIC UTILITIES

ACCT- 805201
SCALE- NONE
BY- CDW
REVIEWED

ELECTRICAL SYSTEM MAP
EFFORT MOUNTAIN #1 & #2 138 kV TAPS

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

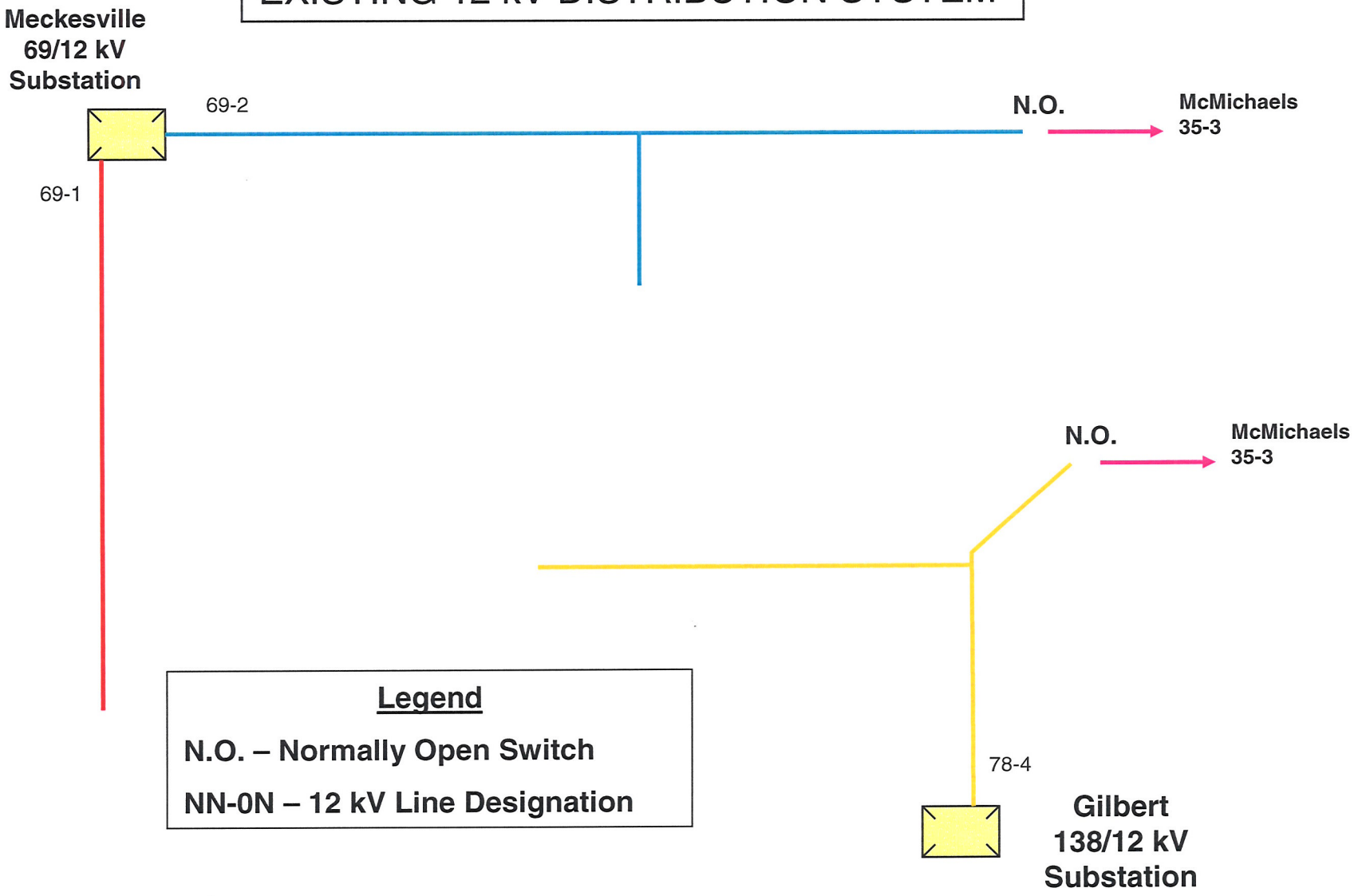
PPL DRAWING NO. D191830
SHEET NO. 1
REV. 62

TRANSMISSION MAP NO.

D191830_5001.DWG

PPL EU FORM 4877 (7/03)
PC CAD

FIGURE B-1: JONAS / SUN VALLEY AREA FUNCTIONAL ONE-LINE DIAGRAM EXISTING 12 kV DISTRIBUTION SYSTEM



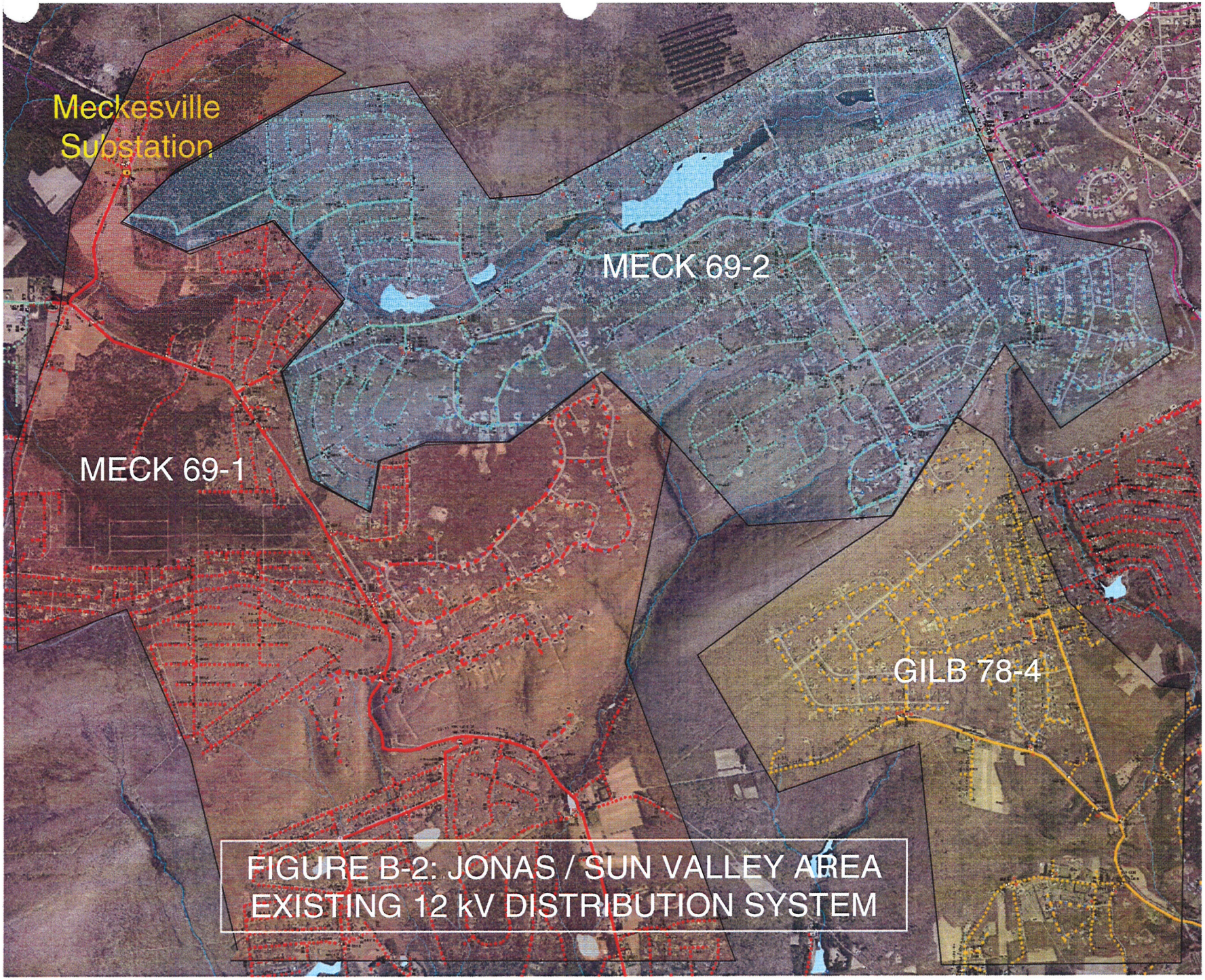
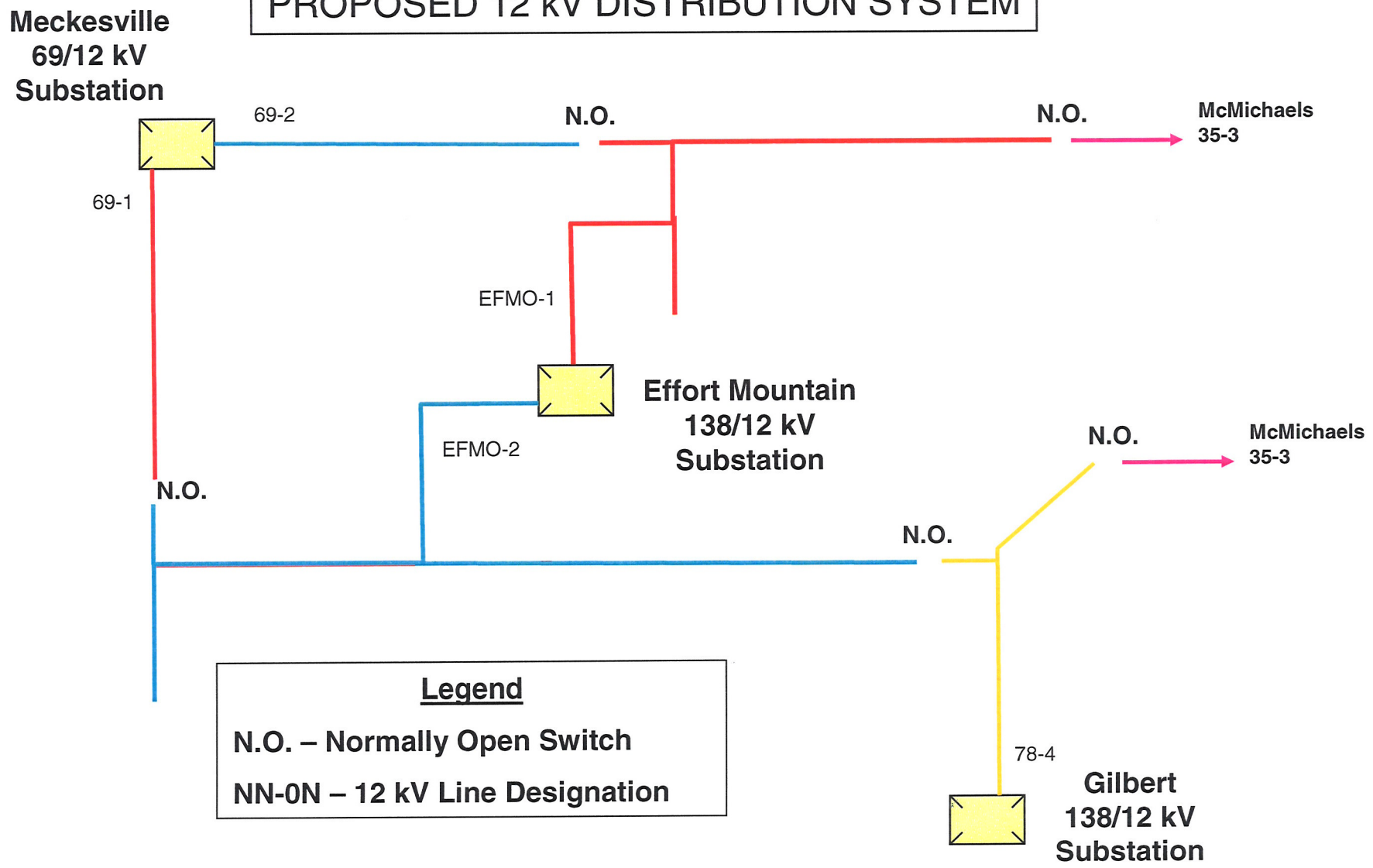


FIGURE B-2: JONAS / SUN VALLEY AREA
EXISTING 12 kV DISTRIBUTION SYSTEM

FIGURE B-3: JONAS / SUN VALLEY AREA FUNCTIONAL ONE-LINE DIAGRAM PROPOSED 12 kV DISTRIBUTION SYSTEM



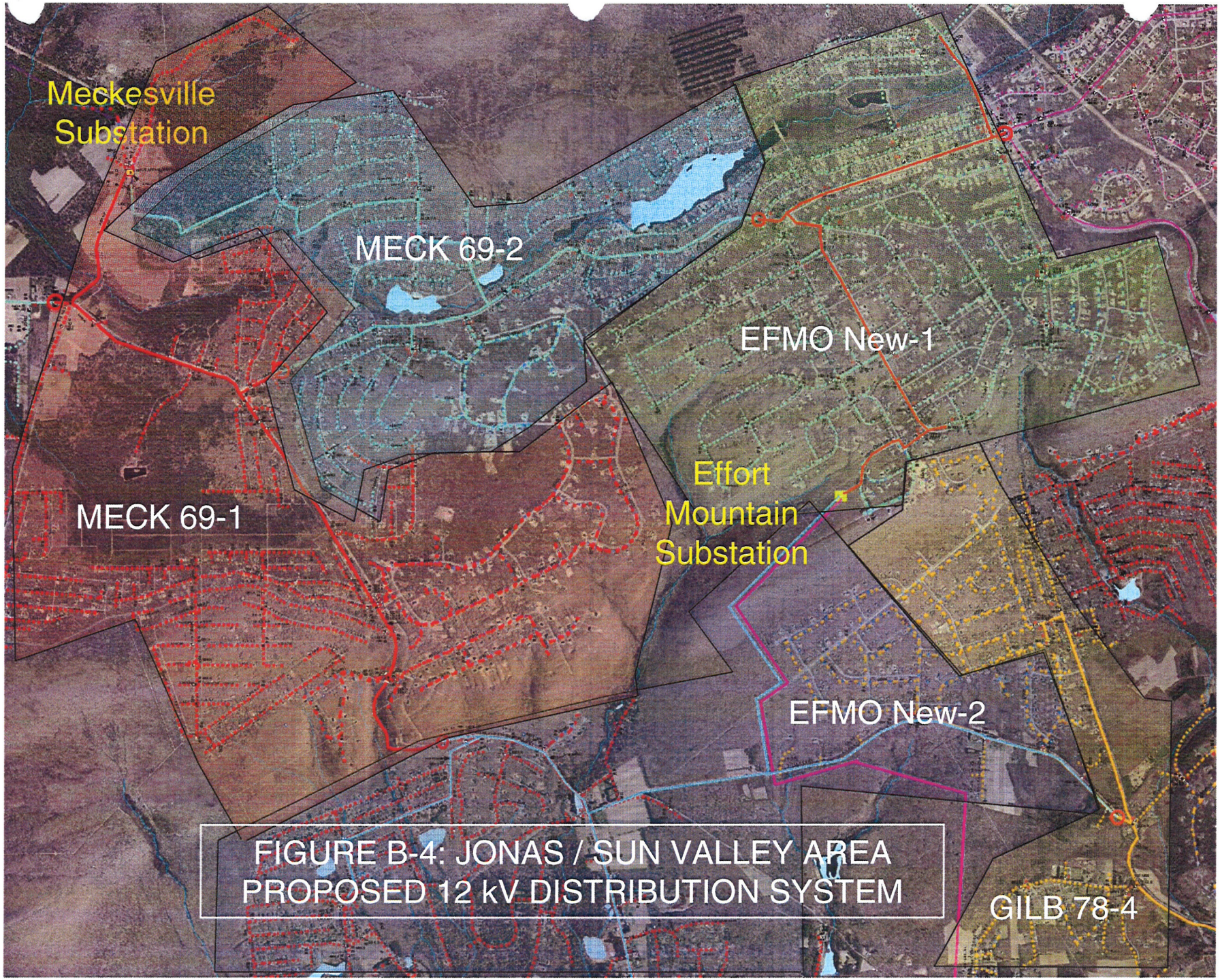


FIGURE B-4: JONAS / SUN VALLEY AREA
PROPOSED 12 kV DISTRIBUTION SYSTEM

Exhibit C

Exhibit C – Environmental Setting: Table of Contents

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1.0 INTRODUCTION

This Exhibit provides background information regarding the general environmental setting of the Project. For the purposes of this discussion, the Project Study Area, as described in this Exhibit, is based on the geographic extent of the Macro Corridor developed during the Alternatives and Siting Analysis (**Exhibit D**). The boundaries of the Macro Corridor were constrained by the Project's Purpose and Need (**Exhibit B** – Necessity Statement) that define the substation location and the tap transmission line.

The information contained in this Exhibit was gathered from numerous sources, including Federal, State, and local Geographic Information Systems (GIS) databases, published reports and maps, and field reconnaissance surveys.

The Project Study Area is located in northeastern Pennsylvania, primarily in Monroe County except where it extends through a small area in Carbon County (**Figure C-1**). Portions of the following municipalities are included:

- Chestnuthill Township, Monroe County
- Polk Township, Monroe County
- Tunkhannock Township, Monroe County
- Penn Forest Township, Carbon County

2.0 NATURAL ENVIRONMENT OF PROJECT STUDY AREA

2.1 Physiographic Region and Topography

Monroe County extends across three physiographic regions (**Figure C-2**), the Glaciated Low Plateau Section and the Glaciated Pocono Plateau Section of the Appalachian Plateau Province in the north and the Blue Mountain Section of the Ridge and Valley Province in the south (Sevon 2000). The eastern margin of Carbon County abutting Monroe County is a continuation of the Glaciated Pocono Plateau Section of the Appalachian Plateau Province in the north and the Blue Mountain Section of the Ridge and Valley Province in the south. Surface topography is shaped by the underlying bedrock geology, as well as glacial and stream erosion and deposition.

The Project Study Area is located primarily in the Blue Mountain Section. Its northern

margin encompasses the southern limit of the Pocono Plateau Section, including the Pocono Plateau Escarpment. The Blue Mountain Section in the Project Study Area is characterized by a valley with low linear ridges and shallow valleys that extend to the base of the Pocono Plateau Escarpment (Sevon 2000). Folded sedimentary rocks produce subparallel ridges of erosion-resistant strata (Berg 1975). Local variation in elevation between the mountain tops and valley floor is about 700 feet

The Pocono Plateau is predominantly a broad, undulating surface with low to moderate local relief (100 to 600 feet) (Sevon 2000). The Pocono Plateau Escarpment is a prominent topographic feature which separates the Pocono Plateau Section from the Blue Mountain Section. In contrast to the Blue Mountain Section, the plateaus' relatively low relief and smooth surface is due to relatively flat underlying rock strata and glacial scouring (PDCNR 2009a). Glacial scouring created small depressions which did not drain and subsequently became sites of wetland development. The elevation of the escarpment (mountain) in the Project Study Area is about 500 feet above its base.

2.2 Geology

The geology of the Project Study Area can be described in terms of underlying consolidated rocks (bedrock geology) and unconsolidated deposits atop bedrock (surficial geology) (Berg (1975), Braun (1997), Carswell and Lloyd (1979), Sevon (1975), and Sevon et al (1975)).

The bedrock geology of the Project Study Area is displayed in **Figure C-3**. The rock units that directly underlie unconsolidated material are Middle to Upper Devonian in age covering a time period ranging from about 365 million year ago to about 390 million years ago. From youngest to oldest they are:

Upper Devonian

- Duncannon Member (Catskill Formation)
- Poplar Gap Member (Catskill Formation)
- Packerton Member (Catskill Formation)
- Long Run Member (Catskill Formation)

- Beaverdam Run Member (Catskill Formation)
- Walcksville Member (Catskill Formation)
- Towamensing Member (Catskill Formation)
- Trimmers Rock Formation

Middle Devonian

- Mahantango Formation (Hamilton Group)

Unconsolidated geologic units overlying Project Study Area bedrock are glacial, alluvial, and colluvial, as defined below. The Project Study Area is known to have undergone glaciation over the last 150,000 years. It is believed glaciers advanced into this area generally from the northeast with the Pocono Plateau Escarpment and Blue Mountain influencing the main direction of flow. Portions of the Project Study Area are covered with material carried by and deposited directly from the ice sheets.

Sediments transported and deposited by present-day and ancestral streams are called alluvium. Alluvial deposits primarily occur within stream banks and in floodplains. Most are post-glacial floodplains.

Portions of the Pohopoco Creek drainage, including Sugar Hollow Creek, show characteristics of being deposited by the flow of melting glacial ice and stream alluvium.

Colluvium is a mass of material that typically accumulates at the base of slopes from upslope erosion. Large deposits of glacial-period colluvium are formed primarily by freeze-thaw action and permafrost in small valleys, lower slopes, and base of slopes adjacent to glaciers. Colluvium with boulders as large as 10 feet in diameter is found at the base of steep slopes in the Poplar Gap and Pohopoco Gap areas. Alluvium may be mixed with colluvium.

2.3 Soils

The general characters of soils that have developed in the Project Study Area correspond closely to physiography and geology (Lipscomb 1981). Soils in the Appalachian Plateau portion are deep soils derived from glacial till and colluvium, and are well to moderately well drained. While soils in the Ridge and Valley soils are also well to moderately well drained, they may be shallow or deep and derived from shale bedrock in addition to till and colluvium. Deep, excessively to well drained soils form in glacial outwash and alluvium on terraces and floodplains. Characteristics of individual soil series found along the alternative transmission line routes are discussed in **Exhibit D** - Alternatives and Siting Analysis, and illustrated in **Figure D-11.**

2.4 Surface Water

The Project Study Area is located within the Pohopoco Creek drainage of the Lehigh River watershed of the Delaware River Basin.[1] Major streams and lakes found on USGS topographic maps are illustrated in **Figure C-4** and discussed further below.

2.4.1 Streams

Named streams[2] in the Project Study Area are:

- Pohopoco Creek – CWF/HQ
- Poplar Creek – CWF
- Sugar Hollow Creek – CWF
- Middle Creek – CWF
- Jonas Creek – HQ

The Pennsylvania Code (Title 25, Chapter 93) establishes narrative and numeric water quality criteria necessary to support a variety of protected water uses. All surface waters must be protected for aquatic life (warm water fishes), water supply (potable, industrial, livestock, wildlife, and irrigation), and recreation (boating, fishing, water contact sports, and aesthetics). In addition to general/narrative standards that are applicable to all

[1] Drainage List D of Pennsylvania Code. Title 25. Chapter 93. Water Quality Standards ("Chapter 93")
[2] Names on USGS 7.5-minute topographic quadrangles.

surface waters, stream reach-specific water quality criteria protect certain stream segments for critical uses (i.e., the most sensitive designated or existing use to be protected).

Stream segments within the Project Study Area have Chapter 93 designated use classifications of CWF (a cold water fishery suitable for the maintenance or propagation of fish indigenous to a cold water habitat) or are designated for special protection as High Quality (HQ) waters (**Figure C-5**). CWF and HQ streams also have a migratory fishes (MF) designated use for the passage, maintenance and propagation of migratory fish. No stream segment in the Project Study Area is afforded special protection by having an Exceptional Value (EV) designated use, however, Jonas Creek and its tributaries, Poplar Creek and its tributaries, and the Pohopoco Creek main stem and tributaries from source to the State Route (SR) 3016 bridge have an EV existing use classification. According to Chapter 93 definitions, Designated Use describes the Statewide water use specified for each stream whether or not they are being attained, whereas Existing Use describes the Statewide water use that the stream has actually attained. Additionally, portions of Pohopoco Creek, Jonas Creek, and Middle Creek in the Project Study Area are Class A wild trout streams which support naturally reproducing populations of trout that do not need stocking.

2.4.2 100-year Floodplains

One-hundred year floodplains are areas adjacent to streams which would be inundated by a flood elevation that has a 1-percent chance of being equaled or exceeded each year. The Federal Emergency Management Agency (FEMA) delineates the extent of some 100-year floodplains on Flood Insurance Rate Maps. The 100-year floodplain boundaries shown on **Figure C-5** were acquired from the Monroe County Planning Commission (MCPC) digital database. The MCPC 100-year floodplain boundaries, obtained from the PADEP digital database, represent FEMA floodplains and differ slightly from those indicated on FEMA maps.

2.4.3 Lakes

Numerous bodies of open water can be found throughout the Project Study Area. The larger lakes and ponds occur along stream floodplains. Major lakes include Seneca Lake,

Lake Trexler, Lake Minsi, and Sun Valley Lake (**Figure C-4**).

2.4.4 Wetlands

United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) wetland maps indicate that wetlands in the Project Study Area are palustrine i.e., nontidal, freshwater wetlands dominated by trees, shrubs, persistent emergent vegetation, and emergent mosses or lichens (**Figure C-4**). NWI wetlands are classified in accordance with the Cowardin system (Cowardin et al. 1979) which also includes open waters (e.g., streams, ponds, lakes) as wetlands.

The wetlands depicted in the NWI database were not identified or delineated in accordance with methodologies used by regulatory agencies to establish boundaries of wetlands under their jurisdiction. The NWI maps were created based on the analysis of aerial photographs from the 1980s with limited ground verification, and should not be considerer an alternative to conducting a delineation based on regulatory requirements. A wetland delineation conducted by wetland scientists for the selected transmission route corridor is reported in **Appendix 6**.

2.5 Vegetation Communities

Vegetation within the Project Study Area includes human-influenced plant communities such as agricultural fields, successional meadows, and landscaped areas with much of the undeveloped portion dominated by upland or floodplain forests.

The Project Study Area lies within the Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Forest ecosystem province (Bailey 1998). This province is temperate, with distinct summer and winter seasons and some of the highest precipitation levels in the eastern United States. Within this ecosystem province, vegetation communities have been further refined into regional classifications such as those established by the Pennsylvania Department of Conservation and Natural Resources (Fike 1999) and Monroe County (NAI; TNC 1991; TNC 1999).

The portion of Monroe County in which the Project Study Area lies is classified as Mixed Oak Forest (TNC 1991). The upland forests within this region are characterized by species such as red oak (*Quercus rubra*), white oak (*Q. alba*), black oak (*Q. velutina*),

sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), tuliptree (*Liriodendron tulipifera*), and hickories (*Carya* spp). Shrub species typical of these forests include blueberry (*Vaccinium corymbosum*), spicebush (*Lindera benzoin*), witch hazel (*Hamamelis virginiana*), and northern arrowwood (*Viburnum recognitum*). Pohopoco Mountain forests vary somewhat from this general community description and are more typical of Northern Hardwoods, including the additional species of yellow birch (*Betula alleghaniensis*), hemlock (*Tsuga canadensis*), and black cherry (*Prunus serotina*).

2.6 Special Use Areas

2.6.1 Scenic Areas

No areas designated as "scenic" by the PDCNR (vistas and overlooks, waterfalls, scenic hikes, or other special areas) are located within the Project Study Area (PDCNR 2009b). Similarly, there are no Heritage Geology Sites designated by the Pennsylvania Natural Heritage Program in the Project Study Area (PDCNR 2009d).

2.6.2 Wilderness Areas

No part of the Project Study Area is located within the National Wilderness Preservation System (NWPS 2009). Most of the 288 acre Jonas Mountain Nature Preserve, an environmental area acquired through use of Monroe County Open Space funds, is located within the Project Study Area. Jonas Mountain Nature Preserve is currently managed by Pocono Heritage Land Trust, and does not have a marked trail network or defined recreational facilities.

2.6.3 Wild and Scenic Rivers

No Wild & Scenic Rivers designated pursuant to the federal Wild & Scenic Rivers Act or designated by the Pennsylvania Scenic Rivers Act are located within the Project Study Area (PDCNR 2009c).

2.6.4 State Game Lands

There are no State Game Lands in the Project Study Area. State Game Lands #38 is located outside the northeast corner.

2.6.5 Nature Conservancy Priority Sites

No sites identified as "Priority Natural Areas" by The Nature Conservancy for Monroe County are located within the Project Study Area (TNC 1991, 1999).

2.7 Wildlife

Typical wildlife species found within the Project Study Area include those found in wetlands, forested habitats, scrub-shrub habitats, and open/agricultural lands. Wetlands in the area harbor species such as green frog (*Rana clamitans*), bullfrog (*R. catesbeiana*), northern water snake (*Nerodia sipedon*), red-wing blackbird (*Agelaius phoenicus*), common yellowthroat (*Geothlypis trichas*), and raccoon (*Procyon lotor*). Forests and scrub-shrub habitats are home to species such as white-tailed deer (*Odocoileus virginianus*), gray squirrel (*Sciurus carolinensis*), wild turkey (*Melagris gallopavo*), box turtle (*Terrapene carolina*), striped skunk (*Mephitus mephitus*), opossum (*Didelphis marsupialis*), and a variety of small mammals and songbirds. Open and agricultural lands are likely to support woodchuck (*Marmota monax*), eastern cottontail (*Sylvilanus floridanus*), Canada goose (*Branta canadensis*), turkey vulture (*Cathartes aura*), and red-tailed hawk (*Buteo jamaicensis*) (TNC 1991, Fergus and Hansen 2000).

2.7.1 Rare, Threatened, and Endangered Species

Based on a search of the Pennsylvania Natural Diversity Inventory (PNDI) database and follow-up consultations with the U.S. Fish and Wildlife Service (USFWS), Pennsylvania Fish and Boat Commission (PFBC), Pennsylvania Game Commission (PGC), and Pennsylvania (DCNR) the following federal and/or state rare, threatened, or endangered (RTE) species could potentially occur within the Project Study Area include one reptile, two plants, and three moths. These are:

- Bog turtle (*Glyptemys muhlenbergii*) – State endangered, Federal threatened reptile

- Variable sedge (*Carex polymorpha*) – State endangered plant
- Pale duckweed (*Lemna valdiviana*) – State extirpated plant
- Toothed apharetra (*Apharetra dentata*) – Rare moth
- Pine barrens Zanclognatha (*Zanclognatha martha*) – Rare moth
- Barrens itame (*Itame* sp 1 near inextricata) – Rare moth

Habitat assessments for these RTE species, including a Phase I Bog Turtle Habitat Survey, were conducted for the selected transmission route corridor. The results of this assessment are located in **Appendix 8**. The habitat assessments concluded that no appropriate habitat for any of the target species was found. As part of the environmental permitting and approval process for the selected route, additional RTE surveys may be required.

3.0 HUMAN ENVIRONMENT OF PROJECT STUDY AREA

Human impacts on the natural environment of the Project Study Area are represented by a number of development types and patterns. These are discussed below using the Monroe County land use codes described in Section 3.1 and other land use/cover categories noted in Sections 3.2 through 3.5.

3.1 Monroe County Land Use Codes

Monroe County Land Use codes in the Project Study Area are displayed in (**Figure C-6**) and discussed below.

3.1.1 Agriculture

Significant sections of the Project Study Area are utilized for agricultural purposes. All of these lands are privately owned. The primary agricultural use involves row crops such as hay, corn, and soybeans. Christmas trees are also a key row crop. Fruit orchards are centrally located at Heckman's Orchard on the west side of Route 115 north of the Village of Effort. Other agricultural uses include horse pastures and dairy farms, but these are limited in extent compared to the row crops.

Monroe County has several mechanisms for protecting farmland.

- Agricultural Security Area (ASA)
- Agricultural Conservation Easement (ACE)
- Act 319 ("Clean and Green Act")

ASA, ACE, and Act 319 lands are shown on **Figure D-4** of **Exhibit D**.

The Farmland Preservation Board administers the creation of an ASA and the purchase of an ACE. An ASA is an area of 500 or more semi-contiguous acres that is used for agricultural production. Farmers voluntarily form and/or join an ASA as a means of receiving special consideration with regards to regulations, nuisance complaints, and conflicting land uses.

The ACE purchase program allows counties to use the Pennsylvania farmland preservation fund to purchase development rights. Qualifying farms must be part of an existing ASA and are rated on the basis of soil quality, proximity to other farms, and other criteria. Once a farm is in easement, agricultural production must continue every year thereafter, with no new structures permitted except farm accessory buildings.

Act 319 provides a means by which landowners whose property meets one of three qualifying uses (farming, forest, water supply/open space) is assessed for property tax purposes on the basis of its use rather than on the basis of its fair market value.

3.1.2 Transportation/Utilities

Monroe County includes only railroads and airports under the transportation land use, not roadways. There are no railroads or airports present within the Project Study Area. Utility pipelines are discussed in Section 3.2.2 (Pipelines). While no airports are situated within the Project Study Area, Pleasant Valley Airport, located approximately 2 miles southeast of the Village of Effort, has been permanently closed for many years (Chestnuthill Township, personal communication, 2009).

3.1.3 Private/Public Parks & Recreation Facilities

There are no federal, state, county, or municipal parks situated within the Project Study Area. In Merwinsburg, at the center of the Project Study Area, approximately 50 acres of land is preserved as open space by Chestnuthill Township. Additional open space lands

are preserved by the Indian Mountain Lake Civic Association and Jonas Mountain Nature Preserve.

3.1.4 Educational Services

No public or private schools are located within the Project Study Area. Several independent day care facilities are situated within commercial areas along Route 115 north of Effort.

3.1.5 Forest

Forested land cover consists of large uninterrupted areas of wooded land identified as a land use/cover type, or smaller fragments incorporated into other land use types, such as residential, agricultural, parks and recreation, or group camps. Fragmented forest cover borders many of the residential developments and farms and often indicates the presence of steep slopes or rocky soils that could not be developed or converted to agricultural use. Large swaths of forest cover are associated with areas preserved for public recreation (Jonas Mountain Nature Preserve), private recreation (Indian Mountain Lake Civic Association), or social groups (Trexler Boy Scout Reservation, New Jersey Camp Jaycees).

3.1.6 Government Services

Government services in the Project Study Area are limited to the Sun Valley Volunteer Fire Department, which is located within the Sun Valley residential development north of Merwinsburg, and a substation of the West End Fire Company, located along Route 115 north of the Jonas Road intersection.

3.1.7 Industrial

There are very few industrial land uses within the Project Study Area. These areas are limited to several parcels located along Route 115 north of Effort. According to the Monroe County Land Use codes, one parcel is associated with Heckman Orchards and the others are located within the commercial strip that parallels Route 115.

3.1.8 Residential

Residential land use is the most prominent land use cover type in the Project Study Area.

Most is composed of single-family residences. Other formats of residential land use include several isolated apartment units near Effort. Most of the residential development has occurred since World War II, much of that within the past 20 years. Major recent residential developments include Birch Hollow Estates, Sierra View, and sections of Indian Mountain Lake.

3.1.9 Retail Trade

Commercial land use occurs primarily as retail development along the major roads, such as Route 209 and Route 115. A few of the retail sites were developed as strip malls, but most are relatively spread out with sections of undeveloped land in between. The more concentrated commercial land use is noted near the villages of Jonas, Gilbert, and Effort. Retail facilities in these villages include restaurants, automotive service stations, and a wide variety of specialty shops.

3.1.10 Resorts & Group Camps

There are no resorts located within the Project Study Area. Group camps include the Trexler Boy Scout Reservation and the New Jersey Camp Jaycees. These camps encompass large areas and are composed primarily of forested land. The 760 acre Trexler Boy Scout Reservation is located east of Jonas, and the 188 acre New Jersey Camp Jaycees is located north of Merwinsburg.

3.1.11 Services & F.I.R.E. (Finance, Insurance, Real Estate)

Service related land uses identified within the Project Study Area include banks, real estate offices, churches, and cemeteries. Most of the banks and real estate offices are concentrated in population centers. Churches and cemeteries are also found in the population centers, as well as in more rural areas.

3.1.12 Vacant

Vacant lands were randomly scattered across the Project Study Area in a wide variety of land cover types and extending over a variety of parcel sizes. For example, numerous small parcels (1 to 2 acres) within the residential developments were noted as vacant if they were undeveloped. Similar sized parcels within the commercialized areas along Route 115 were also noted as vacant if they were unoccupied. Larger parcels of forested

or pasture land, which ranged from 20 to 100 acres, were also identified as vacant.

3.2 Other Linear Features

3.2.1 Roadways

As noted in Section 3.1.2 (Communication/Transportation/Utilities), the Monroe County transportation code does not include roads. The primary roadway system within the Project Study Area is comprised of a two-lane state route (PA State Route 115) with numerous rural roads, residential streets, and several unpaved roads.

PA Route 115 is a major north-south arterial state road that connects Scranton (Lackawanna County) with Brodheadsville. The existing northeast to southwest trending Siegfried-Jackson 138 kV transmission line crosses Route 115 approximately 0.5-mile north of the Village of Effort. Through most of the Project Study Area, Route 115 consists of two undivided traffic lanes with an occasional center turning lane. Commercial development occurs along several sections of Route 115, primarily north of the Village of Effort with large sections of the road bordered primarily by residential or forested land uses.

3.2.2 Pipelines

Two pipelines traverse the Project Study Area. The first pipeline, operated by Williams Gas Pipeline Transco, is a single 24-inch natural gas pipeline which trends northwest to southeast along the eastern edge of the Project Study Area. This line crosses the Siegfried-Jackson 138 kV transmission line near Sugar Hollow Creek. The second pipeline, which is operated by the City of Bethlehem Bureau of Water, trends northeast to southwest along the base of the Pocono Escarpment and crosses the Williams Transco line east of Poplar Creek. The Monroe County Open Space Plan (2001) identifies the water pipeline as a Potential Greenway, called Penn Forest Pipeline, currently used by some residents.

3.3 Historic, Cultural, and Archeological Resources

Extensive Phase I background research was undertaken and completed for the Project Study Area, including archival searches; literature reviews; and a Pennsylvania Archaeological Site Survey (P.A.S.S.) file examination. A search was also made for

information available on previously known and/or recorded archaeological sites located within or adjacent to the Project Study Area. Examined sources included unpublished and published research and regional survey reports, and previous cultural resource management reports completed on other projects situated in or bordering the general Project Study Area. Data from topographic maps, soil reports, geology reports, and archeological site forms maintained at the William Penn Museum in Harrisburg were reviewed.

The results of an extensive shovel testing program were negative for the identification of any potentially significant prehistoric cultural resources. The absence of any prehistoric cultural resources was not unexpected given the extremely poor soil drainage conditions present within the study area and the absence of any moderate to large drainage line. While numerous springs and seeps occur within the study area these are generally on slopes or in areas of extremely poor soil drainage conditions.

Based upon the study to date the project area corridor offers little potential to contain potentially significant prehistoric cultural resources. Any sites which might occur within the study area are likely very small, geographically restricted hunting or foraging camps that can easily be avoided during construction of the proposed power line corridor. More information on the cultural findings are located in **Appendix 7**.

3.4 Hazardous Materials

Four potential sources of contamination were identified by accessing Federal and state databases for listed facilities located within a two-mile search radius of Merwinsburg, the approximate center of the Project Study Area. These databases consisted of:

- National Priority List for Pennsylvania (NPL)
- Federal Comprehensive Environmental Response, Compensation and Liability (CERCLIS)
- Federal Resource Conservation and Recovery Information System (RCRIS)
- State Hazardous Waste (SHWS)

- Leaking Underground Storage Tanks (LUST)
- Solid Waste Facilities/Transfer Stations Sites (SWF/LF)
- Registered Underground Storage Tanks (UST)
- RCRA Treatment, Storage, and Disposal (TSD)
- RCRA Registered Large Quantity Generators of Hazardous Waste (LQG)
- RCRA Regulated Small Quantity Generators of Hazardous Waste (SQG)

The UST database listed the following facilities:

- Dale A. Kresge Mount Effort Service Station
- Uni-Mart Service Station
- West End Fire Company
- Gower Well Driller

Each of these facilities is located on Route 115 in Effort. The Kresge facility, at the intersection of Route 115 and Jonas Road, has five tanks currently in use. One tank has been removed. The Uni-Mart facility, at 2420 Route 115, has two tanks currently in use. The West End Fire Company has an inactive tank exempt from state law and Gower Well Driller has an inactive tank that was closed without a permit. No violations are listed for any of these facilities.

3.5 Proposed Developments

The United States Census Bureau reports a nearly 20 percent increase in Monroe County's population from 2000 to 2008, and about a 70 percent increase from 1990 to 2008. The same trend in population growth has been experienced by Polk Township. Chestnuthill Township has also seen a 20 percent growth 2000 to 2008, while nearly doubling in population 1990 to 2008. The Official Zoning Maps of Chestnuthill and Polk Townships (August 2004) do not identify future residential or commercial development.

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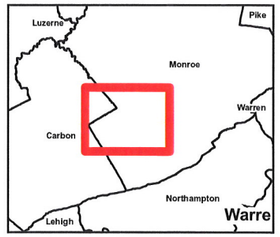
Exhibit C-Figures

Legend

- Project Study Area
- Proposed Substation Area
- County Boundary
- Existing Tap Transmission Line
- Other Transmission Lines



Key Map
Not to Scale

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

U.S Geological Survey Enhanced 100K Scale Topographic Maps - Scranton & Allentown
Note: County Boundary Is Incorrect. See Correct Line Per Legend.

N

0 2,500 5,000 10,000 Feet

1 inch = 5,000 feet

PPL Electric Utilities

URS

Exhibit C - Figure 1
Project Study Area
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB/RRM III	Checked By: BAB
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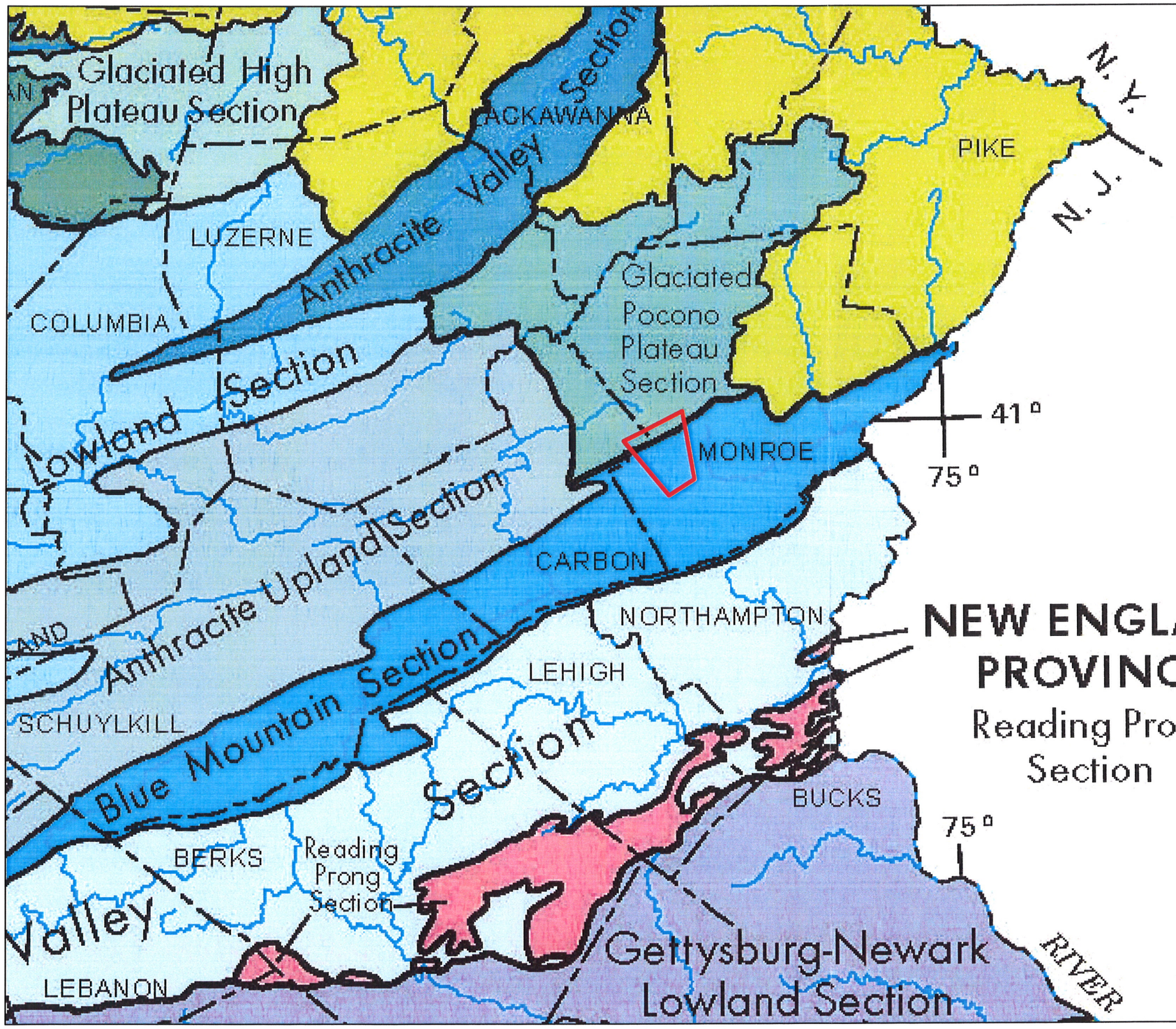

Legend

- Project Study Area
- Anthracite Upland Section
- Anthracite Valley Section
- Blue Mountain Section
- Deep Valley Section
- Gettysburg-Newark Lowland Section
- Glaciated High Plateau Section
- Glaciated Low Plateau Section
- Glaciated Pocono Plateau Section
- Great Valley Section
- Reading Prong Section
- Susquehanna Lowland Section



Key Map
Not to Scale

N

U.S Geological Survey image of the Physiographic Provinces of Pennsylvania (From Sevan 2000)

PPL Electric Utilities

URS

Exhibit C - Figure 2
Physiographic Provinces of Pennsylvania
Effort Mountain #1 & #2
138 kV Taps
PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB	Checked By: BAB
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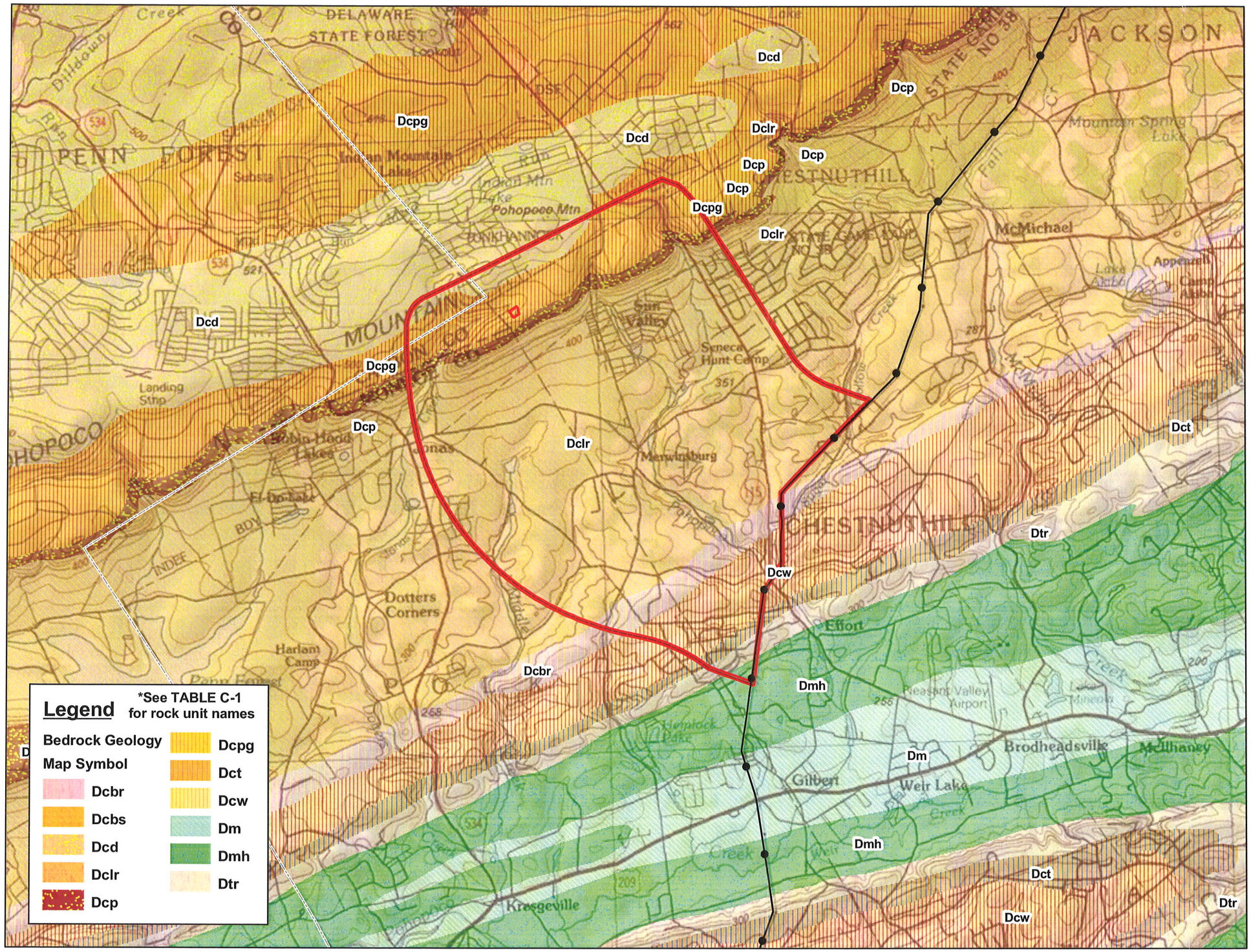
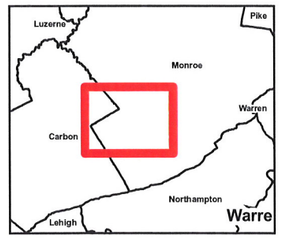


Legend

- Project Study Area
- Proposed Substation Area
- County Boundary
- Existing Tap Transmission Line



Key Map
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Linear Unit: US Foot

U.S Geological Survey Enhanced 100K Scale
Topographic Maps - Scranton & Allentown
Note: County Boundary Is Incorrect. See Correct Line Per Legend.

0 2,600 5,200 10,400 Feet

1 inch = 5,200 feet

Legend

*See TABLE C-1 for rock unit names

Bedrock Geology Map Symbol	
Dcbr	Dcpg
Dcbs	Dct
Dcd	Dcw
Dclr	Dm
Dcp	Dmh
	Dtr

PPL Electric Utilities

URS

Exhibit C - Figure 3
Bedrock Geology
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

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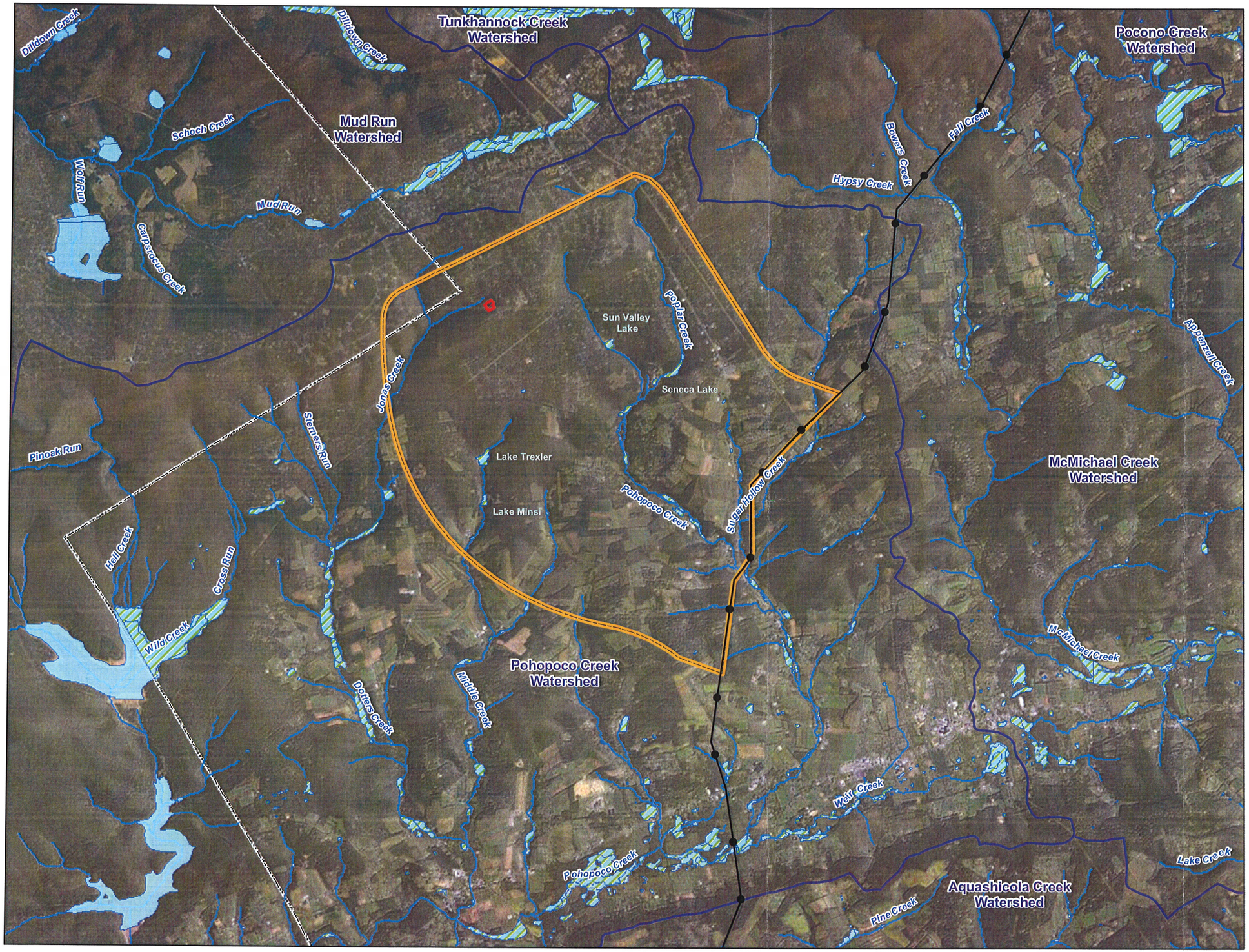
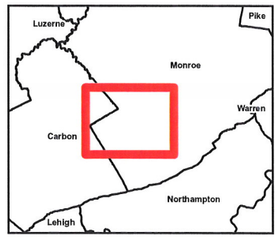


Legend

- Project Study Area
- Proposed Substation Area
- Existing Tap Transmission Line
- Watershed Boundary
- NWI Wetlands
- Lakes and Ponds
- County Boundary
- Rivers and Streams



Key Map
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FIPS 3701
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Linear Unit: US Foot

1 Meter Resolution Color InfraRed
NAIP Aerial Imagery, 11/05/2004

0 2,625 5,250 10,500 Feet

1 inch = 5,250 feet

PPL Electric Utilities

URS

Exhibit C - Figure 4
Watersheds and Surface Waters
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

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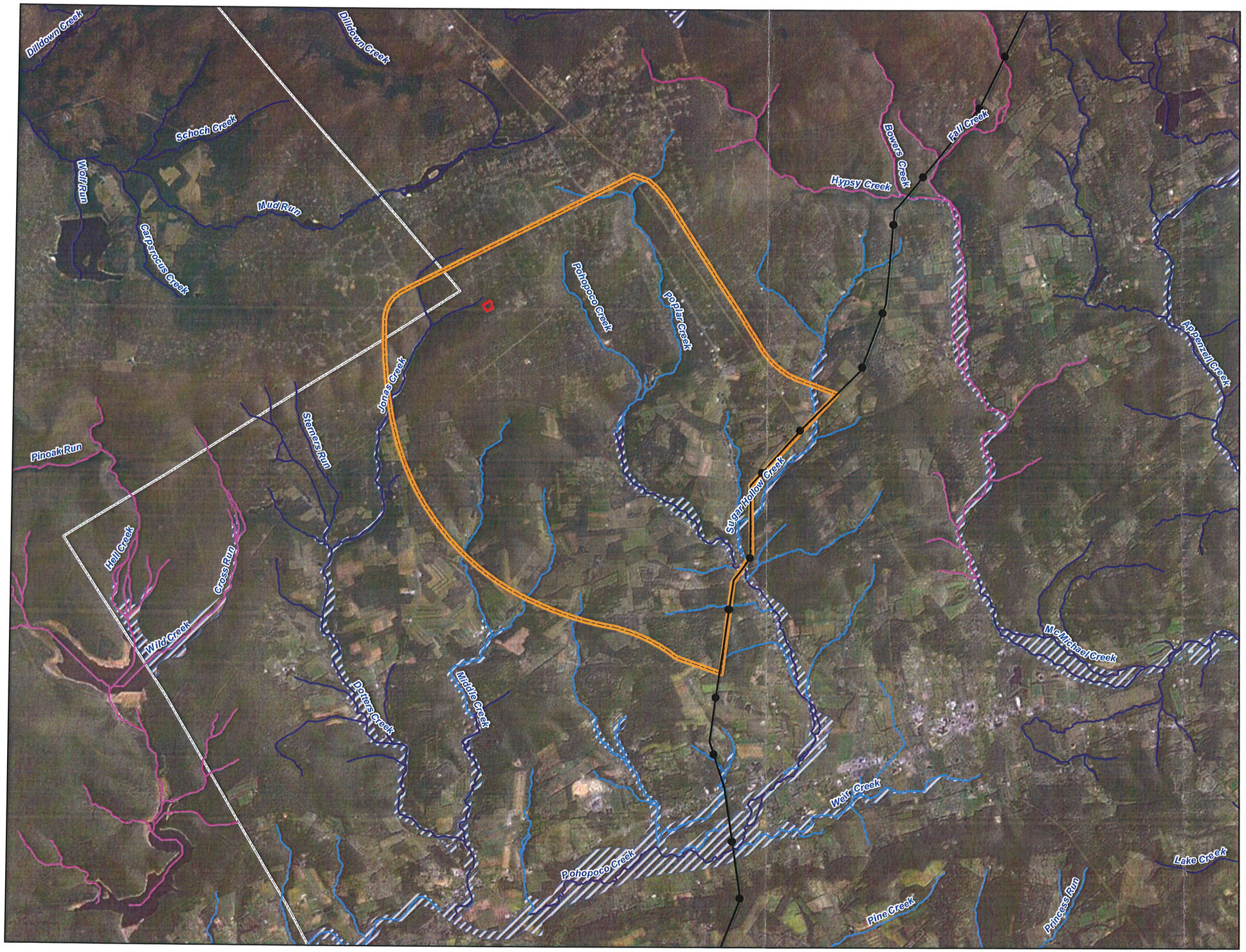
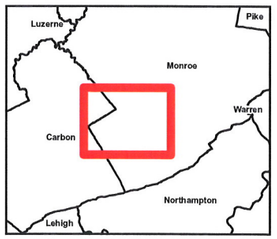


Legend

- Project Study Area
- Proposed Substation Area
- Existing Tap Transmission Line
- FEMA 100-Year Floodplain
- County Boundary

Stream Designated Uses

- CWF (Cold Water Fisheries)
- HQ-CWF (High Quality)
- EV (Exceptional Value)



Key Map
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Linear Unit: US Foot

1 Meter Resolution Color InfraRed
NAIP Aerial Imagery, 11/05/2004

0 2,600 5,200 10,400 Feet

1 inch = 5,250 feet

PPL Electric Utilities

URS

Exhibit C - Figure 5
Stream Designated Uses and Floodplains
Effort Mountain #1 & #2
138 kV Taps
PPL Electric
Effort and Sun Valley Areas, Pennsylvania

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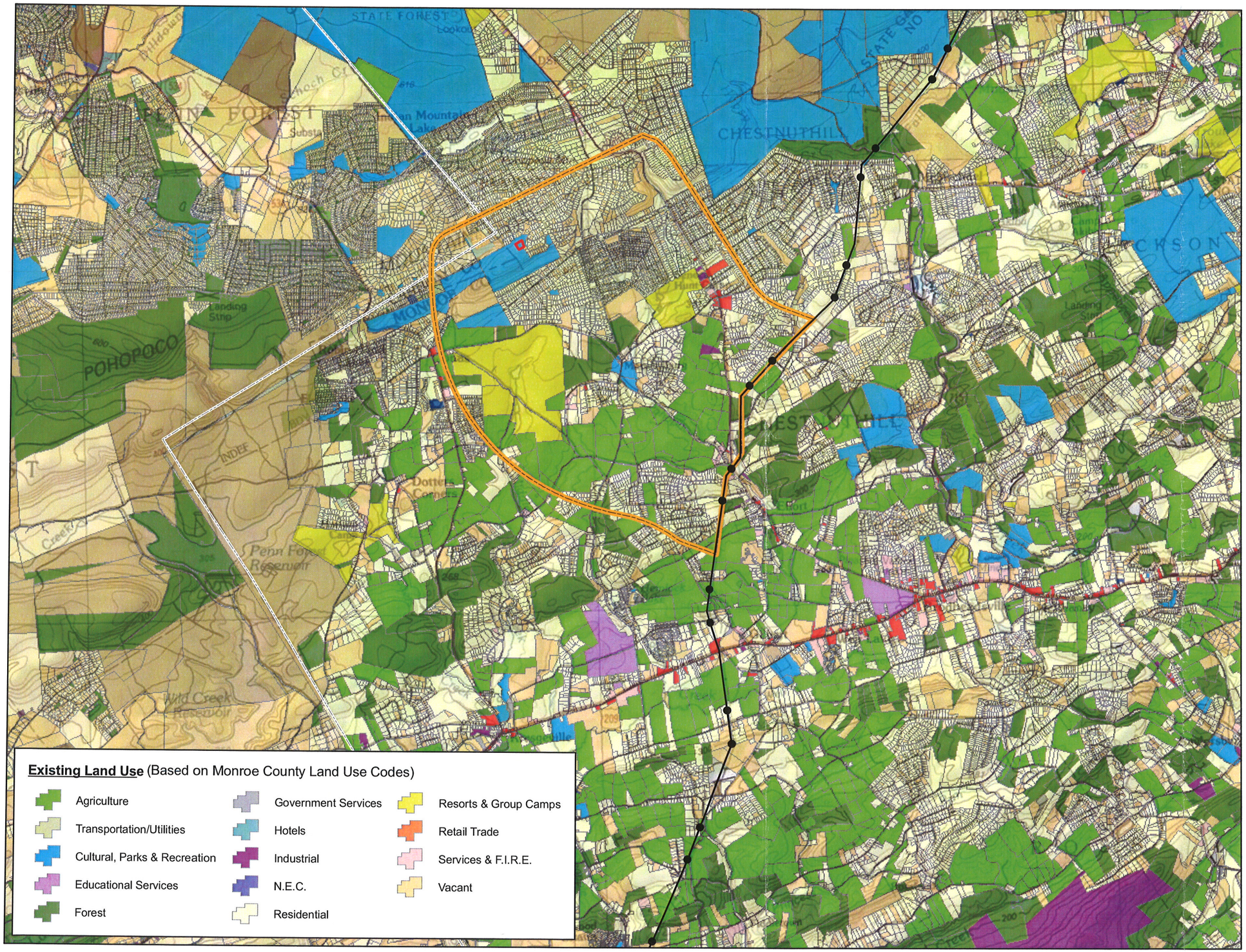
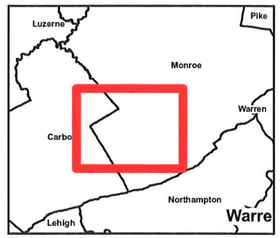


Existing Land Use (Based on Monroe County Land Use Codes)

- Agriculture
- Transportation/Utilities
- Cultural, Parks & Recreation
- Educational Services
- Forest
- Government Services
- Hotels
- Industrial
- N.E.C.
- Residential
- Resorts & Group Camps
- Retail Trade
- Services & F.I.R.E.
- Vacant

Legend

- Project Study Area
- Proposed Substation Area
- County Boundary
- Existing Tap Transmission Line



Key Map
Not to Scale

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

N

U.S Geological Survey Enhanced 100K Scale
Topographic Maps - Scranton & Allentown
Note: County Boundary Is Incorrect. See Correct Line Per Legend.

0 2,500 5,000 10,000 Feet

1 inch = 6,250 feet

ppl PPL Electric Utilities

URS

Exhibit C - Figure 6
Existing Land Use
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

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Exhibit
D

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1.0 INTRODUCTION

This Exhibit describes the methodology utilized to define the alternative routes and to select the proposed transmission line route for this project. The siting study first identified major constraints and then used a quantitative and qualitative evaluation process to compare alternative transmission routes for the project. The methodology used for the siting study, as described herein, provided a framework from which to select the routes most suited for an overhead electric transmission line while satisfying the regulatory filing requirements for such a project. The ultimate goal of the study was to select a route that avoids or minimizes adverse impacts to the natural, cultural, and social environments to the maximum extent practical, while still maintaining the economic viability and technical feasibility of the project.

1.1 Background Research

Prior to initiation of the detailed siting study used to identify alternative routes, extensive background research was conducted regarding the overall environmental setting of the Study Area (**Figure C-1**). This information is provided within **Exhibit C** (Environmental Setting).

1.2 Quantitative and Qualitative Siting Methodology

Following the background research, a quantitative siting study method was used to initially score and rank alternative routes according to certain selected criteria. Subsequently, a qualitative evaluation that incorporated both public input and professional judgment was conducted in order to reach a final decision regarding the selected route. It is important to note that not all criteria can be counted and scored, making the qualitative evaluation an essential step in the selection process. The results of the qualitative evaluation are discussed later in this report.

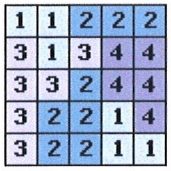
The quantitative criteria for evaluating options are complex and often at odds with one another. For example, a route option that minimizes impacts to residential areas will often result in greater adverse ecological impacts. Therefore, it is important to provide a reasonable, inclusive method for selecting and then comparing route options with respect

to these criteria. The criteria ranking, scoring, and selection methods are discussed further in Section 3.0 of this study.

The data used in this analysis fall into three broad categories – ecological, land use/cultural, and technical/engineering. These are in general accordance with National Environmental Policy Act (NEPA) criteria and have been used in many prior siting studies. Data were drawn from a wide variety of sources, including state and local Geographic Information System (GIS) databases, field reconnaissance surveys, information supplied by public agencies, published documents, and publicly available electronic information.

1.2.1 GIS Evaluation

Many valid methods and tools are available for displaying and analyzing geographic data. These include displaying data as points, polygons, and lines (often termed vector data), or displaying the data as a series of grid cells, e.g., aerial photography, or a map displaying landcover types. This is often called "raster data" and can used to generate a suitability surface across which preferred routes can be identified. The suitability surface is comprised of cells that contain a value representing, for example, an opportunity (suitable) area such as open land, or a constraint area (less suitable) such as a residential neighborhood. In the image below, for example, the cells with a one could be open land, and a residential neighborhood could be cells with a four.



A least cost corridor or path can be determined across this suitability surface through the mathematical addition of the value numbers from given start to end points. Cost in this context does not equate to a monetary value, but rather represents the least impact to critical features.

Regardless of the method used, it is important to understand that the fundamental goal remains the same – to find a viable route from one point to another that identifies

preferred areas (opportunities) to site the line while minimizing, to the maximum practicable extent, the negative effects on natural resources, cultural resources, residences, and other sensitive features (identified as "constraints").

The siting methodology used for determining the preferred route for the transmission line for the new Effort Mountain #1 & #2 138 kV Taps is a combination of a raster suitability surface method followed by a vector analysis when the data precision increases. The raster method is adapted from a protocol developed by the Electric Power Research Institute (EPRI) and Georgia Transmission Corporation (GTC).[1] The EPRI method incorporates GIS technology, statistical evaluation, and stakeholder collaboration into the decision-making process. The methodology formalizes many of the methods and principles used in the industry and by consultants over the last few years. It was developed over the course of a number of years with collaboration and feedback from utility companies, federal, state, and local government agencies, and other key stakeholders, such as private landowners. The process was tested and calibrated against existing transmission line siting projects that had been successfully completed.

The siting phases used for this specific project are discussed in Section 3.0. A more detailed review of the methodology is included in Section 2.0 below, and a full discussion of the EPRI-GTC Siting Methodology can be found in the EPRI-GTC Overhead Electric Transmission Line Siting Methodology (2006) report.

[1] EPRI-GTC Overhead Electric Transmission Line Siting Methodology (2006)

2.0 SITING METHODOLOGY

2.1 Summary of Siting Methodology Approach

As noted in Section 1.0, the siting methodology used for determining the selected transmission route is adapted from a protocol developed by the Electric Power Research Institute (EPRI) and Georgia Transmission Corporation (GTC). URS and other consultants have been using similar opportunity and constraint review methods for many years in transmission and other siting studies. Based on URS' professional review and comparisons with its own siting methods, the EPRI process offers an excellent framework for siting analysis **when used with appropriate modifications for project specific criteria**. The siting methodology used for this project includes both quantitative and qualitative evaluation techniques. The quantitative evaluation was used to initially develop, score, and rank alternative routes according to certain selected criteria. Subsequently, a qualitative evaluation that incorporated both public input and professional judgment was conducted in order to reach a final decision regarding the selected route.

The siting method consists of three fundamental phases:

- Generate Macro Corridors. These Macro Corridors are used to define the outer edges of the Study Area.
- Generate Alternative Corridors. Alternative corridors most suitable for transmission line development are generated within the Study Area from three primary perspectives: a) protection of the Natural Environment, b) protection of the Built Environment, and c) Engineering Requirements.
- Identify Alternative Routes within the Alternative Corridors and Determine Selected Route.

2.2 Phase I – Macro Corridor Generation/Study Area Determination

Macro Corridor analysis begins after the start and end points of the new transmission line have been established. The first step in the Macro Corridor development process is to develop a landuse/landcover GIS database that identifies some of the key opportunity and constraint areas that are traditionally reviewed as part of a siting study. Typical

opportunity areas include paralleling or rebuilding existing utility corridors, paralleling primary or secondary roads, or crossing open and undeveloped areas. A next step removes Avoidance Areas from the database analysis effectively prohibiting the proposed Macro Corridors from crossing sensitive locations. Examples of these areas include listed historic structures or districts, wildlife refuges, mines and quarries, national or state parks, church or cemetery parcels, airports, and military facilities. These avoidance features are typically used, but it is important to note that project specific circumstances may require that they be considered in the analysis.

This GIS map of the area of study is created using commercially available landuse and landcover data and other feature data that includes road networks, terrain, and existing transmission line alignments. As noted in section 1.0, a Composite Suitability Surface Map is created composed of a grid of cells. The features of each cell (e.g., commercial land use, transmission line right-of-ways, agriculture, wetlands, steep slopes) are then ranked from 1 (most suitable) to 9 (least suitable). A feature is considered suitable if a transmission corridor through it is possible with little adverse impact, such as open pasture. A feature is considered less suitable if a transmission line going through it would have some adverse consequences, such as impacting wetlands.

Based on the numeric values assigned to each feature, a composite suitability surface is created. This composite suitability surface is used to produce a series of potential broad corridor areas for the following three scenarios:

- Opportunities to rebuilding or paralleling existing transmission lines and other linear features.
- Opportunities to parallel existing road right-of-ways.
- Opportunities to cross undeveloped land (cross country).

These corridors represent preferred opportunity areas for developing a new transmission line. This process determines the corridor across the suitability surface that minimizes the sum of the values within that corridor. Corridors with the lowest sums have the higher overall suitability. Corridors with a larger suitability sum would be considered less optimal.

These lowest sum areas, i.e., the preferred transmission line development areas, are identified as scenario-specific Macro Corridors (see figures in Section 4.0). After the most suitable scenario-specific Macro Corridor is identified, these three scenario corridors are merged together into a final combined Macro Corridor area. The outer boundary of this Macro Corridor area effectively defines the Study Area for the project.

2.3 Phase II – Alternative Corridor Generation

In Phase II, Alternative Corridors are generated from within the Macro Corridor based on three distinct perspectives and utilizing more detailed data. The three perspectives are defined as follows:

- Built Environment - protecting human and cultural resource areas, by reducing potential conflicts with existing residential neighborhoods and other community-valued buildings or historic sites.
- Natural Environment - protecting plants, animals and aquatic resources, by minimizing the impact to ecological resources and natural habitat.
- Engineering Requirements – maximizing co-location and minimizing cost and schedule challenges by seeking the shortest path, or utilizing existing right-of-ways, while avoiding areas that pose significant construction obstacles, such as steep slopes or unique agricultural practices.

The three primary perspectives (Built, Natural, and Engineering) utilize the same datasets to establish specific Alternative Corridors, but apply a higher weighting to data aligned with their unique perspective. The Built Environment assessment, for example, applies a higher weighting to features related to building proximity and building density; whereas the Natural Environment applies a higher weighting to floodplain and wildlife habitat features. Similarly, the Engineering perspective is based on linear infrastructure and slope features. This approach provides the ability to compare the environmental, social, and financial costs and benefits of the different corridors.

During these various assessments, feature value weights may be adjusted based on the underlying purpose of the specific perspective. For example, land use under the Built Environment perspective would place a high suitability value on undeveloped land

(forested areas) because the purpose is to avoid buildings and to utilize the undeveloped land. Conversely, land use under the Natural Environment perspective would place a low suitability value on the same undeveloped forest because the purpose would be to preserve the forest.

Additional and more detailed data used in the Alternative Corridor assessment are either gathered from existing data clearing houses or may be created specifically for each project based on aerial photo interpretation and field visits. For example, data on parcel lines and municipal boundaries are typically obtained from county or local municipal agencies. Other data, such as slope, is usually derived from the USGS Digital Elevation Models (DEMs) that are acquired from the federal government clearinghouses. Numerous datasets are derived from analysis of high-resolution digital orthophotography when available. For example, review of the aerial orthophotography is used to identify all buildings within the study area. Although the buildings are not directly used in the Alternative Corridor assessment, specific building characteristics, such as building density, building proximity, and building buffers, are derived from the building dataset to be included in the assessment.

Values are assigned based on different forms of assessment. Values were determined during the EPRI-GTC Methodology development through a collaborative outreach involving stakeholders from Federal, State, and local governments, environmental and engineering experts, as well as home owner associations and other groups. This outreach process involved discussion and structured input designed to assist in reaching a consensus. The suitability of each feature was calibrated and normalized on a scale of 1 (most suitable) to 9 (least suitable). The rationale for normalization is to provide a means to compare the data. Data generated for each constraint may vary between very low and very high values, but reading a specific value in isolation provides no insight as to its relative impact, or how it compares to the other options. Normalized scores are statistically calculated by assessing the full range of values within each constraint. Using a normalized 1-9 scale allows the different data values to be mathematically combined and compared without being distorted by differences in measurement scale. Additional discussion of data normalization is included in Section 4.0.

The Data Layers in a specific perspective are emphasized in the analysis by utilizing a weighted average in which the specific perspective being considered is given five times more importance than the other two. This weighting ensures all the various constraint features are included in the analysis of each perspective, but that appropriate weight is given to the perspective being considered. During the methodology development, testing and calibration of weight averaging on various projects demonstrated that the weighting of five times was most effective in emphasizing one perspective over the others while still retaining some influence from the other two perspectives. As noted above, information from the Data Layers of the other perspectives must be included so the model does not completely ignore those factors. For example, the model must account for the location of houses even when emphasizing the Natural Environment perspective.

Alternative Corridors are generated by utilizing standard GIS analysis tools. An accumulated cost surface is generated that characterizes the cost/impact from a starting location to all other potential ending locations. Another tool is then used to define a corridor or single route across this surface from the starting point, to a defined end-point, for example, a tap transmission line. This corridor or route identifies the area or path of least resistance (i.e., minimal cost/impact). This procedure is used to assess each of the three different perspectives and produce a distinct Alternative Corridor for each perspective based on the weighted averages assigned for that perspective.

The URS and PPL Electric siting teams reviewed the ranking and weighting values created during the EPRI-GTC methodology development and utilized those that offered the most relevance for this project study area. These EPRI-GTC weights were utilized as starting point values for the following reasons:

- They were developed through significant outreach and collaboration between multiple stakeholders from utilities, government agencies and the general public.
- They used established collaborative and statistical techniques in their determination.
- They were calibrated against successfully developed transmission line routes.

With the above points noted however, the ranking, weights, and features considered for analysis have to be reviewed and potentially modified or added to, for a given State and/or local project regulations and specific features. Simply taking a "cookbook" approach to a siting study without a detailed and collaborative review of all aspects of the methodology might lower the relevance of the study. For example, in this project modifications and additions were made to the natural environment features related to the streams and wetlands. These modifications included the development of protective buffers and associated rankings that are relevant for the Commonwealth of Pennsylvania and representative of the stream and wetlands types for the project area. In all cases the development of project specific ranks and weights were conducted by collaborative analysis between environmental, engineering, and public outreach technical experts. These are presented in the tables and text within Section 3.0.

2.4 Phase III – Alternative and Selected Route Development

The next step in the process, determining the Alternative Routes within the Alternative Corridors, is accomplished by identifying a preferred path or alignment within the Alternative Corridors. These alternative transmission line route developments utilize a similar least cost tool, but this time focus on a single alignment rather than a broader corridor area. The Alternative Route minimizes the least preferred areas that are crossed along a route connecting the starting and ending locations. This route is derived by identifying the most effective path that seeks to minimize the impacts to the built and natural environments, while still allowing for a feasible transmission line to be constructed.

To assess the advantages and disadvantages of the various Alternative Routes, feature metrics, or specific parameters measured for a particular feature, such as the number of relocated residences or number of stream crossings per route, are considered for each route. These quantitative feature metrics are normalized, assigned relative weights, and organized within the three Perspectives (Built Environment, Natural Environment, and Engineering Requirements). The three perspectives may be weighted equally (33 percent), but these weights can be changed to make a routing solution more sensitive to a specific perspective. With the establishment of these quantitative values, an overall score

for each Alternative Route can be calculated. Lower scores are preferred as they indicate less difficulty or potential impact along that route. The numerical score provides an objective reference for comparing each of the Alternative Routes.

The next step in the evaluation process applies expert judgment to rank the Alternative Routes. Siting team members qualitatively rank the most preferred routes (lowest overall scores) based on several important considerations such as, visual concerns, community concerns, schedule delay risk, special permit issues, and construction and maintenance accessibility; (additional considerations can be added if considered relevant to a given project). These considerations are assigned weights and individual responses are combined to develop an overall team ranking per route. This process is designed to encourage thorough discussion in evaluating and selecting a final route in an objective, consistent, and comprehensive manner. The goal of the qualitative expert judgment process is to determine two or three Selected Routes through the project area.

During this qualitative assessment phase, minor adjustments to the route alignment, based on best practices, may be conducted to decrease the potential impact of the specific routes. These changes may reduce the visibility of a proposed line by placing it closer to an existing tree line, or moving the alignment to parallel an active agricultural field rather than bisecting the field.

A final phase for this project incorporated public comment regarding the Alternative Routes. Feedback obtained from landowners and the surrounding community was incorporated into route locations and into the re-calculation of route scores. Landowner input, for example, may reduce certain scores by allowing changes of the proposed alignment to go around an undesirable feature, or possibly increase a routes' score by requesting avoidance of certain areas on a specific property. A Selected Route can then be determined after all these factors have been incorporated into the considerations.

3.0 ALTERNATIVE ROUTE DETERMINATION

The goal of this siting analysis was to determine the most suitable transmission line route to connect the proposed Effort Mountain 138-12 kV substation, to be located on the crest of Pohopoco Mountain, to the most appropriate tap location along a defined 6-mile stretch of the Siegfried-Jackson 138 kV transmission line. The following sections describe how the methodology was used to select the appropriate tap location and the proposed Transmission Line Route. The substation location and required tap transmission were determined as part of the need analysis as described in Exhibit B.

3.1 Generating Macro Corridors - Defining the Study Area

The Study Area is defined by a progressive process that uses various datasets to create a Composite Suitability Surface Map that in turn is used to generate broad Macro Corridors. The map is composed of data that represent opportunity areas (e.g., existing transmission line right-of-ways and cross country areas) and constraint areas (e.g., residential neighborhoods and wetlands). These opportunity and constraint areas are integrated together and then a final process step removes defined avoidance areas, such as historic districts, public parks, and wilderness areas, which are avoided where it is practical to do so.

Specific avoidance areas included State Game Lands #38, two local quarries, non-spannable water bodies (Lake Trexler), and several church or cemetery parcels. Other potential avoidance area categories, such as airports, military facilities, listed historic structures or districts, wildlife refuges, and wild scenic rivers are not present within the Project Study Area.

The following datasets were used to create a composite suitability surface with each grid cell classified by its underlying land use as discussed in Section's 1.0 and 2.0 above. A numeric opportunity or constraint value associated with each grid cell is then assigned as detailed below.

- Pennsylvania Landuse/Landcover dataset – describes the land use (residential, commercial, agriculture) and land cover (forest, wetlands, and streams) based on the Anderson Land Use/Land Cover system.

Note that this dataset (Pennsylvania State University, 2007), is based on aerial photographs collected between 2003 and 2007. A windshield survey was conducted in January 2009 to "ground truth" the accuracy of the remote data and the data was updated as necessary.

- USGS Digital Elevation Model (DEM) data – used to process and the derive slope information; reclassified to two types – slopes greater than or less than 30 degrees.
- PA Department of Transportation Roads (2008) – used to define to Interstate, primary, and secondary roads.
- Transmission Corridors – provided location of existing transmission lines based on PPL data.
- Gas Pipelines (Platts PowerMap) – provided location of existing gas pipelines.

The opportunity/constraint values for the land use surface are provided in **Table D-1**. Three types of suitability surfaces, as discussed in Section 2.0 were created for three potential scenarios:

- Rebuilding or paralleling existing transmission lines
- Paralleling existing road right-of-ways
- Crossing undeveloped land (cross country)

A GIS siting tool called the Least Cost Corridor process produces a series of potential Macro Corridors for each of the three scenarios noted above and shown in **Figure D-1**. The outer extent of these three corridors when combined together effectively defines the outer extent of the **study area**. This process is used to create a more quantifiable method for determining the study area. Traditional methods of defining the study area extent are sometimes criticized for the apparently arbitrary selection of features such as nearby roads or rivers to define the study area boundaries. The siting tool works by effectively reviewing each individual composite surface to determine the "least cost" cell values that can be crossed to get from the proposed substation location to the tap transmission line.

TABLE D-1:Opportunity/Constraint Values* for Study Area Creation by Different Routing Scenarios

Land Cover Classification	Source	X-Country[1]	Roads[2]	Existing Transmission Lines[3]
Open Water	PA LULC 2005	**7**	**7**	**7**
Urban	PA LULC 2005	**9**	**9**	**9**
Open Land	PA LULC 2005	**1**	**2**	**2**
Surface Mining / Rock Outcrop	PA LULC 2005	**9**	**9**	**9**
Forest	PA LULC 2005	**1**	**2**	**2**
Agriculture	PA LULC 2005	**1**	**2**	**2**
Wetland	PA LULC 2005	**9**	**9**	**9**
Transmission Corridors	PPL Data 2009	**5**	**5**	**1**
Other Utility Corridors	PA LULC 2005	**5**	**5**	**5**
Interstate	TeleAtlas 2003	**9**	**9**	**9**
Primary Roads	TeleAtlas 2003	**5**	**1**	**5**
Secondary Roads	PA LULC 2005	**5**	**1**	**5**
Slopes > 30 degrees	USGS 10-meter DEM	**9**	**9**	**9**

*The Opportunity/Constraint Value system is based on a 1-9 scale, with a **rank of 1 being most desirable and a rank of 9 being least desirable.** These values are depicted on **Figure D-2** as colored coded areas.

1- Route scenario where corridor would cross over undeveloped land

2- Route scenario where corridor would follow existing roadways

3- Route scenario where corridor would follow existing transmission line right-of-ways

Avoidance Features for this system included: Historic Structures, Historic Districts, Archaeology Sites, Archaeological Districts, State and National Park Interiors, Wildlife Refuges, and Wilderness Areas

It is important to note again here, that "cost" in this context does not equate to monetary value, but rather represents the least impact to critical features. These individual least cost corridors then effectively determine a preferred corridor area for each routing scenario, which are illustrated in Figure D-1 as the Combined Map image. These individual Macro corridors are then combined and the outer extent of the individual corridors establishes the outer extent of the Project Study Area. This Project Study Area, shown in **Figure D-2**, forms the basis for the collection and analysis of more detailed datasets that are used in the Alternative Corridor analysis.

3.2 Generating Alternative Corridors

Alternative Corridors are generated utilizing the same Least Cost Corridor method as the Study Area, but uses more detailed datasets only from within the defined study area.

Datasets added to the evaluation process for Alternative Corridors included:

- National Wetland Inventory (NWI)) wetlands.
- Federal Emergency Management Agency (FEMA) 100-year floodplains.
- Pennsylvania Department of Environmental Protection (PADEP) Chapter 93 stream classifications.
- Tax parcel boundaries (Monroe County) utilized to define edge of properties which reflect a preferred area for a new alignment as opposed to bisecting a property.
- Public land classifications (e.g., conservation easements, open space lands, agricultural easements).

Additionally custom created data, including building density, proximity to buildings, state-owned lands, land divisions, land cover, and wildlife habitat were developed as required for the analysis.

Three types of Alternative Corridors are generated within the Project Study Area. These corridors are identified as being the most suitable for transmission line development from three distinct perspectives - Built Environment, Engineering Considerations, and Natural Environment. Opportunity/constraint values are assigned to the different siting criteria within each perspective as shown in **Table D-2**. **Table D-3** lists the avoidance features used in this level of analysis.

Although Table D-2 uses many of the original EPRI derived rankings and weights, the table was refined with respect to some layers. These refinements were made by PPL Electric and URS technical experts in environmental, engineering, and public outreach disciplines to better represent conditions within Pennsylvania such as the inclusion of stream classifications to offer better protection of this key resource within the natural environment perspective. A more detailed discussion of these elements is included in Sections 3.2.1 to 3.2.3.

TABLE D-2: Opportunity/Constraint Values for Alternative Corridor Generation by Criteria Type

Built Environment		Engineering		Natural Environment	
Proximity to Buildings	**11.5%**	**Linear Infrastructure**	**48.3%**	**Floodplain**	**6.2%**
Background	1	Rebuild Existing Transmission Lines	1	Background	1
900-1200	2	Parallel Existing Transmission Lines	2	100-Year Floodplain	9
600-900	3	Parallel Interstate ROW	3	**Streams/Wetlands**	**20.9%**
300-600	4	Parallel Gas Pipelines	3	Background	1
0-300	9	Parallel Railway ROW	3	Forested Wetlands + 100' buffer	6
Eligible NRHP Historic Structures	**13.9%**	Future PennDOT Plans	3	Streams classified as CWF/WWF/MF/TSF + 100' buffer	6
Background	1	Background	5	PEM/PSS wetlands + 100' buffer	7
900-1200	3	Parallel Roads ROW	7	HQ Streams + 150' buffer	8
600-900	4	Road ROW	8	EV Streams + 200' Buffer	8
300-600	5	Scenic Highways ROW	9		
0-300	9				
Building Density	**37.4%**	**Slope**	**9.1%**	**Public Lands**	**16.0%**
0-0.05 Buildings/Acre	1	Slope 0-15%	1	Background	1
0.05-0.25 Buildings/Acre	3	Slope 15-30%	6	Conservation Lands - Open Space, Conservation Easements	5
0.25-1 Buildings/Acre	5	Slope >30%	9	State-Owned Lands - Game Lands	5
1-4 Buildings/Acre	7			USFS	8
4-25 Buildings/Acre	9				
Proposed Development	**6.3%**	**Intensive Agriculture**	**42.6%**	**Land Cover**	**20.9%**
Background	1	Background	1	Open Land, Pastures, Scrub/Shrub, etc	1
Proposed Development	9	Fruit Orchards	2	Row Crops and Horticulture	2
Spannable Lakes and Ponds	**3.8%**	Christmas Tree Farms	2	Managed Timber Lands	2
Background	1			Developed Land	6
Spannable Lakes and Ponds	9			Hardwood/Natural Coniferous Forests	9
Land Divisions	**8.0%**			**Wildlife Habitat**	**36.0%**
Edge of Field	1			Background	1
Land Lots	8			Important Birding Areas	2
Background	9			Natural Areas	5
Land Use	**19.1%**			Species of Concern Habitat	7
Undeveloped	1				
Nonresidential	2				
Residential	9				

Legend:

Perspective Categories
Layers
Layer Influence Percentages
Value
Features

NOTE: The Opportunity/Constraint Value system is based on a 1-9 scale, with **a rank of 1 being most desirable and a rank of 9 being least desirable**. These values are depicted on **Figure D-9** as colored coded areas.

TABLE D-3: Avoidance Features for Alternative Corridor Generation
NRHP- Listed Archaeology Sites - 500'
NRHP- Listed Archaeology Districts - 500'
NRHP- Listed Historic Districts- 500'
NRHP- Listed Historic Structures - 500'
NRHP- Eligible Historic Districts - 300'
EPA Superfund Sites
Airports
Military Facilities
Mines & Quarries
Large Buildings + 100' buffers
Residential Buildings + 100' buffers
School Parcels (K-12)
Day Care Parcels
Church Parcels
Cemetery Parcels
Non-Spannable Water Bodies
Wild & Scenic Rivers
Wildlife Refuge
USFS Wilderness Areas
National & State Parks
County & Township Parks
Sites of Ritual Importance

In addition to the opportunity/constraint values assigned to each element of the individual layers, the layers are also assigned a relative weight. For example, while looking to avoid potential impact to new development areas within the Built Environment Perspective is a consideration, it is seen as more important to avoid close proximity to existing buildings, or densely populated building areas. Therefore these latter two layers have a proportionally larger influence or weight (percentage) in the development of the Built Environment Composite Suitability Surface for this perspective. Additional details on

the use of weighting and its importance can be found in Sections 3.1 and 3.2, as well as Section 2.0. It is always essential however, to review these weights on a project specific basis to ensure that assigned values are relevant for the given study area. As noted previously this was accomplished through close review between the PPL Electric and URS siting team.

3.2.1 Datasets Used for Alternative Corridor Generation

Figures D-3 through D-8 illustrate some of the core datasets that were used to develop Alternative Corridors for the three perspectives. **Figure D-3** consists of Existing Land Use categories, which were refined and updated for this analysis and based on field review. **Figure D-4** illustrates the different Agricultural Preservation areas within the Study Area. **Figure D-5** indicates the location of Cultural and Historic resources identified within the Study Area. **Figure D-6** shows the different Zoning areas based on review of the Chestnuthill and Polk Township ordinances. **Figure D-7** provides information on the streams, wetlands, and floodplain areas. **Figure D-8** identifies areas of Steep Slopes ranging from moderate (15-25%) to extremely steep (>25%).

These datasets, as well as the diverse forms of information reviewed in Exhibit C, were also utilized in the analysis of the selected route in an effort to locate and identify airports or potential archeologic, geologic, historic, scenic, or wilderness areas within two miles of the selected route right-of-way. More details of these efforts are discussed in Section 3.5 of Exhibit D.

3.2.2 Engineering Calibrations

Engineering options may be restricted based on the agricultural crop grown and farming methods utilized by landowners, such as the fruit orchards and center pivot irrigation technique. In the Study Area, evergreen (Christmas) tree farms are a prevalent agricultural crop. Evergreen farms were added to the Engineering Perspective as a means of addressing these potentially sensitive agricultural areas. Due to their relative compatibility with transmission line siting, however, these farms were issued a value of two.

3.2.3 Environmental Calibrations

Refinements of the environmental calibrations involved classifying streams and wetlands and defining protective buffers. These refinements are described in further detail below.

Streams were classified in accordance with the protected water uses designated by PADEP in 25 Pa. Code Chapter 93. Special Protection Waters are classified as High Quality (HQ) or Exceptional Value (EV). Protective buffers for HQ and EV streams were set at 150 feet and 200 feet, respectively. Streams classified as protective of cold-water fisheries (CWF), warm-water fisheries (WWF), or trout stocked fisheries (TSF) were given protective buffers of 100 feet. The minimal buffer width (100 feet) was based on local stormwater ordinances developed by the Monroe County Conservation District and endorsed by Jackson, Polk, and Chestnuthill Townships to provide protection to streams. Based on professional judgment, buffer widths for the HQ and EV streams were broadened to increase protection of these Special Protection Waters. All of these various stream classifications were added to the Streams/Wetlands section under the Environmental perspective. CWF/WWF/TSF streams were issued a value of six, whereas HQ/EV streams were issued a value of eight.

Similarly, wetlands were classified in accordance with US Fish and Wildlife Service's Cowardin system[2]. The vegetated Cowardin wetland types in the Study Area are palustrine emergent (PEM), palustrine shrub-scrub (PSS), and palustrine forested (PFO). These wetland types are identified in the NWI dataset on the basis of aerial photography. The 100-foot protective buffer assigned to NWI wetlands was also based on local stormwater ordinances. These wetland classifications were added to the Streams/Wetlands section under the Environmental perspective. PFO wetlands were issued a value of six, whereas PEM/PSS wetlands were issued a value of seven. Although PFO wetlands are of great ecological importance, within the project Study Area PEM/PSS wetlands were deemed more ecologically sensitive due to the potential utilization of these habitats by the bog turtle (*Glyptemys muhlenbergii*), a federally Threatened and Pennsylvania Endangered species.

[2] Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979)

For the Public Lands section, "Other Conservation Areas" and "State-owned lands" were more specifically defined as to the type of public land affected. For example, conservation areas within the Study Area include lands protected by conservation easements (Jonas Mountain Preserve) and farmland areas protected by agricultural conservation easements. These easements preserve the land in its existing condition (upland forest, riparian forest, active agriculture) by purchasing the development rights of the land with public funds from state, county, and township sources. Other farmland preservation techniques, such as Agricultural Security Areas and Act 319 "Clean and Green" were identified, but not considered for similar protection, because the development rights of the land are still applicable and public funds were not used.

In the original model development the primary State-owned lands used for constraint analysis are Wildlife Management Areas (WMA). However, Pennsylvania owns State Parks, State Game Lands, and State Forests. State Parks are already protected under the Avoidance Area category, but the other land types are not similarly protected. For this analysis, State Forests and State Game Lands were added to the State-owned category. No State Forests are located in the Study Area, but the 5,477-acre State Game Land #38 is located in the northeastern corner of Chestnuthill Township and the northwestern corner of Jackson Township. State Game Lands are managed by the Pennsylvania Game Commission and are utilized for wildlife management, hunting, hiking, and other outdoor opportunities. For this analysis, State-owned lands were assigned a value of five, offering them a same valuation as the other conservation lands.

3.2.4 Review of Alternative Corridors

After the new attributes were added and values updated, Alternative Corridors were created for each of the three perspectives. These corridors form the optimal areas for development of alternative route alignments for consideration, as shown in **Figure D-9**.

3.3 Alternative Route Generation and Adjustments

3.3.1 Alternative Routes and Initial Analysis

Determining Alternative Routes within the Alternative Corridors was accomplished by using a GIS tool similar to the Least Cost Corridor tool. In this case however, a single

preferred path for each of the different perspectives is determined using the Least Cost Path tool. This method effectively identifies a preferred alignment across the accumulated cost surfaces, which runs from the proposed substation to the tap transmission line.

To complete this task, more sophisticated data was developed and existing data modified. For example, to generate the Alternative Routes, a 328-foot (100-meters) protective buffer was created encompassing the residential units. This buffer width is based on the definition of a house's curtilage, which includes the land or buildings within 100 meters of a house that are used for domestic purposes. The 100 meters limit, however, does not extend beyond the homeowner's property line.

Based on the three perspectives (Built, Natural, Engineering), three Alternative Routes were identified that connected the proposed Effort Mountain substation to the Siegfried-Jackson 138 kV transmission line (**Figure D-10**). These Alternative Route lines tapped to the Siegfried-Jackson transmission line north or south of the village of Effort and proceeded west in either a "northern" or "southern" course, relative to their position when compared to the village of Effort, toward the proposed substation site. Initial review of the Northern and Southern routes noted that they merged west of the village of Merwinsburg and paralleled each other across the central section of the Trexler Boy Scout Reservation, through the center of the Jonas Mountain Preserve, and up the southern flank of Pohopoco Mountain. Due to the similarity in the Built and Natural Alternative Route alignments (southern routes), these two Alternative Routes were assessed through the rest of the siting process as one route by combining them into a single route alignment. By combining the two southern routes into a single alignment the process provided two alternative routes: north route (Engineering Alternative Route) and south route (Built/Natural Alternative Routes).

3.3.2 Adjustments for the Trexler Boy Scout Reservation

Evaluation of these two Alternative Routes noted potential impacts to the Trexler Boy Scout Reservation. The impacts were assessed and modifications to the Alternative Routes through this area were evaluated. Based on review of aerial maps and direct communication with officials having jurisdiction over the Boy Scout properties,

alternative pathways for the Northern and Southern routes were formalized. These modifications took into account the high-use areas within the camp, which are located primarily along the southern edge of the property and are centered along Camp Trexler Road. Also identified was the importance of Trexler Lake, which is located just north of these high-use areas and generally in the center of the Boy Scout property. To avoid these sensitive areas, the Alternate Routes were modified to follow the eastern boundary of the Boy Scout parcel, turn west above Trexler Lake, and parallel the southern edge of Jonas Road. These modifications changed approximately 2 miles of the Northern Route and 3 miles of the Southern Route.

3.3.3 Adjustments Based on Field View Information

A windshield survey from publicly accessible locations of the two Alternative Routes was conducted in March 2009. The goal of the windshield survey was to field check the land use of the area including sections where conditions had changed since the existing data and aerial photography was collected. Additionally the field review allowed for review of other potential cultural and historical resource features in the area outside of the desktop review completed through the Pennsylvania Historical and Museum Commission (PHMC) online GIS system. Field assessment of the alignment also provided insight into how the proposed transmission lines would visually change the existing scenario and where potential alterations could reduce these changes. During the field view, the locations of several potential wetland areas were also identified. It was noted that some of the wetlands were located within soil series that were not specifically characterized as hydric, but as soils with hydric inclusions. Based on these observations, hydric soils and soils with hydric inclusions were added to the analysis as wetland features and considered in alignment changes. Hydric soils are soils that are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper regions and are therefore primary wetland indicators. Hydric inclusions are small areas of hydric soils located within a larger soil type that is not typically identified as hydric. **Figure D-11** provides information on all the soils located along each of the Alternative Routes.

3.3.4 Engineering Adjustments to Alternative Route Alignments

Based on the field observations and assessment of aerial maps, the initial Alternative Routes were modified to reflect a more practical alignment. Changes included:

- Straightening the proposed alignments in areas where the generated alignment was irregular (zigzagging through open fields).
- Setting possible pole sites to minimize potential impact to environmental and sensitive land use features. A 1,000 foot distance was used as the longest possible distance for a span between transmission line poles.
- Setting possible pole sites in positions to effectively span some features (crop fields) or to make turns that avoid other features (residential areas). Many of these modifications were implemented to decrease potential impact to farming processes.
- Placing proposed alignments along the edge of open fields or along farm roads. These modifications were also implemented to decrease potential impact to farming processes.
- Placing proposed alignments set distances, typically 100 feet, from specific property lines to decrease potential conflicts with neighboring landowners
- Placing proposed alignments that lie within forest areas set distances, typically 100 feet, from the edge of fields. This modification was used to decrease visibility of the alignment.

The resulting alignments are described below and illustrated in **Figure D-12**.

3.4 Description of Alternative Routes

The following is a description of each of the alternative routes that were identified via the analysis previously described.

3.4.1 Route A – Northern Route

Alternative Route A is 5.86 miles in length. This alternative ties into the Siegfried-Jackson 138 kV Transmission Line on the east side of Route 115, 1.2 miles north of the

Village of Effort, in Chestnuthill Township. The following narrative describes this proposed route. Note that all linear distances (feet) are approximate:

- This alternative would tap into the existing Siegfried-Jackson 138 kV Transmission Line at the top of a hill located between Sugar Hollow Road to the south and Route 115 to the west.
- The line would then proceed 3,000 feet to the west, crossing over Pohopoco Creek, a High-Quality (HQ) stream, above Route 115, and along the edge of agricultural fields. The terrain around Pohopoco Creek is steep and the 100-year floodplain is 200 feet wide.
- The line would then turn to the north for 4,200 feet. This segment would traverse through Heckman's Orchards, another agricultural field, and through a 700 foot section of forest. To minimize impacts to these the orchard and crop fields, the line was adjusted to utilize farm roads, forested edges, and maximum pole distances.
- After turning to the northwest, the line would then proceed for 2,300 feet. In this segment, the line would proceed along the edge of an agricultural field, paralleling The Highlands residential development, and then cross Jonas Road before entering a wooded area to the north of the road.
- At this point, the line would turn to the southwest and proceed for 5,600 feet, crossing Zeigler Road, Mountain Road, and Jonas Road north of the Village of Merwinsburg. The line in this segment would primarily be crossing through sections of forest, which are owned by Camp Jaycees (a special use camp) and other private landowners. The line would also cross over the confluence of Poplar Creek and Pohopoco Creek, both of which are classified as cold-water fisheries (CWF) in this section. The terrain associated with these stream valleys is relatively steep. Although not mapped by FEMA, the 100-year floodplain associated with these streams is 500 feet wide.
- For 8,600 feet, the proposed line would proceed in a northwesterly direction, generally paralleling Jonas Road to the south. The general land cover in this area

is forest, with the majority owned by the Trexler Boy Scout Reservation. After crossing onto the Trexler Boy Scout Reservation, the line was adjusted to proceed above and around the Trexler Lake area. While on the Trexler Boy Scout Reservation property, the line would cross over Middle Creek, a CWF classified stream with moderately steep banks and a narrow floodplain. Midway across this section, the line crosses into Polk Township.

- 3,700 feet (0.7 miles) east of the Village of Jonas, the proposed line would turn north, crossing Jonas Road and proceed 7,200 feet toward and up Pohopoco Mountain. The majority of this segment would traverse through forest lands, some of which are part of the Jonas Mountain Preserve and others that are lands owned by the Indian Mountain Lake Homeowners Association. The slope up Pohopoco Mountain is extremely steep. After cresting Pohopoco Mountain, the line would turn to the east and proceed down into a shallow valley that is the headwater area for Jonas Creek, a HQ-classified stream.
- The transmission line would end at the proposed substation that will be constructed along the southwestern boundary of the Indian Mountain Lake community and at least 500 feet upslope from Jonas Creek. The substation would be located 500 feet west of Reynolds Road in a forested section of land owned by the Indian Mountain Lake Homeowners Association.

3.4.2 Route B - Southern Route

Alternative Route B is 5.54 miles in length. This alternative ties into the Siegfried-Jackson 138 kV Transmission Line on the west side of Route 115, 0.5-mile northwest of the Village of Effort, in Chestnuthill Township. The following narrative describes this proposed route:

- This alternative would tap into the existing Siegfried-Jackson 138kV Transmission Line at the top of a hill located between Astolat Road to the south and Pheasant Run Road to the north.
- The line would then proceed 1,800 feet to the northwest, crossing above Pheasant Run Road and Pheasant Run, a tributary to the HQ-classified Pohopoco Creek.

The line would traverse through a forested area east of The Pines residential development, cross over a meadow area associated with Pheasant Run, and enter another forested area north of Pheasant Run Road. The terrain associated with Pheasant Run is moderately steep and the floodplain is relatively narrow. Some of the aerial crossing in this segment would parallel Hillside Memorial Cemetery.

- After turning west, the line would proceed for 4,000 feet, generally paralleling Pheasant Run Road to the north. In this section, the line would pass through a mix of forested lands and agricultural fields. To minimize impacts to these and all other crop fields, the line was adjusted to utilize farm roads, forested edges, and maximum pole distances.
- At this point, the line would turn to the northwest and proceed 2,500 feet before crossing Burger Hollow Road. Land use in this section is primarily agricultural. After crossing Burger Hollow Road, the line enters into Polk Township.
- The line would continue in a westerly direction for 4,000 feet, crossing New York Boulevard, and then turning to the north. In this section, the line would pass through a mix of forested lands and agricultural fields, and cross over an unnamed tributary to Middle Creek. This stream, which is classified as a CWF stream, has minimally steep slopes and a narrow floodplain.
- For 5,000 feet, the new transmission line would head north toward Jonas Road. The line would then turn to the northwest for 4,500 feet, generally paralleling Jonas Road to the south. This 9,500-foot section primarily lies within the Trexler Boy Scout Reservation and was adjusted to minimize impacts to camp activities. In this section, the line traverses primarily through forested land and crosses over Middle Creek, a CWF classified stream with moderately steep banks and a narrow floodplain. Sections of Alternative Route A parallel this alternative from this area on to the proposed substation site.
- 3,200 feet (0.6 miles) east of the Village of Jonas, the proposed line would turn north, crossing Jonas Road and proceed 7,500 feet toward and up Pohopoco Mountain. The majority of this segment would traverse through forest lands, some of which are part of the Jonas Mountain Preserve and others that are part of

the lands owned by the Indian Mountain Lake Homeowners Association. The slope up Pohopoco Mountain is extremely steep. After cresting Pohopoco Mountain, the line would turn to the east and proceed down into a shallow valley that is the headwater area for Jonas Creek, a HQ-classified stream.

- The transmission line would end at the proposed substation that would be constructed along the southwestern boundary of the Indian Mountain Lake community and at least 500 feet upslope from Jonas Creek. The substation would be located 500 feet west of Reynolds Road in a forested section of land owned by the Indian Mountain Lake Homeowners Association

3.5 Adjustments of the Alternative Routes Based on Public Feedback

Upon completion of the initial round of alternative route generation and subsequent modifications, additional modifications were made to Route A and Route B based on feedback from the public outreach events. These additional modifications, ultimately resulting in Route A1 and Route B1, and the justifications for them, are discussed below.

3.5.1 Overview of Public Outreach

PPL Electric conducted an extensive public outreach program for this project aimed at disseminating information to the public about this project and gathering input from the public to incorporate into the decision-making process. This public outreach included meetings with, phone calls with, and mailings to owners of property within 1,000 feet of the two alternative transmission line routes, posting on April 8, 2009 of advertisements in the Stroudsburg Pocono Record and the Lehighton Times News, distribution of a press release to local media outlets and establishment and updating of a project website (http://www.monroepowerproject.com/).

Throughout the public outreach process, PPL Electric has responded to questions and concerns from property owners, residents, and other interested persons through Open Houses, in-person meetings, personal phone calls, emails, and project update letters.

3.5.2 Public Open House Feedback - First Open House

An Open House was held by PPL Electric on April 13, 2009 at the West End Fire Hall on Route 715 in Brodheadsville, Pa. Owners of land within 1,000 feet of Alternative Route

A and Alternative Route B, including the owners of land in the required 100-foot wide right-of-way, were invited by letter to attend the Open House. The public was invited through the newspaper advertisements. Information on the need for the new transmission line and descriptions of the proposed routes were provided with the mailed invitations.

An exhibition-styled format was employed at the workshop using a variety of displays to explain various aspects of the project. Displays were staffed by representatives of PPL Electric and other experts who explained the project to attendees, received feedback and other input from attendees, and answered questions and/or recorded questions for subsequent follow-up. The information stations at the event covered various subjects, such as the need for the line, engineering and construction requirements, right-of-way acquisition procedures, and route-selection procedures. The following six information stations were used to help provide information to the attendees:

- Station 1 – Welcome and Sign-In. Attendees were asked to sign in and were given directions to the stations and general information about the format of the meeting.
- Station 2 – Why This Project is Needed in Effort. Representatives explained the project is needed to improve reliability by reducing existing overloads.
- Station 3 – Work to Occur in the Area. Representatives described the alternative routes where the power line could be sited, as well as reasons for choosing those routes. In addition, the proposed height of towers, as well as the proposed substation planned for the area, was discussed.
- Station 4 – Siting of Project/Recognizing Community Concerns. Representatives at this station discussed PPL Electric's willingness to take local property owners' and residents' concerns into account in order to build this project in a way that minimizes its impacts.
- Station 5 – Next Steps/Timeline for Project. This station detailed the timeline that PPL Electric will follow to complete this project, including filing with the Pennsylvania Public Utilities Commission for approval of the project.

- Station 6 – How You Can Stay Informed. The project team identified how to submit comments (including submitting comment cards taken during the Open House), ask further questions and receive additional information and updates regarding the project.

Results

Approximately 100 individuals attended the event. Feedback from attendees ranged from curiosity to concern. Specific concerns from landowners along the Alternative Route right-of-ways included:

- A perceived loss in property value due to proximity to the transmission line
- Perceived health concerns related to transmission lines
- Impact to the Jonas Nature Preserve. Many property owners stated that this land is already protected by the Pocono Heritage Land Trust as a preservation area for wildlife, plants and streams
- "Destruction" of open space
- Aesthetic concerns of having a power line near residential properties.

After the Open House, residents who attended the event were mailed thank you letters. Additionally, people residing within 1,000 feet of the proposed alternative line routes who did not attend the event were mailed a letter which updated them about the Open House and provided contact information for them to express comments, questions or concerns about the project to PPL Electric.

Specific feedback on possible modifications to the two original Alternative Routes was obtained and is illustrated as two new Alternative Routes (A1 and B1) in **Figure D-13**. Landowner requests regarding line adjustments on their property included the following:

Route A changes – Route A1

- Owners of Heckman's Orchards stated that the alignment through the center of their orchard would create difficulty in maintaining existing trees and coordinating new tree planting. A possible alternative would be to turn the line to the west before reaching the orchard, proceed for 900 feet, and then turn north

along the eastern edge of the Birch Hollow Estates residential development. Having the line proceed north would result in the line reaching the same point as the original alignment. This change would not add any length to the line, but would place the alignment closer to several sections of the residential development.

- Owners of the property between Zeigler Road and Mountain Road were concerned with how close the alignment was to their home and lake. A possible alternative would be to extend the alignment to the north and proceed around the outer edge of the property. This alignment would result in the line being further north along Mountain Road and would thereby extend the length as the alignment is brought back south to cross Mountain Road at the appropriate spot. This change would extend the line by approximately 600 feet.
- Another suggested route across the Trexler Boy Scout Reservation would involve turning the alignment sharply to the north toward Jonas Road, turning west just south of the road, and paralleling a longer section of Jonas Road. This alternative would reduce the need to cross Middle Creek, but would involve crossing several smaller tributaries and an area with a high potential for wetlands.

The changes noted above were implemented and the result was Alternative Route A1, which was added to the list of alternative routes to be further evaluated in the Selected Route process. Alternative Route-A1 is approximately 6.28 miles in length.

<u>Route B changes – Route B1</u>

- Property owners along Pheasant Run Road requested that the alignment through their properties be within the tree lines so as to not interfere with farming activities. Adjustments to the alignment would involve moving several potential pole positions approximately 50 feet north and others over 100 feet south. All of the adjustments would be confined to the original properties.

- To avoid lands protected with an Agricultural Conservation Easements, a possible alternative would be to move the alignment onto adjacent fallow lands that are not agriculturally protected. The adjustment would still require crossing a small portion of an Agricultural Conservation Easement property, but no poles would be located within the boundary of that parcel. This change, in conjunction with the above request, would result in a straighter configuration that requires fewer poles, moves the alignment away from several residential areas along Burger Hollow Road and New York Blvd Road, and reduces impacts on active farm operations. This alternative still crosses Burger Hollow Road, New York Boulevard, and an unnamed tributary to Middle Creek, but at points further south than previously noted.

- Another suggested route across the Trexler Boy Scout Reservation would involve edging the alignment to the east to parallel the property line closer and following this alignment further north toward Jonas Road before turning to the west. The adjustment would move the alignment approximately 100 feet closer to several residential areas on the west side of New York Boulevard. This alternative would provide the scout camp with additional forested buffer between their high activity areas and the transmission line.

- To minimize forest fragmentation on the north side of Jonas Road, an alternative alignment would parallel segments of an existing water main right-of-way corridor, owned by the City of Bethlehem's Bureau of Water, which bisects the Jonas Mountain Preserve from southwest to northeast. The line would then turn to the north and parallel the forested edge of the Birch Hollow Estates residential development before ascending Pohopoco Mountain.

The changes noted above were implemented and the result was Alternative Route B1, which was added to the list of alternative routes to be further evaluated in the Selected Route process. Alternative Route B1 is approximately 5.70 miles in length.

All four Alternative Routes are illustrated in Figure D-13**.** The Selected Route, as presented at the Second Public Open House meeting, is shown in **Figure D-14.** The

methodology to determine the selected route is discussed in Section 4, but the route is presented here for continuity with the Public Open House Outreach.

3.5.3 Public Open House Feedback - Second Open House

PPL Electric held a second Open House at the West End Fire Hall in Brodheadsville on May 28, 2009 to announce its plans to construct the transmission line along a modified version of proposed Alternative Route B1. Owners of land within 1,000 feet of the proposed Alternate Route B1 were invited to this Open House through a letter and all residents of the area were invited through advertisements that appeared May 21, 2009 in the Stroudsburg Pocono Record and the Lehighton Times News. At the same time as the selection of Route B1 was announced, property owners residing along alternative Routes A and A1, and identified areas along Route B, were mailed letters stating that these routes had not been selected for the project. Approximately 40 property owners and other interested persons attended the event. Most of the property owners who attended the Open House listed mailing addresses in Effort, Pa.

Results

Some residents who attended this Open House expressed several concerns with placing the line along proposed Alternative Route B1:

- Residents of Birch Hollow Estates expressed concerns about how close the selected route is to their homes.
- Two attendees stated that the selected route would cross the only public access to the Jonas Mountain Preserve.
- Several attendees perceived that there would be a loss in property value due to proximity to the transmission line and substation site to their homes.
- Two people commented that the transmission lines would adversely impact the environment.

After the second Open House, property owners and other interested persons who attended the event were mailed thank you letters and residents along the 1,000-foot corridor of alternative Route B1 who did not attend were mailed an Open House update letter.

3.5.4 Summary of Additional Written Communication

Since this project was announced in March 2009, PPL Electric has received several letters from nearby property owners expressing concerns about the project. PPL Electric has responded to each letter, discussing the Company's commitment to listen to and respond to the concerns of affected property owners, to complete this project in an open and honest manner, and to make changes in response to community input where practical.

In addition, PPL Electric sent a letter specifically to residents of the Birch Hollow Estates community on June 19, 2009, which discussed concerns raised and also affirmed that the project would be built near the western edge of the community (but not within the community as some residents had questioned) an average of 220 feet from several residential properties. In closing, the letter mentioned that although there is no "perfect route" to site these facilities, PPL Electric would work on an individual basis with all property owners from which it requires right of way to build the line in a way that takes the concerns of residents and their feedback into consideration. By October 2009, a modified route alignment through this area had been coordinated with the landowners. The route would be moved several hundred feet west of Birch Hollow Estates. Although this alignment would increase the fragmentation of the Jonas Mountain Preserve, PPL Electric has coordinated the purchase of an adjacent forested parcel, through which the alignment also traverses, to be donated to the Jonas Mountain Preserve. This alignment is illustrated in **Figure D-15**.

On July 30, 2009, all residents along the selected route were mailed a project update letter that discussed the detailed environmental studies that PPL Electric plans to conduct, such as wetland, plant, and animal life surveys, in the project area. This letter also reaffirmed the need for the project as a way to meet the increasing demand and improve the reliability of electric service in the area.

In addition to comments made to PPL Electric at open houses or through letters sent since the project was announced, the Company has also worked to respond to 27 other inquiries received by email and phone. A majority of these phone and email inquiries received through the project website have dealt with concerns about the lines proximity to residential properties and environmental concerns about placing the line through

undeveloped, natural areas. PPL Electric has responded to these inquiries expressing a willingness to listen to the concerns of interested parties and work to complete this project in a way that minimizes its impact.

4.0 ROUTE SELECTION PROCESS

4.1 Evaluation Metrics

The decision process of identifying the Selected Route involves quantitatively evaluating the advantages and disadvantages of the various Alternative Routes, and then qualitatively assessing the various routes based on less tangible criteria using team based expert judgment. Initial steps in this process require calculating the evaluation metrics of the various routes and summarizing these data in a tabular form organized within the three Perspectives (Built Environment, Natural Environment, and Engineering Requirements). The metrics used for this evaluation process are defined in **Table D-4**.

Evaluation metrics provide detailed information on relative lengths, acres of easement, and particular circumstances. Specific evaluation metrics answer questions regarding the length of the alternative route, acres of wetland crossing, and number of road crossings.

Constraint data (e.g. linear feet of wetland's crossed, houses within 100 feet etc) is recorded on a variety of scales/units, including aerial, linear, and point. It is common for one route, for example, to cross 100 linear feet of wetland, while another might cross 10 feet of wetland and be in close proximity to 100 houses; which then, is the "better" route? Data normalization is required at this point to allow for the meaningful comparison of the routes using these measurement values, e.g., miles of line and acres of wetlands. Normalizing the data allows the underlying characteristic of the data sets to be compared by removing the units (feet, acres, etc) associated with the various measurements.

This is achieved by first comparing a single constraint value for a given route against the other same constraint value of the alternative routes. To use an example from this study we first determine which routes have the "lowest" and "highest" potential wetland impacts by comparing the range of values between the routes. This range lies between 0.09-acres for Route B1 to 2.50-acres for Route A. A normalization calculation is used that assigns each route a value, based in this case, on a scale of 0 – 100. 0 for this study is assigned to the lowest potential impact route and 100 to the highest potential impact route; the other routes are assigned a value in between the 0 – 100 based on their relative potential impact when compared between the lowest and highest scoring routes. This

same process is then used to assign a value on the 0 – 100 scale for all the metrics being evaluated, e.g., acres of natural forests impacted, number of road crossings, and number of residences with 300-feet of the line.

The Tabular Summary of the Alternative Routes (**Table D-5**) illustrates the raw metric and corresponding normalized values for the four Alternative Routes.

TABLE D-4: Metric Definitions

Built Environment
NHRP Listed/Eligible Structures/Districts: Identifies the number of historic structures or districts that would be located within 1500' of the transmission line. No NHRP features were noted in the study area.
Residences within 300': Residences that may be visually impacted by the proposed transmission line.
Proposed Housing Developments: Areas that have physical indications of new residential development or that were obtained from review of township records.
Commercial Buildings within 300': Structures would include retail stores, restaurants, and service garages. Project specific commercial structures also included riding stables and certain barns that were used in commercial activities (orchard).
Industrial Buildings within 300': Structures would include steel mills, power plants, or quarries. Several quarries were noted in the area but were classified as avoidance areas and avoided by the route selection process.
School, Day Care, Church, Cemetery, or Park Parcels: Identifies the number of areas where the transmission line would border any of these sensitive land uses.
Non-condemnable Properties: Properties that contain residences that lie within 100-meters of or have their curtilage crossed by the proposed transmission line.
Natural Environment
Natural Forests: Acres of forest potentially impacted by the proposed transmission line.
Stream/River Crossing: Number of streams that will be crossed by the proposed transmission line. Values based upon use of GIS stream data. Smaller tributaries are often not identified in the GIS database, thus the number of crossings may be higher.
NWI Wetlands and Hydric Soils: Acres of potential wetlands that will be crossed by the proposed transmission line. NWI (National Wetland Inventory) features were mapped over 20 years ago and are not highly accurate. Hydric soils indicate areas with high potential for wetland features. Soils with hydric inclusions, which also have a high wetland potential, were not used in the assessment, thus the area of potential wetlands may be higher.
Floodplain Areas: Acres of floodplains that will be crossed by the proposed transmission line. Values based on State generated GIS FEMA floodplains, where available, or use of the PADEP accepted 50-feet default floodway limit rule on either side of a known stream (approximately 100 feet wide).
Engineering Variables
Length: Length of transmission line as calculated by GIS analysis
Miles parallel with Roads: Length of proposed transmission line adjacent to (within 100') of roadway. These areas have easier access for construction and maintenance. Conversely, length of line distant from roadways will have higher engineering constraints.
Number of Road Crossings: Number of times the proposed transmission line crosses a public road. These areas have engineering constraints due to height requirements.
Areas of Steep Slopes (>25%): Acres of steep slopes crossed by the proposed transmission line. These areas have engineering constraints based on access road development, pole placement, and long-term maintenance.
Number of Parcels: Identifies the number of different landowners associated with the proposed transmission line.
Estimated Total Project Costs: Value to be estimated based on total length

TABLE D-5: Tabular Summary of Alternative Routes

	METRIC	EFFORT/JONAS - ROUTE A	EFFORT/JONAS - ROUTE B	EFFORT/JONAS - ROUTE A1	EFFORT/JONAS - ROUTE B1
BUILT ENVIRONMENT	NHRP Listed/ Eligible Structures/ Districts (1500ft from edge of R/W)	0	0	0	0
	Normalized				
	Residences (w/i 300ft of transmission center line)	5	7	13	10
	Normalized	**0**	**25**	**100**	**63**
	Proposed Housing Developments	0	0	0	0
	Normalized				
	Commercial Buildings (w/i 300ft of transmission center line)	0	1	0	1
	Normalized	**0**	**100**	**0**	**100**
	Industrial Buildings (w/i 300ft of transmission center line)	0	0	0	0
	Normalized				
	School, Day Care, Church, Cemetery, Park Parcels (#)	0	1	0	1
	Normalized	**0**	**100**	**0**	**100**
	Non-condemnable Properties	0	0	0	0
	Normalized				
NATURAL ENVIRONMENT	Natural Forests (acres)	55.27	48.23	59.85	55.47
	Normalized	**61**	**0**	**100**	**62**
	Stream/River Crossings (#)	4	3	3	3
	Normalized	**100**	**0**	**0**	**0**
	NWI Wetlands & Hydric Soil Areas (acres)	2.50	0.76	2.20	0.09
	Normalized	**100**	**28**	**88**	**0**
	Floodplain Areas (acres)	1.00	0.77	0.77	0.61
	Normalized	**100**	**41**	**41**	**0**
ENGINEERING VARIABLES	Length (miles)	5.86	5.54	6.28	5.70
	Normalized	**43**	**0**	**100**	**22**
	Miles of Rebuild w Existing T/L	0.00	0.00	0.00	0.00
	Normalized & Inverted				
	Miles of Co-location w Existing T/L	0.00	0.00	0.00	0.00
	Normalized & Inverted				
	Miles parallel w/ Roads	0.00	0.00	1.17	0.43
	Normalized & Inverted	**100**	**100**	**0**	**63**
	Number of Road Crossings	6	4	6	4
	Normalized	**100**	**0**	**100**	**0**
	Areas of Steep Slopes (> 25%) (Acres)	8.18	6.51	7.10	5.29
	Normalized	**100**	**42**	**63**	**0**
	Number of Parcels	19	20	16	18
	Normalized	**75**	**100**	**0**	**50**
	Estimated Total Project Costs ($)	5819993.00	5560440.00	6237126.00	5721030.00
	Normalized	**38**	**0**	**100**	**24**

4.2 Weighting Procedures and Modifications

The normalized metric values derived from Table D-5 were further adjusted through a weighting process shown in Weighted Metrics and Weighted Totals (**Table D-6**). As noted in Section 2, in its simplest form, weighting is a recognition that under certain circumstances, one evaluation criteria is more important or relevant in determining an outcome than another. For example, locating a transmission line close to a residential neighborhood is seen as less preferable if compared to locating close to an industrial development area. As another example, a route through an urban, paved setting is essentially an engineering problem (i.e. the route is severely limited by where the line physically can go). Conversely, a route through a nationally recognized ecological preserve with the addition of known sensitive archaeological resources will be decided by the least ecologically and culturally sensitive routes, rather than the most practical for an engineering perspective. Therefore, it is clear that weights can, and indeed should, be evaluated on a case by case basis. As with the route alignment generation the URS and PPL Electric siting team reviewed the weight criteria and assigned weights based on expert judgment.

In the first procedure noted in Table D-6, the metric values are assessed based on a relative weight assigned to each specific metric, e.g., Proximity to Residences is assigned a weight of 16.3%, while Proximity to Industrial Buildings is assigned a weight of only 1.8%. This weighting ensures that the features requiring the most "protection" are assigned a higher relative influence in the final ranking. Relative weights for all the metrics within each perspective (Built Environment, Natural Environment, and Engineering Requirements) must add up to 100%. The total of the weighted metrics within each perspective is summarized and illustrated on the line titled "Total" at the bottom of the perspective (e.g., Route B has a Total of 21 for the Built Environment.)

TABLE D-6: Weighted Metrics and Weighted Totals

PERSPECTIVE / METRICS	Perspective Weight / Metric Weight	EFFORT/JONAS - ROUTE A	EFFORT/JONAS - ROUTE B	EFFORT/JONAS - ROUTE A1	EFFORT/JONAS - ROUTE B1
BUILT	**33.0%**				
NHRP Listed/ Eligible Structures./ Districts (1500ft from edge of R/W)	**15.5%**				
Weighted					
Proximity to Residences (w/i 300ft of transmission center line)	**16.3%**	0	25	100	63
Weighted		0	4	16	10
Proposed Housing Developments	**5.4%**				
Weighted					
Proximity to Commercial Buildings (w/i 300ft of transmission center line)	**3.6%**	0	100	0	100
Weighted		0	4	0	4
Proximity to Industrial Buildings (w/i 300ft of transmission center line)	**1.8%**				
Weighted					
School, Day Care, Church, Cemetery, Park Parcels (#)	**13.1%**	0	100	0	100
Weighted		0	13	0	13
Non-condemnable Properties	**44.3%**				
Weighted					
TOTAL	**100.0%**	0	21	16	27
WEIGHTED TOTAL		**0**	**7**	**5**	**9**
NATURAL	**33.0%**				
Natural Forests (acres)	**15.0%**	61	0	100	62
Weighted		9	0	15	9
Stream/River Crossings (#)	**32.3%**	100	0	0	0
Weighted		32	0	0	0
NWI Wetlands & Hydric Soil Areas (acres)	**40.3%**	100	28	88	0
Weighted		40	11	35	0
Floodplain Areas (acres)	**12.4%**	100	41	41	0
Weighted		12	5	5	0
TOTAL	**100.0%**	94	16	55	9
WEIGHTED TOTAL		**31**	**5**	**18**	**3**
ENGINEERING	**33.0%**				
Length (miles)	**40.0%**	43	0	100	22
Weighted		17	0	40	9
Miles of Rebuild w Existing T/L	**0.0%**				
Weighted					
Miles of Co-location w Existing T/L	**0.0%**				
Weighted					
Miles parallel w/ Roads	**0.0%**	100	100	0	63
Weighted		0	0	0	0
Number of Road Crossings	**10.0%**	100	0	100	0
Weighted		10	0	10	0
Areas of Steep Slopes (> 25%) (Acres)	**15.0%**	100	42	63	0
Weighted		15	6	9	0
Number of Parcels	**15.0%**	75	100	0	50
Weighted		11	15	0	8
Estimated Total Project Costs	**20.0%**	38	0	100	24
Weighted		8	0	20	5
TOTAL	**100.0%**	51	21	69	21
WEIGHTED TOTAL		**17**	**7**	**23**	**7**
SUM OF WEIGHTED TOTAL		**48**	**19**	**47**	**19**

In the second weighting process noted in Table D-6, the Weighted Total for each route, within the three perspectives, is further assessed based on the relative weight assigned to the different perspectives (i.e., the 33% noted at the top of the Perspective Weight/Metric Weight). The three perspectives (Built Environment, Natural Environment, and Engineering Requirements) were reviewed by the siting team to determine if there were any exceptional conditions relevant for this project that would validate an additional higher relative weighting of one perspective over another. To reference our earlier example, a route through a nationally recognized ecological preserve might indicate that an additional emphasis be placed on the natural environment perspective. Since no exceptional conditions were determined by the siting team each perspective was assigned an equal weight (33%). The result of these perspective weights on the weighted metric total is illustrated on the line titled "Weighted Total", also located at the bottom of each perspective. The Weighted Total values for the entire process are summed at the bottom of the table on the line titled "Sum of Weighted Total". This Sum of Weighted Total result effectively shows which of the routes has the lowest cumulative impact (i.e., a low number is preferred) to the built and natural environment while being technically feasible to construct from an engineering perspective.

Review of these cumulative values indicates that both of the northern routes, Route A (48) and Route A1 (47), would produce significantly more costs and impacts relative to both of the southern routes, Route B (19) and Route B1 (19). Specifically, inspection of the Natural Environment and Engineering Restriction Perspectives notes considerable variation between the northern and southern routes. Natural Environment metrics, for example, note higher values for Routes A (31) and A1 (18) relative to the values noted for Routes B (5) and B1 (3). The higher metrics for the northern routes result from increased incidence of wetlands, stream crossings, and acres of forest cover along the proposed alignments. Similarly, Engineering Restriction metrics note higher values for Routes A (17) and A1 (23) relative to the values noted for Routes B (7) and B1 (7). These higher metrics for the northern routes result from an increased incidence of steep slope areas along the proposed alignments and a greater total length.

The final summed and weighted metric value for both of the southern routes is the same. Some differences between the southern alignments exist when compared to each other

however, noted in the Built Environment and Natural Environment Perspectives. Built Environment metrics, for example, are higher for Route B1 (9) relative to the value noted for Route B (5). This difference is due to the higher number of residences within 300 feet identified along Route B1. Natural Environment metrics, on the other hand, note a slightly higher value for Route B (5) relative to the value noted for Route B1 (3). This difference is due to the higher number of potential wetland and floodplain crossings identified along Route B.

4.3 Expert Judgment Process and Discussions

The last step in identifying the Selected Route involved the qualitative assessment of the Alternative Routes using team based expert judgment. Team members assessed the different routes based on the following qualitative criteria: Visual Concerns, Community Concerns, Schedule Delay Risk, Special Permit Issues, and Construction/ Maintenance/Accessibility. These criteria were determined by the siting team to be most relevant to this study. As illustrated on the Expert Judgment Form (**Table D-7**), each of these variables was assigned a weight based on its significance within the scope of the project. Each of the variables on the Expert Judgment Form was ranked by the team members on a one-to-three (1-3) scale, with one (1) indicating a low impact and three (3) indicating a high impact.

TABLE D-7: Expert Judgment Form

Criteria	Weights	Effort/Jonas Route A	Effort/Jonas Route B	Effort/Jonas Route A1	Effort/Jonas Route B1
VISUAL ISSUES	10%	3	2	3	2
Weighted		0.3	0.2	0.3	0.2
COMMUNITY ISSUES	20%	2	2	2	2
Weighted		0.4	0.4	0.4	0.4
SCHEDULE DELAY RISK	20%	3	2	3	1
Weighted		0.6	0.4	0.6	0.2
SPECIAL PERMIT ISSUES	30%	3	2	3	1
Weighted		0.9	0.6	0.9	0.3
CONSTRUCTION/MAINTENANCE ACCESSIBILITY	20%	2	2	3	1
Weighted		0.4	0.4	0.6	0.2
TOTALS	**100%**	**2.6**	**2.0**	**2.8**	**1.3**

*Expert Judgment Form ranked on a scale of 1-3 with 1 indicating a low impact and 3 a high impact

The weights assigned to the variables were reviewed by the siting team to determine appropriate values. Considerations included:

- **Construction/accessibility issues and visual concerns** related to the rolling terrain and need to traverse Pohopoco Mountain were considered significant obstacles for constructing and maintaining the transmission line network, yet these same topographic features create situations that increase the visibility of the network through the landscape.
- **Schedule delays and community concerns** were not ranked as high as sometimes considered since typical schedule delays (permit requirements, right-of-way acquisition), were being proactively addressed through route alignment modifications that effectively decreased situations that would require permits, such as stream crossings and wetland impacts. Furthermore, the public outreach and open house interactions had created constructive opportunities to discuss right-of-way acquisition from the pertinent landowners, which improved the prospect of alignment modifications that further reduced the schedule delay. Additionally the public outreach process allowed for feedback from surrounding

land owners that was already incorporated into the alignment development process to help reduce some of the fundamental community concerns. To assign a high weight value to these considerations at this point would effectively double count their input in the decision making process.

4.3.1 Comprehensive Plans and Zoning Review

In preparation for the Expert Judgment process, the siting team reviewed relevant county and local documents regarding planned growth and preservation of open space, including the Monroe County Comprehensive Plan (1999), Monroe County Open Space Plan (2001), West End Open Space Plan (Chestnuthill and Polk Townships) (2003), and a Regional Joint Comprehensive Plan (includes Chestnuthill Township) (2006). The siting team also reviewed current zoning and land development ordinances for Chestnuthill and Polk Townships to determine if possible adjustments to the line routes, pole heights, or pole locations, needed to be made to adhere to these ordinances. Information from the county comprehensive plan indicated the region has a strong potential for growth for all utilities. The county open space plan further acknowledges that the high voltage transmission lines have a multiple use potential as recreation and greenway corridors.

Conversely, the local comprehensive and open space plans do not address transmission lines or their right-of-ways. In regards to local ordinances, Chestnuthill Township defers to the Pennsylvania Public Utility Commission to decide that the utility in question is reasonably necessary for the convenience or welfare of the public. Polk Township ordinances also defer to the Pennsylvania Public Utility Commission to decide that a utility is necessary. Chestnuthill Township ordinances related to height restrictions specifically notes that electric transmission lines are exempt. Polk Township has a similar height ordinance but does not specifically note the exemption of electric transmission lines.

All of these items were considered during the Expert Judgment process and were incorporated into the decision-making process where practical.

4.3.2 Visual Concerns

Initial Team discussions focused on visibility concerns. As noted in **Exhibit E** (Design and Engineering), the transmission line network would utilize single pole structures that would be between 95 to105 feet in height and have a average lane span length of 500 to 600 feet, which is similar to the existing Siegfried-Jackson 138 kV line that is located within the project study area. Team members revisited the field assessment that they conducted to assess the visibility of the existing Siegfried-Jackson 138 kV line, which occurred in mid-winter and early-spring when leaf cover was low and the ability to evaluate the landscape high. Reviewing the surrounding and similar land use and land cover of the new route alignments to this existing route offered an excellent comparison frame of reference for potential visual impacts.

During those field visits, it was observed that the existing Siegfried-Jackson 138 kV alignment (poles and line) was most visible while crossing over steep slope areas and in the open agricultural and tree farm areas, but that visibility decreased significantly in the mature forested areas, which have an average height of approximately 75 to 85 feet. In these forested areas, the tops of the transmission poles extended minimally above the treetops and were indiscernible from a distance. From the perspective of the various residential developments through which it passed, the visibility of the Siegfried-Jackson 138 kV alignment was notably evident in the unforested residential communities, but usually imperceptible within the forested residential areas. Due to the dense tree growth, the alignment was generally hidden by the forest and could not be distinguished at a distance of 100 feet within the forested areas. It should be noted that many of these residential developments, which have housing units within 100 feet of the existing alignment, were developed after the construction of the Siegfried-Jackson 138 kV transmission line. Also observed during the field visit was that the undulating topography actually decreased the visibility of the alignment relative to adjacent residential communities and potential view points located along the local roadways.

Based on this information, team discussions concluded the following:

- Poles will need to be placed adjacent to all road crossings to maintain a required distance above the local distribution and communication network that parallels the road; poles at these locations would have the highest visibility
- Span length between poles could extend up to 1,000 feet in highly desirable areas, such as along or over steep slopes, or over stream and wetland crossings
- Visibility of the poles may not be reduced in areas of steep slopes due to the need to construct sturdier pole arrangements required to support the added span length; this is particularly significant in regards to the arrangement proposed to traverse Pohopoco Mountain
- However, because increasing span length would result in fewer poles, increasing span length may reduce visual impact.
- Through the use of selective pole placement, the visibility of the alignment could be reduced by utilizing lower topographic spots or bypassing around, rather than over, higher topographic spots
- Visibility of the poles within agricultural areas could be reduced by paralleling the alignment with adjacent tree lines that typically border the productive fields
- Utilization of forested areas to reduce visibility could be incorporated into the proposed alignments through coordination with applicable landowners

In regards to the different Alternative Routes, the Expert Judgment Team concluded that visibility concerns were deemed more problematic for the northern routes (Route A and Route A1). This conclusion was based on the observations that the area around these two Alternative Routes is more densely populated, has several proposed road crossings over the same primary road, a higher incidence of steep slopes, and an extended length of the alignment.

Compared to each other, an assessment of Alternative Route B to Alternative Route B1 concluded that the difference in the visual concerns associated with these two routes would not be significant. Each of these routes traverses similar landscapes and cross the same roads and stream valleys.

4.3.3 Community Concerns

Community concerns raised in response to the proposed transmission line range from potential personal affects (Electric and Magnetic Fields (EMF), visual) to potential community-wide affects (decrease in property values, impacts to environment). To proactively address some of these concerns, PPL Electric has communicated the alignment rationale and route options via newspaper announcements and residential mailings, conducted two Open Houses, maintained an e-mail and phone system to document and address specific concerns, and met individually with numerous landowners. These measures have significantly improved the alignment analysis by presenting landowners opportunities to provide guidance on potential route alignments across their properties. Neighboring landowners have also benefited by being presented information on the nature and limits of potential EMF from the proposed alignment, as well as the limited impact of the alignment on property values.

Despite these measures, a focused community concern regarding the potential impact of the proposed alignment to specific neighborhoods and an adjacent environmentally sensitive area (Jonas Mountain Preserve) has been maintained. This area of concern is located between Jonas Road and the crest of Pohopoco Mountain, which is a section that is traversed by all four potential alignments. Alternatives in this section are limited and involve either increasing forest fragmentation in Jonas Nature Preserve by creating a direct route up Pohopoco Mountain, or decreasing this impact by moving closer to and paralleling the edge of an adjacent residential neighborhood, which is opposing the proximity to their homes. As noted in Section 2.7.4 above, a consensus on the route alignment through this area had been coordinated with the landowners. The route would be moved several hundred feet west of the residential neighborhood. Although this alignment would increase the fragmentation of the Jonas Mountain Preserve, PPL Electric has coordinated the purchase of an adjacent forested parcel, through which the alignment also traverses, to be donated to the Jonas Mountain Preserve.

Since the primary community concern has been centered on a location common to the different Alternative Routes, the Expert Judgment Team concluded that community concerns were deemed equally problematic for all four potential routes.

4.3.4 Schedule Delay

Risk of schedule delay is directly related to the other variables discussed under the Expert Judgment section. For example, negative community reaction, complicated right-of-way acquisition, additional field studies for environmental permit clearance, and construction complexity can result in delayed schedules. As is discussed in these different sections, many of the potential reasons for schedule delays along each of the Alternative Routes are being proactively addressed.

In regards to the different Alternative Routes, the Expert Judgment Team concluded that schedule delay concerns were deemed more problematic for the northern routes (Route A and Route A1). This conclusion was based on the increased visibility of the proposed routes, additional permit requirements anticipated for the intricate crossing of Pohopoco Creek and adjoining wetlands, and construction complexity associated with the various steep slopes and roadway crossings.

Assessment of Alternative Route B compared to B1 concluded that Route B would have more schedule delay issues. This difference is based on the potential need for more special permits and studies, as well as a relative increase in the construction complexity of Route B.

4.3.5 Special Permit Requirements

There are various types of permits that may be required for the development of a new transmission alignment. Depending on the degree of stream or wetland impact, the U.S. Army Corps of Engineers (USACE) may require that a Section 404 encroachment permit be obtained for work conducted in these areas. A similar permit (Section 105) from the Pennsylvania Department of Environmental Protection (PADEP) would also be required for these activities. For specific low-impact activities, such as for overhead stream crossings, minor road crossings, and temporary stream crossings, PADEP may require General Permits to be obtained. PADEP, in conjunction with the county conservation district, may also require permits for stormwater discharge activities. The special permit requirements for stormwater discharge increase depending on the water quality of the receiving stream, thus HQ and EV streams having more stringent protection. Other

permits, such as for highway occupancy or aviation safety, may be required from other specific state or federal agencies.

Often, to acquire these permits, other forms of studies and clearances need to be conducted and obtained. For example, to obtain the USACE Section 404 permit, the wetland and stream boundaries need to be confirmed through a jurisdiction determination conducted by the USACE. Furthermore, specific studies related to threatened and endangered species or historic and cultural features also need to be conducted, and documented compliance with the appropriate government agency obtained, prior to receiving the Section 404 permit. The complexity of the permits and their associated requirements depends upon the environmental and cultural context of the proposed activities.

Team discussions focused on the environmental and cultural information acquired for the project study area through literature review and field visits. Based on these sources, potential studies for cultural/historic features and threatened/endangered species are equally relevant for all of the alternatives. Differences between the various routes were more evident in regards to the potential number of road crossings and areas of wetland/stream impacts. From the Alternative Route assessment, it was concluded that the northern routes would need to cross an increased number roads and roads with a higher activity level, such as Route 115 and Jonas Road. From the field visits, it was observed that the wetland and stream complex associated with the confluence of Pohopoco and Poplar Creeks (adjacent to Zeigler Road along the northern route) would be a very difficult area to construct transmission poles and span transmission lines without impacting the permitted features. The proposed work would be further complicated by the steep slopes on either side of the stream/wetland network, and the additional stormwater requirements that would need to be addressed for the stream, which is presently a CWF but may be elevated to HQ based on existing use.

In regards to the different Alternative Routes, the Expert Judgment Team concluded that permit requirement concerns were deemed more problematic for the northern routes (Route A and Route A1). This conclusion was based on extensive permit requirements

anticipated for the roadway crossings, stormwater management, and the intricate crossing of Pohopoco Creek and adjoining wetlands.

Assessment of Alternative Route B compared to B1 concluded that Route B would have more special permit requirements. This difference is based on the increased presence of hydric soils, an indicator of potential wetlands, and floodplain areas along Route B.

4.3.6 Construction/Maintenance/Accessibility

Discussions for this section took into consideration the variables involved in constructing a transmission line network, conducting mandatory routine maintenance of the facilities, and providing appropriate access to all the required areas. Initial construction phases require the use of various types of heavy machinery (bulldozers, cranes, cement mixers) that need to traverse the landscape to the proposed pole positions. These vehicles aid in leveling out the access roads and footer/pad areas, digging the footer or creating the concrete foundations, and erecting the pole structures. Typically, wire installation is conducted by hand, with construction personnel carrying lighter leader lines between poles and using small power equipment to pull the line taught and haul the heavier line into place. This process often allows the lines to be strung over wetlands or stream valleys, thereby decreasing potential impacts to protected features and avoiding steep slopes. Due to the ability to bypass certain complex areas between the poles, the access road system does not necessarily need to extend for the entire length of the proposed alignment. This decrease in access road length also reduces the potential for various permits. The access road system would only need to assure admission to the pole locations for routine inspections and maintenance requirements.

Based on this information, team discussions concluded the following:

- Construction and maintenance access over agricultural areas would utilize existing farm roads wherever possible, thereby eliminating access road construction at these locations
- Span length between poles could extend up to 1,000 feet in highly desirable areas, such as along or over steep slopes, or over stream and wetland crossings

In regards to the different Alternative Routes, the Expert Judgment Team concluded that constructability concerns were deemed more problematic for the northern routes. This conclusion was based on the observations that the alignment along these two Alternative Routes has a higher incidence of steep slopes, more stream crossings, larger wetland crossing area, and a longer length. Sections of the southern routes cross less intensive agricultural land, have less stream and wetland crossings, and have a lower incidence of steep slopes. A large area of the agricultural land on the southern route was observed to be fallow overgrown fields with no active farming.

Assessment of Alternative Route B compared to B1 concluded that Route B would have more construction and access issues. This difference is based on the increased presence of steep slopes and the number of proposed alignment turns located along Route B.

4.4 Expert Judgment Conclusion of Selected Route

The following summarizes the variables reviewed and conclusions determined by the Expert Judgment Team:

- Visibility concerns were deemed more problematic for the northern routes (Route A and Route A1) when compared to the southern routes (Routes B and Route B1) based on the observations that the northern area is more densely populated, has several proposed road crossings over the same primary road, a higher incidence of steep slopes, and an extended length of the alignment.
- Relative visibility concerns between the two southern routes (Route B and Route B1) were deemed insignificant as each of these routes traverses similar landscapes and cross the same roads and stream valleys.
- Community concerns, which have been centered on a location common to all four Alternative Routes, were deemed equally problematic for all four potential routes.
- Schedule delay concerns were deemed more problematic for the northern routes (Route A and Route A1) when compared to the southern routes (Routes B and Route B1) based on the increased visibility of the proposed routes, additional permit requirements anticipated for the intricate crossing of Pohopoco Creek and

adjoining wetlands, and construction complexity associated with the various steep slopes and roadway crossings.

- Schedule delay concerns between the two southern routes (Route B and Route B1) concluded that Route B would have more schedule delay issues based on the potential need for more special permits and studies, as well as a relative increase in the construction complexity.
- Permit requirement concerns were deemed more problematic for the northern routes (Route A and Route A1) when compared to the southern routes (Routes B and Route B1) based on the extensive permit requirements anticipated for the roadway crossings, stormwater management, and the intricate crossing of Pohopoco Creek and adjoining wetlands.
- Schedule delay concerns between the two southern routes (Route B and Route B') concluded that Route B would have more special permit requirements based on the increased presence of hydric soils, an indicator of potential wetlands, and floodplain areas along Route B.
- Constructability concerns were deemed more problematic for the northern routes (Route A and Route A') when compared to the southern routes (Routes B and Route B1) based on the observations that these alignment have a higher incidence of steep slopes, more stream crossings, larger wetland crossing area, and a longer length.
- Constructability concerns between the two southern routes (Route B and Route B') concluded that Route B would have more construction and access issues based on the increased presence of steep slopes and the number of proposed alignment turns located along Route B.

Expert Judgment Team values illustrated in Table D-7 indicate that Route B1 scored the best and Routes A and A1 scored the worse out of the four routes. This was due primarily to the visual concerns and permit requirements associated with the Route A and A1 alignments. The two lowest (best) scoring routes, Route B and B1, reflect more desirable circumstances, but Route B1 scored better due to less schedule delay risks, permit issues,

and constructability concerns. Therefore, based on the quantitative assessment of the Alternative Routes, in conjunction with the qualitative Expert Judgment process, Route B1 was chosen as the Selected Route, which is illustrated on **Figure D-15**.

4.5 Description of Selected Route

The Selected Route, described below, was primarily developed through aerial analysis of the environmental, cultural, and social characteristics of the study area, as well as limited field assessment of the proposed alignment. Through this process, all airports and potential archeologic, geologic, historic, scenic, or wilderness areas within two miles of the selected route right-of-way have been located and identified. Further studies into these valued items, primarily archeologic, are still in process. As such, minor changes to this alignment are anticipated as more in-depth information becomes available.

The Selected Route is 5.70 miles in length. The route will tie into the Siegfried-Jackson 138 kV Transmission Line on the west side of Route 115, 0.5-mile northwest of the Village of Effort, in Chestnuthill Township. The following narrative describes the alignment of this route:

- The new transmission line will tap into the existing Siegfried-Jackson 138 kV Transmission Line at the top of a hill located between Astolat Road to the south and Pheasant Run Road to the north.
- The line would then proceed 1,800 feet to the northwest, crossing above Pheasant Run Road and Pheasant Run, a tributary to the HQ-classified Pohopoco Creek. Initially, the line would traverse through a forested area east of The Pines residential development, cross over a meadow area associated with Pheasant Run, and enter another forested area north of Pheasant Run Road. The terrain associated with Pheasant Run is moderately steep and the floodplain is relatively narrow. A narrow wetland associated with the floodplain would be crossed at this point. Some of the aerial crossing in this segment would parallel Hillside Memorial Cemetery.
- After turning west, the line would proceed for 9,000 feet, generally paralleling Pheasant Run Road to the north. In this section, the line would pass through a

mix of forested lands and agricultural fields. To minimize impacts to these and all other crop fields, the line was adjusted to utilize farm roads, forested edges, and maximum pole distances. The line would cross Burger Hollow Road and New York Boulevard in this section. After crossing Burger Hollow Road, the line enters into Polk Township. Prior to crossing New York Boulevard, the line would cross over an unnamed tributary to Middle Creek. This stream, which is classified as a CWF stream, has minimally steep slopes and a narrow floodplain. Several small wetland crossings are anticipated along this section.

- For 7,000 feet, the new transmission line would head north toward Jonas Road. The line would then turn to the northwest for 4,400 feet, generally paralleling Jonas Road to the south. This 11,400 foot section primarily lies within the Trexler Boy Scout Reservation. In this section, the line traverses primarily through forested land and crosses over Middle Creek, a CWF classified stream with moderately steep banks and a narrow floodplain. Narrow wetland areas associated with the floodplain and headwater area of Middle Creek, and its tributaries, would be crossed in this section.

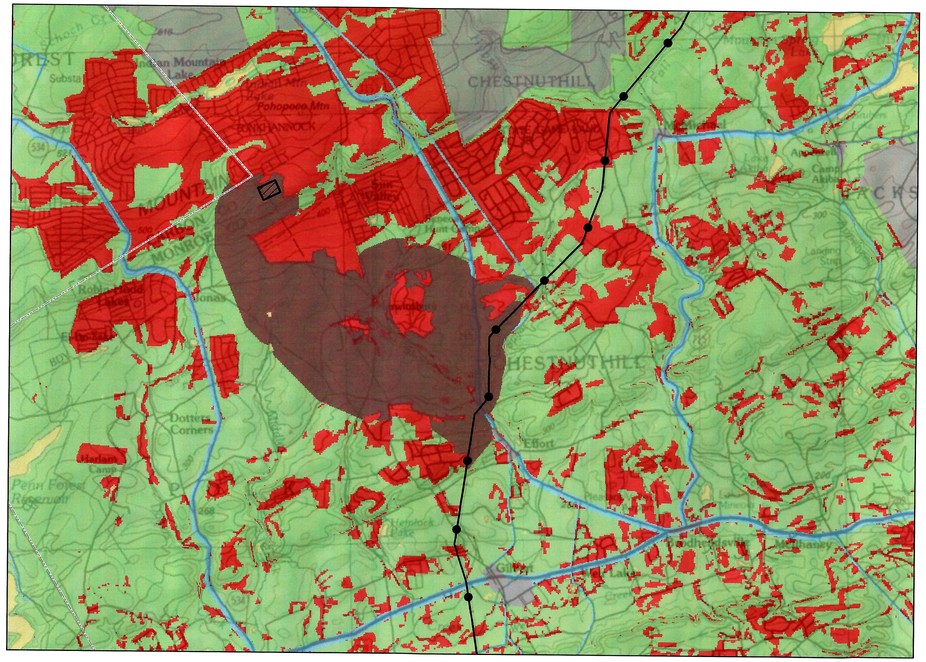
- East of the Village of Jonas, the line would turn north, crossing Jonas Road and proceed 4,000 feet toward and up to the crest of Pohopoco Mountain. The majority of this segment would traverse through forest lands, some of which are part of the Jonas Mountain Preserve. The slope up Pohopoco Mountain is extremely steep. Narrow wetland areas associated with the headwater area of various Middle Creek tributaries may be crossed in this section.

- After cresting Pohopoco Mountain, the line would turn to the northeast and proceed 1,600 feet down into a shallow valley that is the headwater area for Jonas Creek, a HQ-classified stream. The line would then turn east and proceed another 1,600 feet to the proposed substation site. Within this section, the line crosses back into Chestnuthill Township. This segment would traverse through forest lands that are part of the Indian Mountain Lake Homeowners Association.

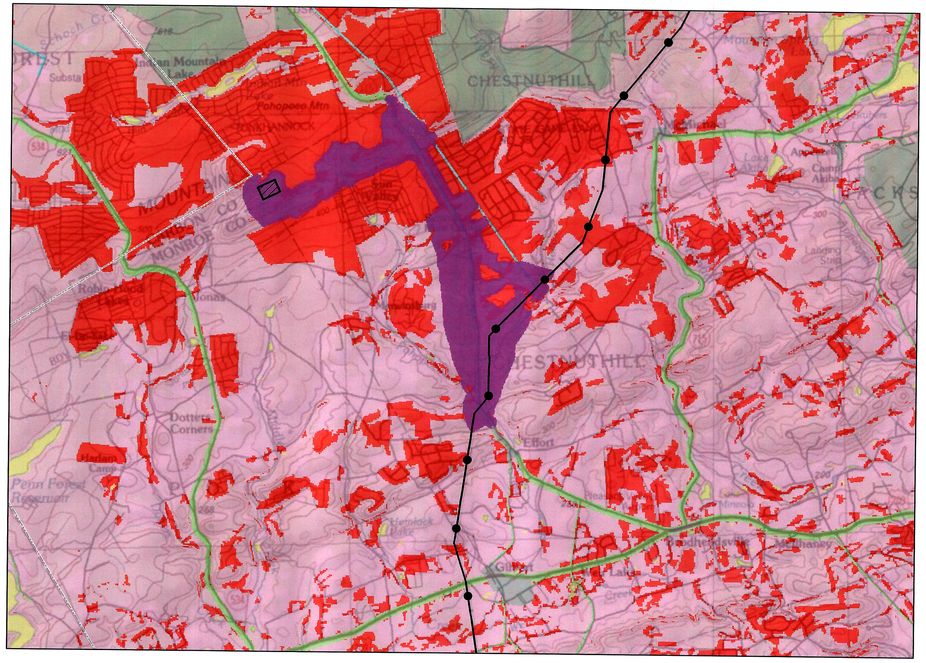
- The transmission line would end at the proposed substation that would be constructed along the southwestern boundary of the Indian Mountain Lake

community and at least 500 feet upslope from Jonas Creek. The substation would be located 500 feet west of Reynolds Road in a forested section of land owned by the Indian Mountain Lake Homeowners Association.

Exhibit D-Figures



A - Cross Country Surface and Generated Macro Corridor



B - Paralleling Roads Surface and Generated Macro Corridor

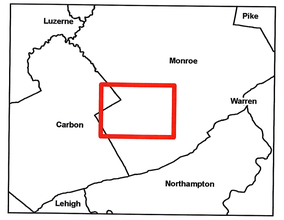
Legend

- Existing Tap Transmission Line
- Potential Substation Area

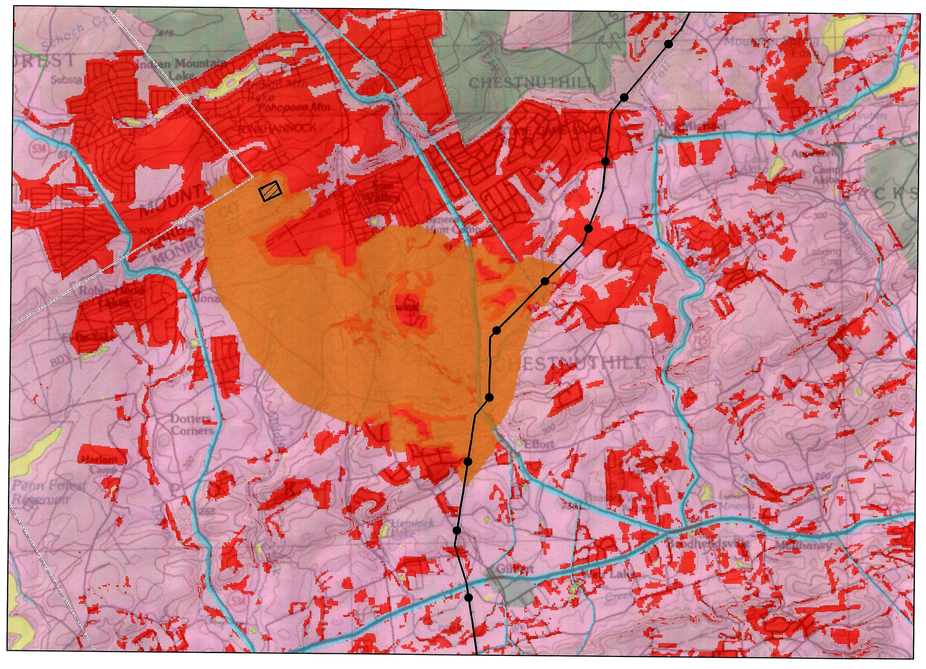
Surface Evaluation Values (as defined by EPRI-GTC)

- Value - 1 (Most Desirable)
- Value - 2
- Value - 5
- Value - 7
- Value - 9 (Least Desirable)
- Parallel/Rebuild Existing Transmission Macro Corridor
- Cross Country Macro Corridor
- Parallel with Roads Macro Corridor
- County Boundary

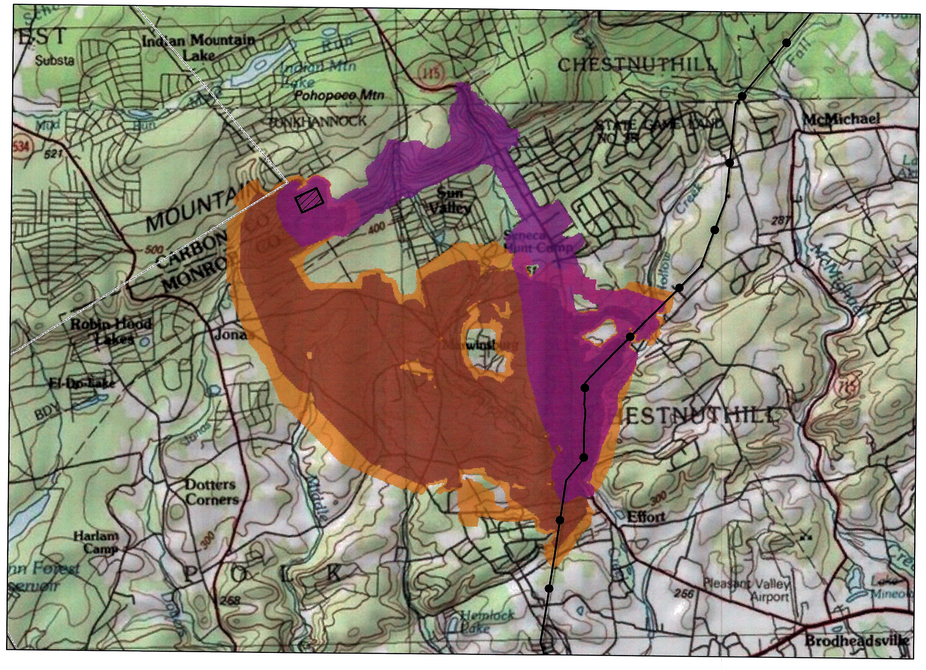
See associated Table D-1 for detail ranking of opportunity and constraint parameters



Key Map - Not to Scale



C - Paralleling Existing Transmission Surface and Generated Macro Corridor



D - Combined Macro Corridors

N

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

U.S Geological Survey 7.5" Topographic Maps
Mount Pocono, Pocono Pines, Saylorsburg, and Brodheadsville, Blakeslee, Pohopoco Mountain
Note: County Boundary Is Incorrect. See Correct Line Per Legend.

Maps 1 - 3

0 2,500 5,000 10,000 15,000 20,000 Feet

1 inch = 5,000 feet

Map 4

0 2,000 4,000 8,000 12,000 16,000 Feet

1 inch = 4,000 feet

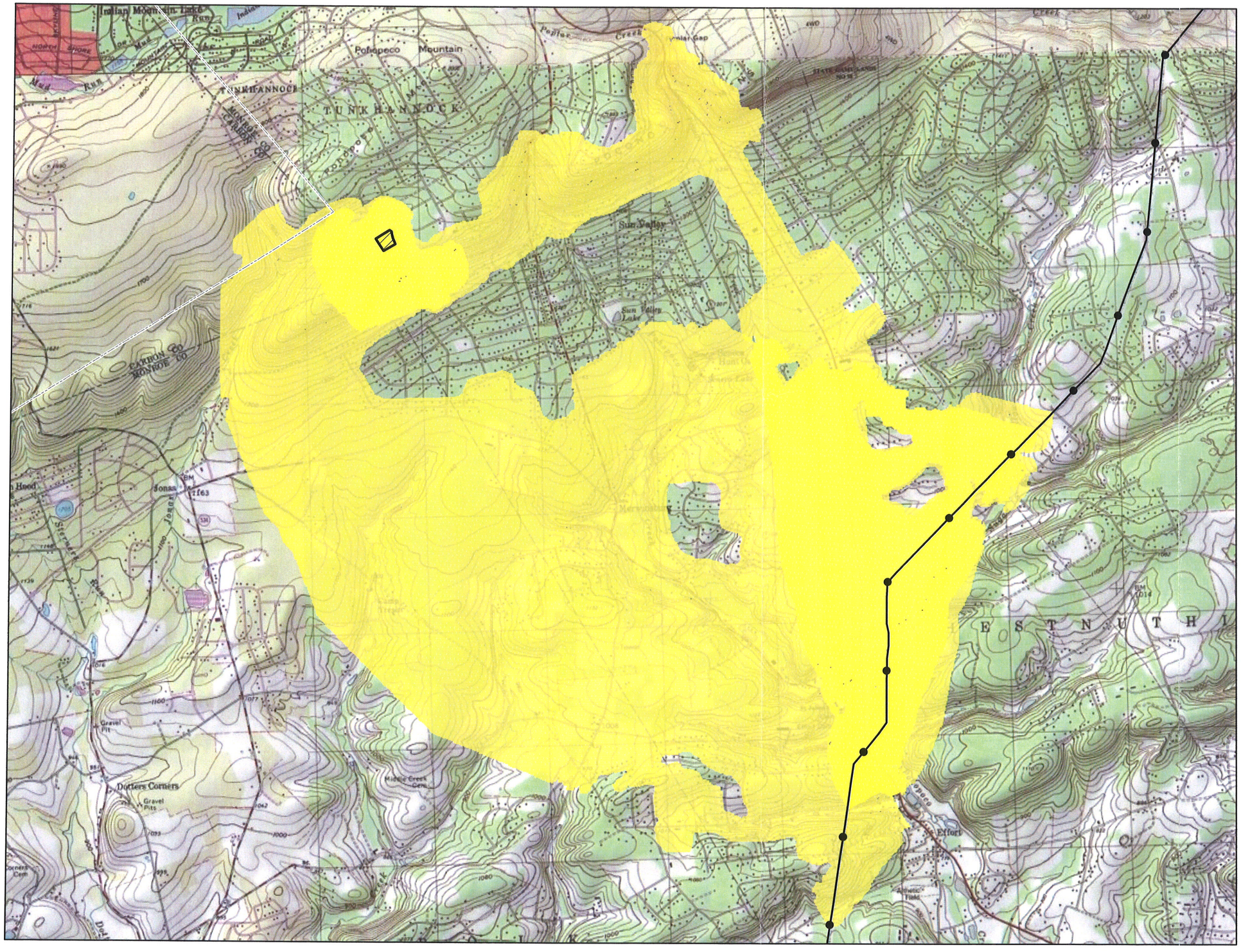
PPL Electric Utilities

URS

Exhibit D - Figure 1
Composite Suitability Surfaces & Macro Corridor Maps
Effort Mountain #1 & #2
138 kV Taps

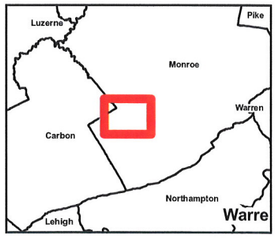
PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB	Checked By: MLR
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\Exhibit D-1 Macro Corridor Generation.mxd



Legend

- Proposed Substation Area
- Existing Tap Transmission Line
- Extent of Detailed Alternative Corridor Study Area
- County Boundary



Key Map
Not to Scale

N

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

U.S Geological Survey Enhanced 100K Scale Topographic Maps - Scranton & Allentown
Note: County Boundary Is Incorrect. See Correct Line Per Legend.

0 1,375 2,750 5,500 Feet

1 inch = 2,750 feet

PPL Electric Utilities

URS

Exhibit D - Figure 2
Extent of Detailed Alternative Corridor Study Area
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB	Checked By: VP/MMR
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\Effort Mountain Macro Corridors Figure 1 11x17.mxd



Legend

- Existing Tap Transmission Line
- Proposed Substation Area

Existing Land Use

- Agriculture
- Communication/Transportation/Utilities
- Cultural, Public/Private Parks & Recreation
- Developed
- Educational Services
- Forested
- Government Services
- Hotels
- Industrial
- N.E.C.
- Orchard
- Residential
- Resorts & Group Camps
- Retail Trade
- Services & F.I.R.E.
- Vacant



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008
Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

ppl PPL Electric Utilities

URS

Exhibit D - Figure 3
Existing Land Use
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB/RRM III	Checked By: MMR
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\PhaseIII\Exhibit D-3 Existing Land Use Map.mxd

TUNKHANNOCK

PENN FOREST

POLK

CHESTNUTHILL

3007

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534

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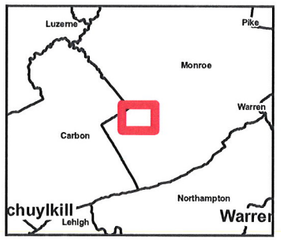
Legend

- Existing Tap Transmission Line
- Proposed Substation Area
- Municipalities
- Agricultural Conservation Easements
- Agricultural Security Areas
- PA Act 319 Preferential Assessment Parcels



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008
Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

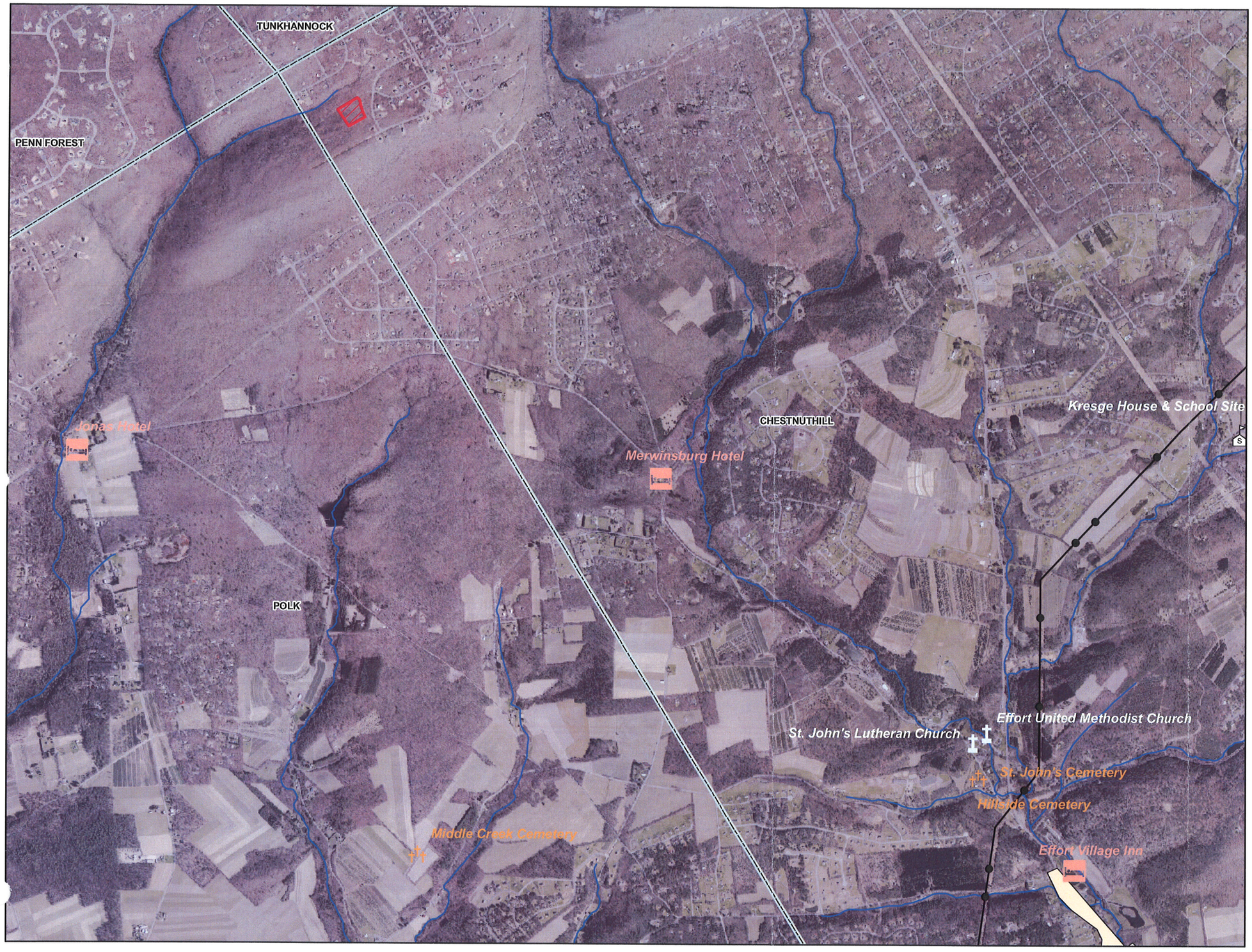
ppl PPL Electric Utilities

URS

Exhibit D - Figure 4
Agricultural Preservation
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB/RRM III	Checked By: MMR
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\PhaseIII\Exhibit D-4 Agricultural Preservation Map.mxd

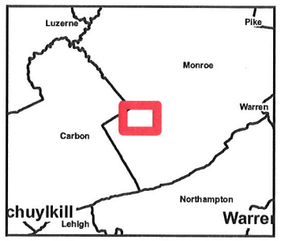


Legend

- Cemetery

Historic & Cultural Buildings

- Church
- Hotel
- School
- Existing Tap Transmission Line
- Streams
- Historic Zones
- Proposed Substation Area
- Municipalities



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008 Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

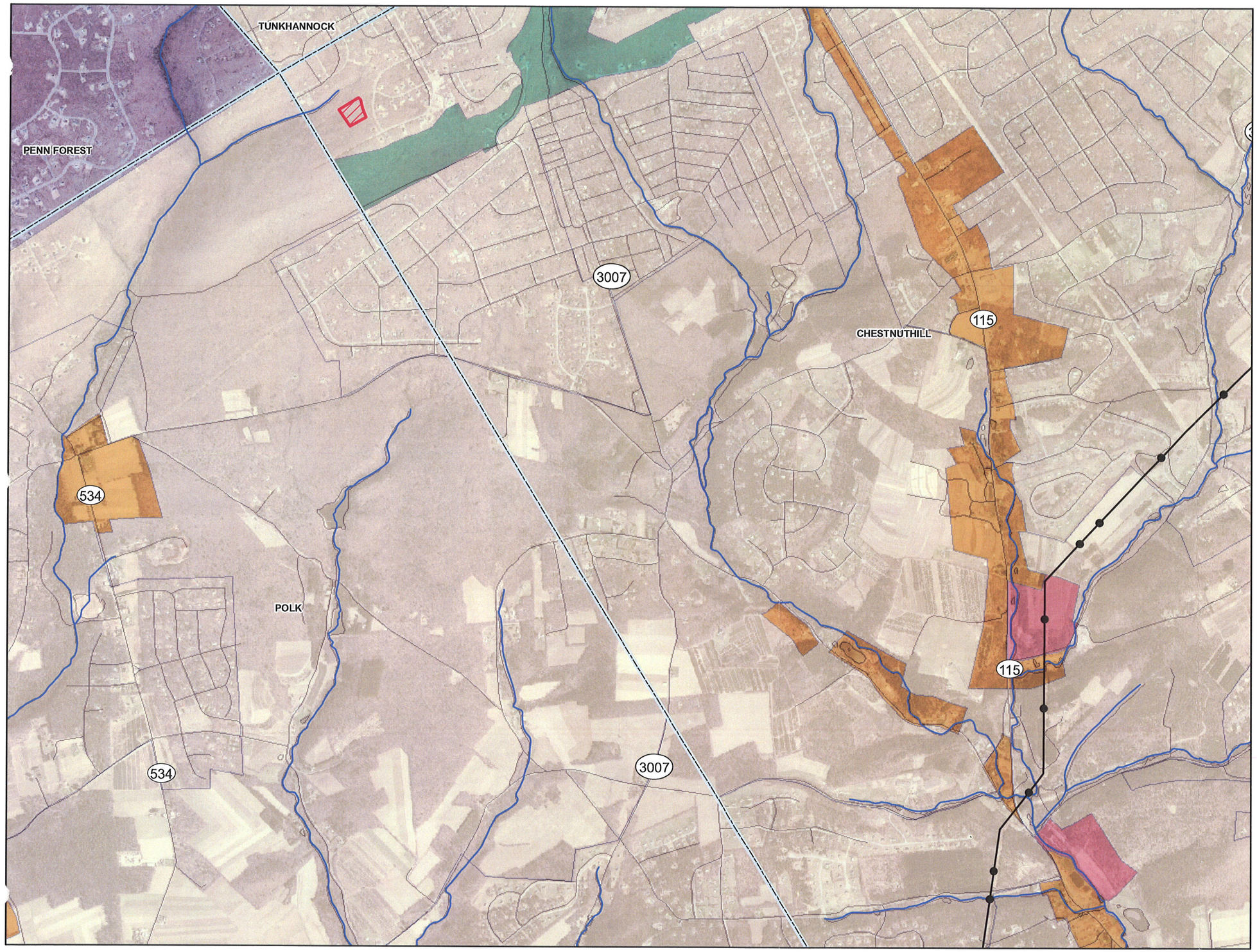
PPL Electric Utilities

URS

Exhibit D - Figure 5
Cultural & Historic Features
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB	Checked By: MMR
Job: 19998145.00002	O:\GIS_Data\PPL\EFFORTMTN\Projects\PUCApp\Exhibit D\PUC_App\Exhibit D-5 Cultural & Historic Features.mxd

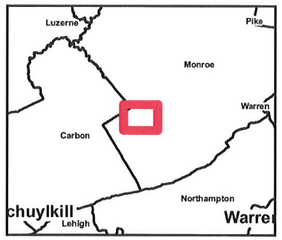


Legend

- Existing Tap Transmission Line
- Streams
- Proposed Substation Area
- Municipalities

Zoning

- Conservation
- Residential
- Commercial
- Industrial



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008
Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

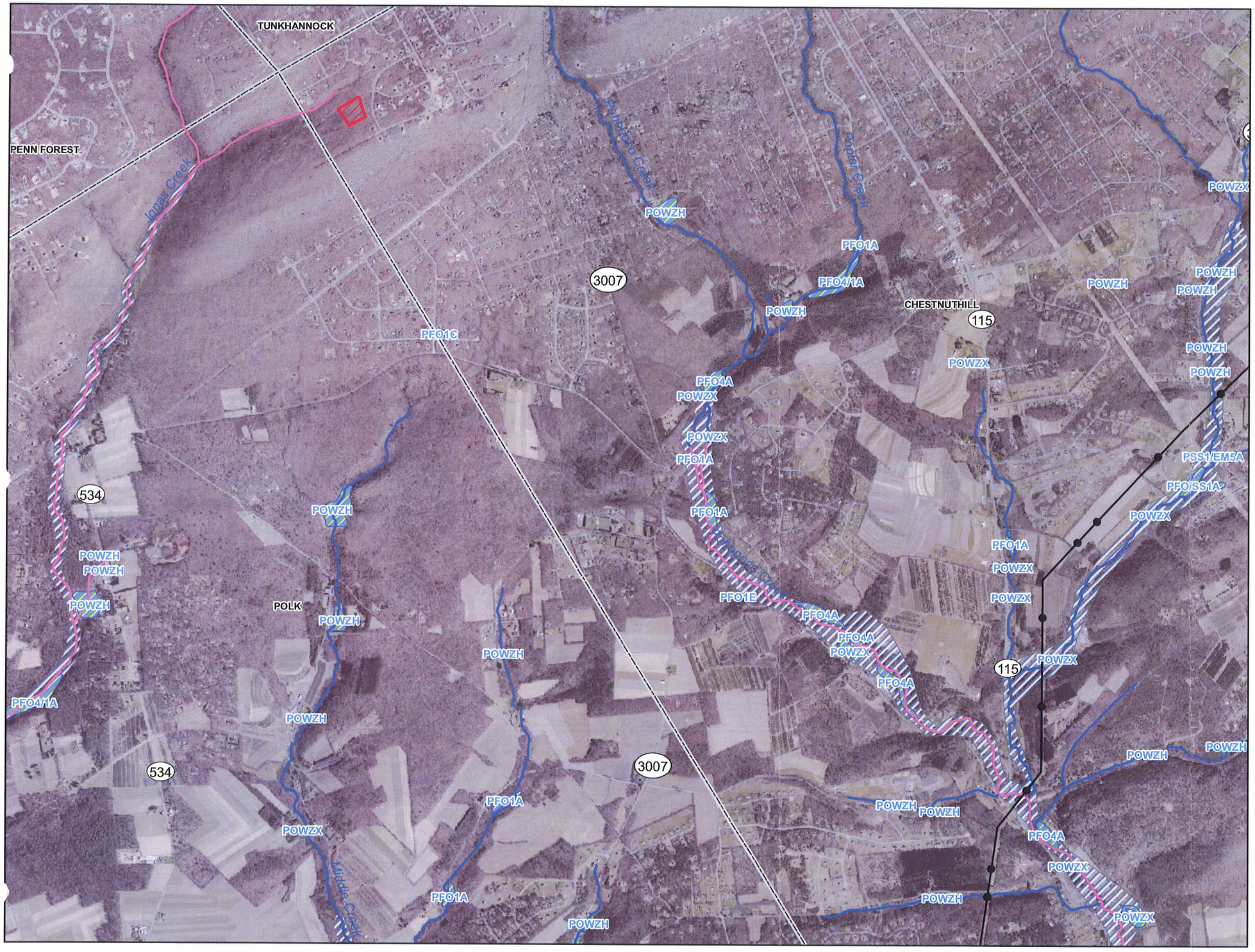
PPL Electric Utilities

URS

Exhibit D - Figure 6
Zoning Map
Effort Mountain #1 & #2
138 kV Taps

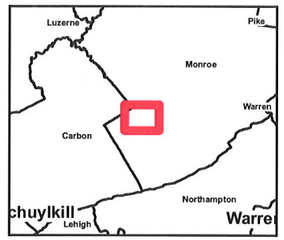
PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB	Checked By: MMR
Job: 19998145.00002	Q:\GIS_Data\PPL\EFFORTMTN\Projects\PUCApp\Exhibit\D\PUC_App\Exhibit D-6 Zoning Map.mxd



Legend

- Existing Tap Transmission Line
- Cold Water Fishes
- High-Quality - Cold Water Fishes
- NWI Wetlands
- 100-Year Floodplains
- Proposed Substation Area
- Municipalities



Key Map
Not to Scale

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

N

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008 Monroe and Carbon Counties

NOTE: POW wetland classification refers to ponds

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

PPL Electric Utilities

URS

Exhibit D - Figure 7
Natural Features
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB	Checked By: MMR
Job: 19998145.00002	Q:\GIS_Data\PPL\EFFORTMTN\Projects\Exhibit D-7 Natural Features.mxd

TUNKHANNOCK

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CHESTNUTHILL

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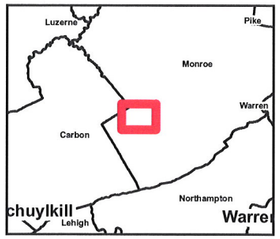
Legend

- Existing Tap Transmission Line
- Proposed Substation Area
- Municipalities
- Steep Slopes >25%
- Steep Slopes 15-25%



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008 Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

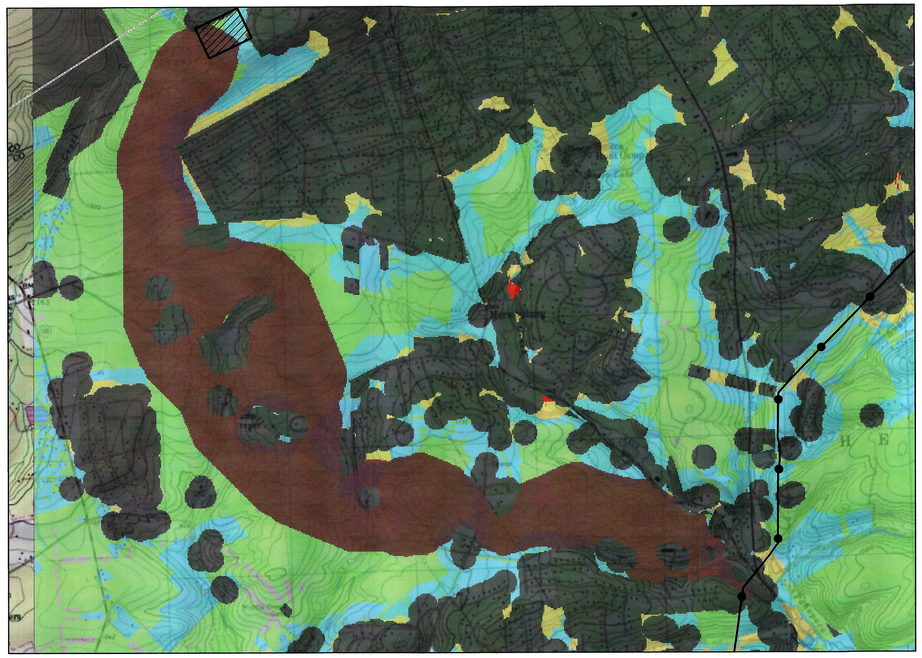
PPL Electric Utilities

URS

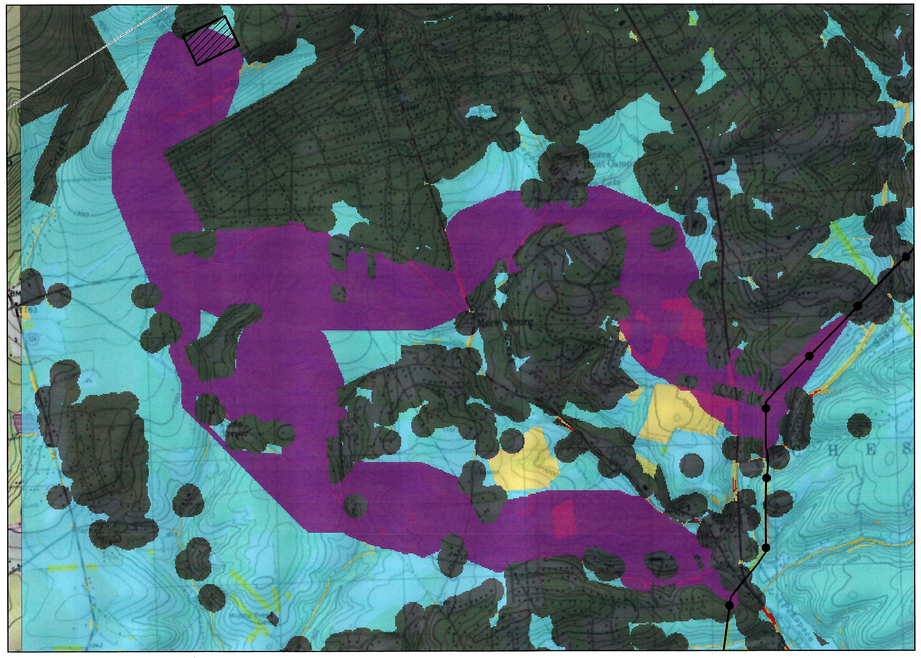
Exhibit D - Figure 8
Steep Slopes
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB	Checked By: MMR
Job: 19998145.00002	Q:\GIS_Data\PPL\EFFORTMTN\Projects\Exhibit D-8 Steep Slopes.mxd



Map 1 - Built Environment Perspective Potential Routes



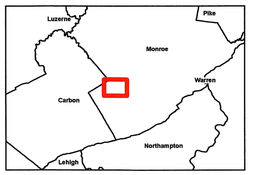
Map 2 - Engineering Perspective Potential Routes

Legend

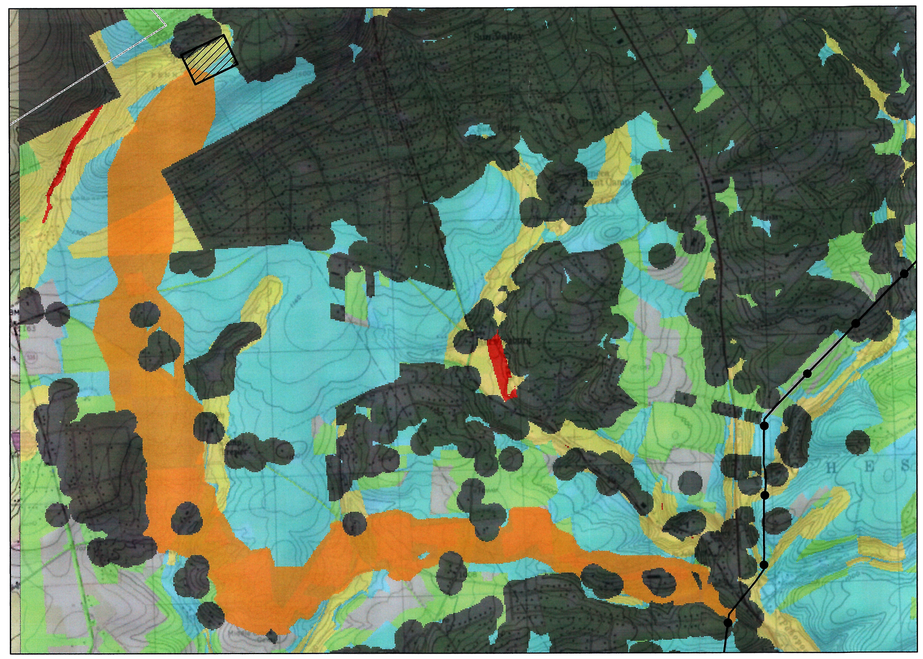
- Existing Tap Transmission Line
- Potential Substation Area

Perspective Values

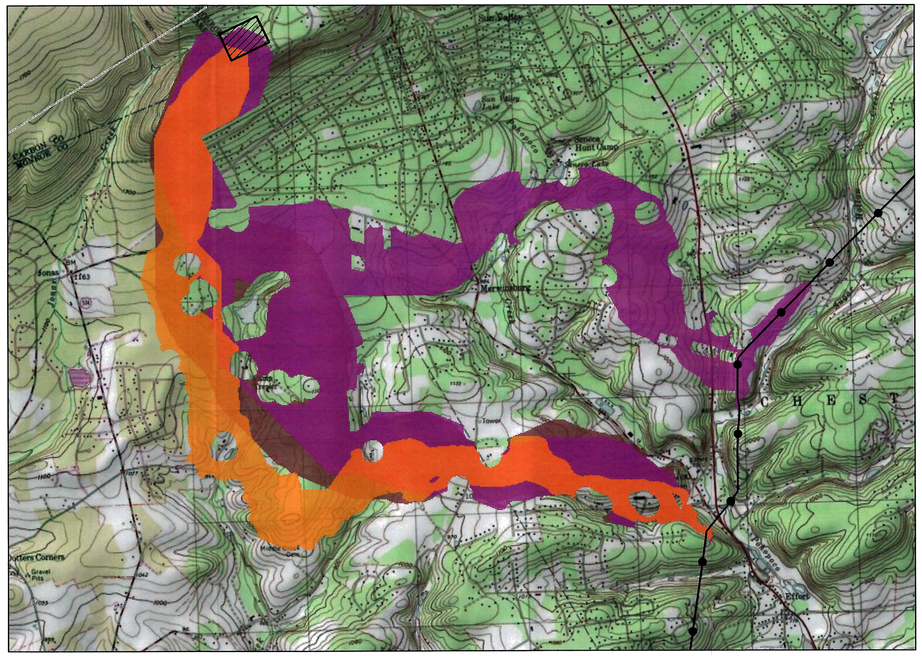
- Avoidance Areas
- Value - 1 (Most Desirable)
- Value - 2
- Value - 3
- Value - 4
- Value - 5 (Least Desirable)
- Built Environment Perspective Corridor
- Engineering Perspective Corridor
- Natural Environment Perspective Corridor
- County Boundary



Key Map - Not to Scale



Map 3 - Natural Environment Perspective Potential Routes



Map 4 - Alternative Corridor Review Areas

N

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

U.S Geological Survey 7.5" Topographic Maps
Mount Pocono, Pocono Pines, Saylorsburg, and Brodheadsville, Blakeslee, Pohopoco Mountain
Note: County Bourdary Is Incorrect. See Correct Line Per Legend.

Maps 1 - 3

0 1,000 2,000 4,000 6,000 8,000 Feet

1 inch = 2,000 feet

Map 4

0 1,125 2,250 4,500 6,750 9,000 Feet

1 inch = 2,250 feet

PPL Electric Utilities

URS

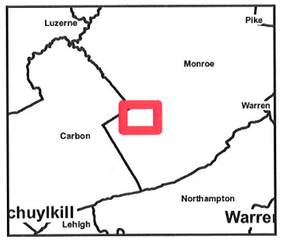
Exhibit D - Figure 9
Composite Suitability Surfaces & Alternative Corridor Maps
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: RRM/BAB	Checked By: BAB
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\PUCApp\Exhibit D Figure 9.mxd

Legend

- Model Generated Optimal Engineering Perspective Route
- Model Generated Optimal Environmental Perspective Route
- Model Generated Optimal Built Environmental Perspective Route
- Proposed Substation Area
- Existing Tap Transmission Line
- Parcels



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008 Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

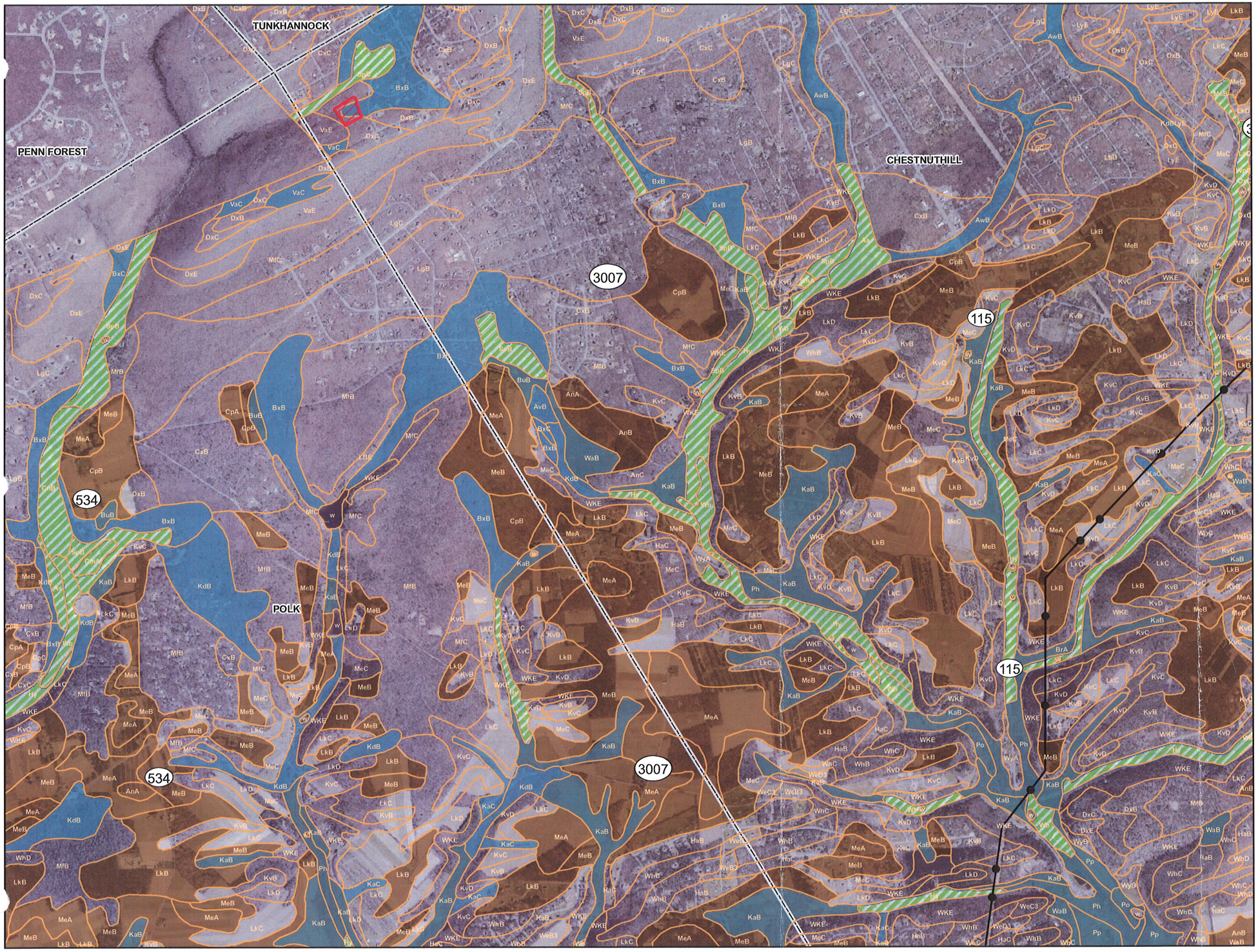
ppl PPL Electric Utilities

URS

Exhibit D - Figure 10
Model Generated Alternative Routes
Effort Mountain #1 & #2
138 kV Taps

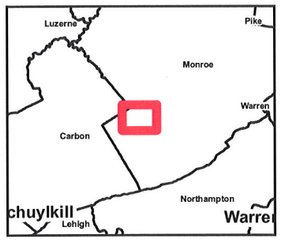
PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB	Checked By: MMR
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\IPUCApp\Exhibit D\Effort Mnt Phase III Alternative\Routes Figure 2.mxd



Legend

- Existing Tap Transmission Line
- Proposed Substation Area
- NRCS Soils
- Municipalities
- Hydric Soils
- Hydric Inclusions
- Prime Agricultural Soils



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008 Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

URS

Exhibit D - Figure 11
Soil Characteristics
Effort Mountain #1 & #2
138 kV Taps

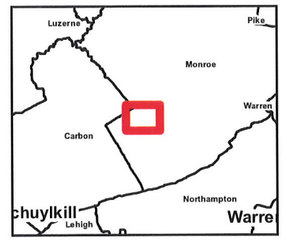
PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: BAB	Checked By: MMR
Job: 19998145.00002	Q:\GIS_Data\PPLIEFFORTMTN\Projects\Exhibit D-11 Soil Characteristics.mxd



Legend

- Alternative Route A
- Alternative Route B
- Proposed Substation Area
- Existing Tap Transmission Line
- Parcels



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008 Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

ppl PPL Electric Utilities

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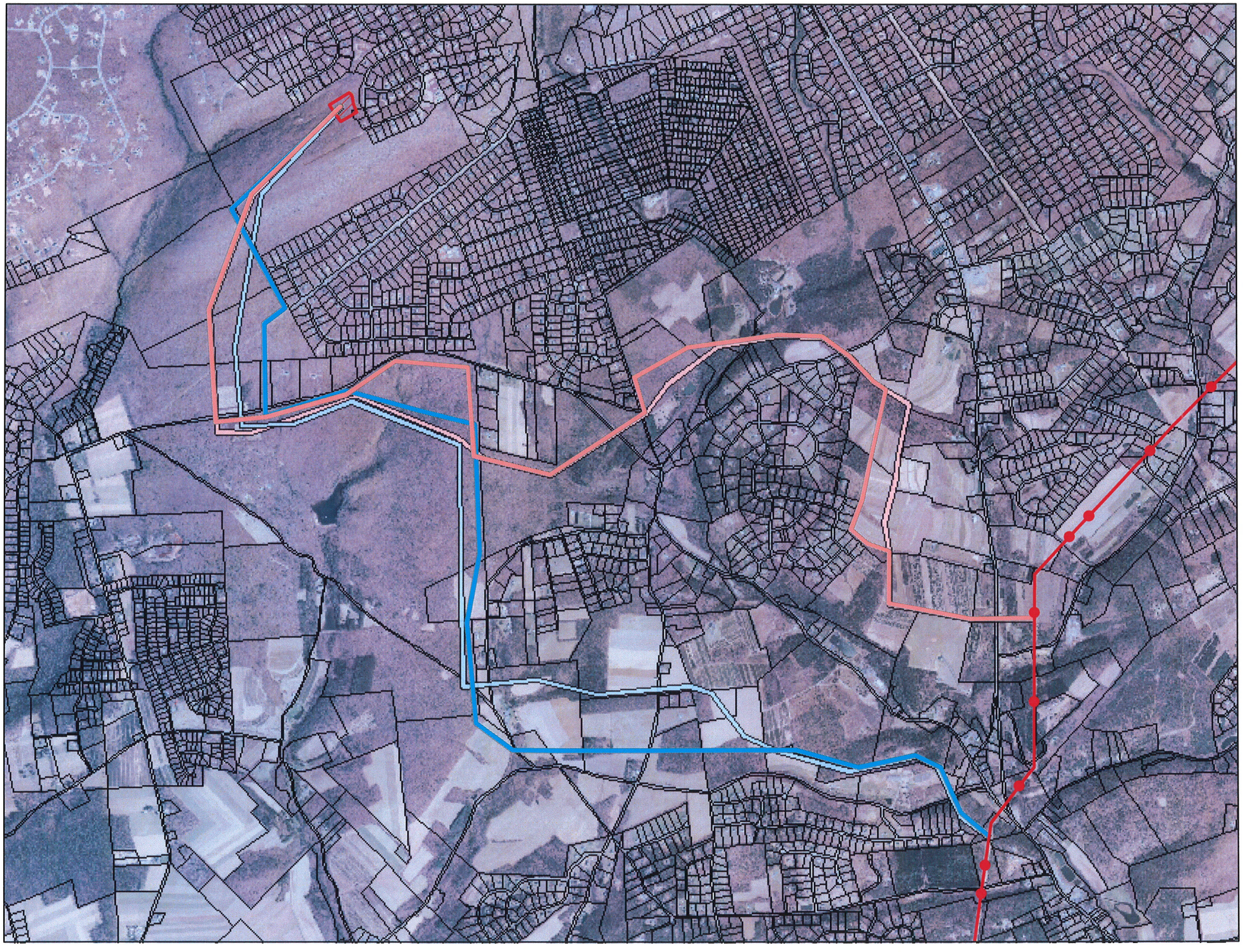
Exhibit D - Figure 12
Modified Alternative Routes Presented at Public Open House Meeting 1
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: RRM	Checked By: BAB
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\PUCApp\Exhibit D Figure12.mxd

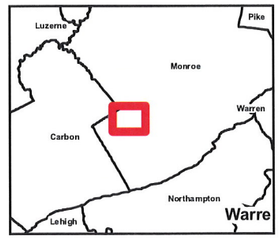


Legend

Alternative Routes 100-foot RoW

Route

- Alternative Route A
- Alternative Route B
- Alternative Route A1
- Alternative Route B1
- Proposed Substation Area
- Parcels
- Existing Tap Transmission Line



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2004 Monroe and Carbon Counties

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

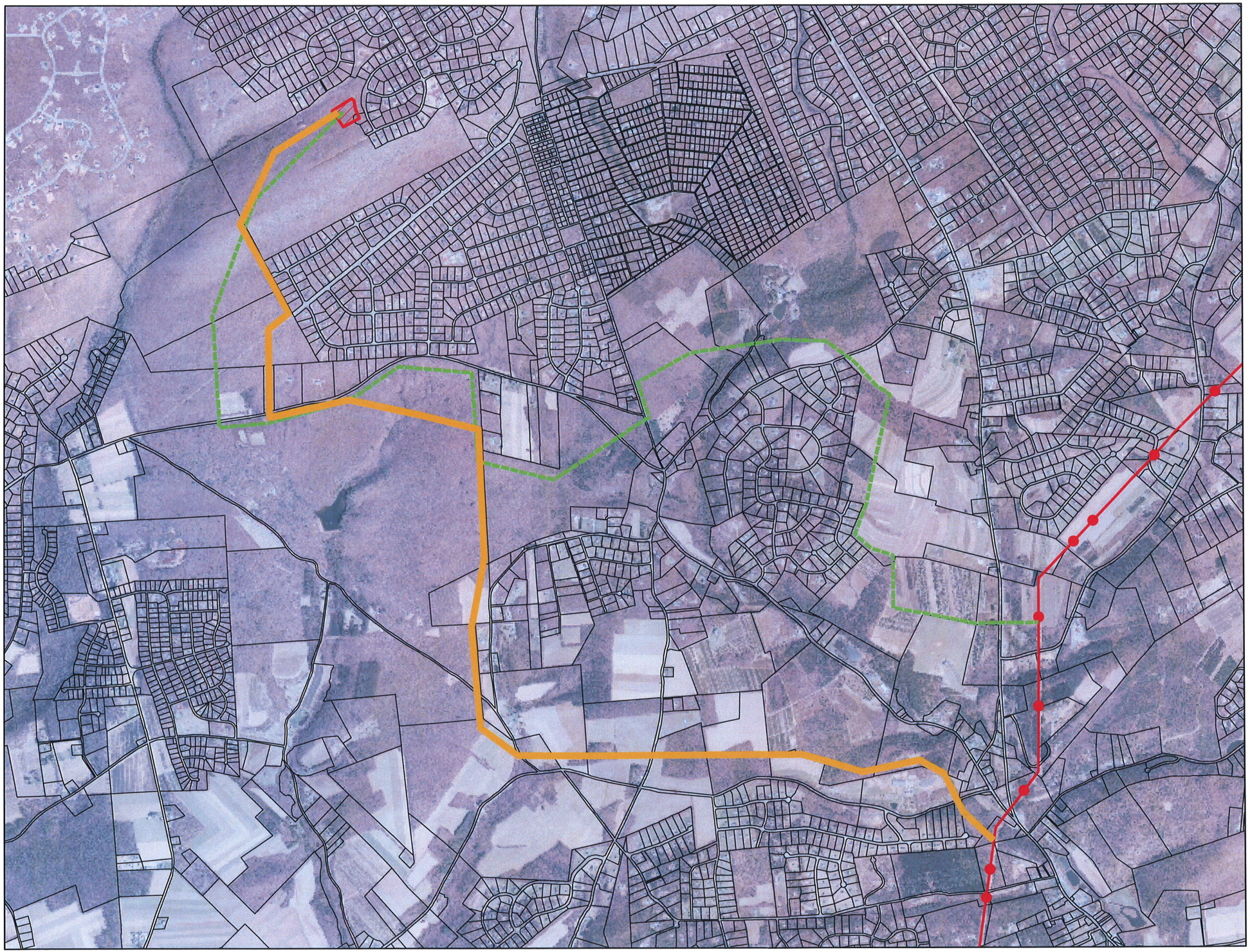
PPL Electric Utilities

URS

Exhibit D - Figure 13
New Alternative Routes
Effort Mountain #1 & #2
138 kV Taps

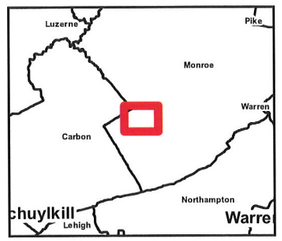
PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: RRM	Checked By: BAB
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\PUCAppl\Exhibit D Figure 13.mxd



Legend

- Selected Route B1
- Alternative Route A1
- Proposed Substation Area
- Existing Tap Transmission Line
- Parcels



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008 Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

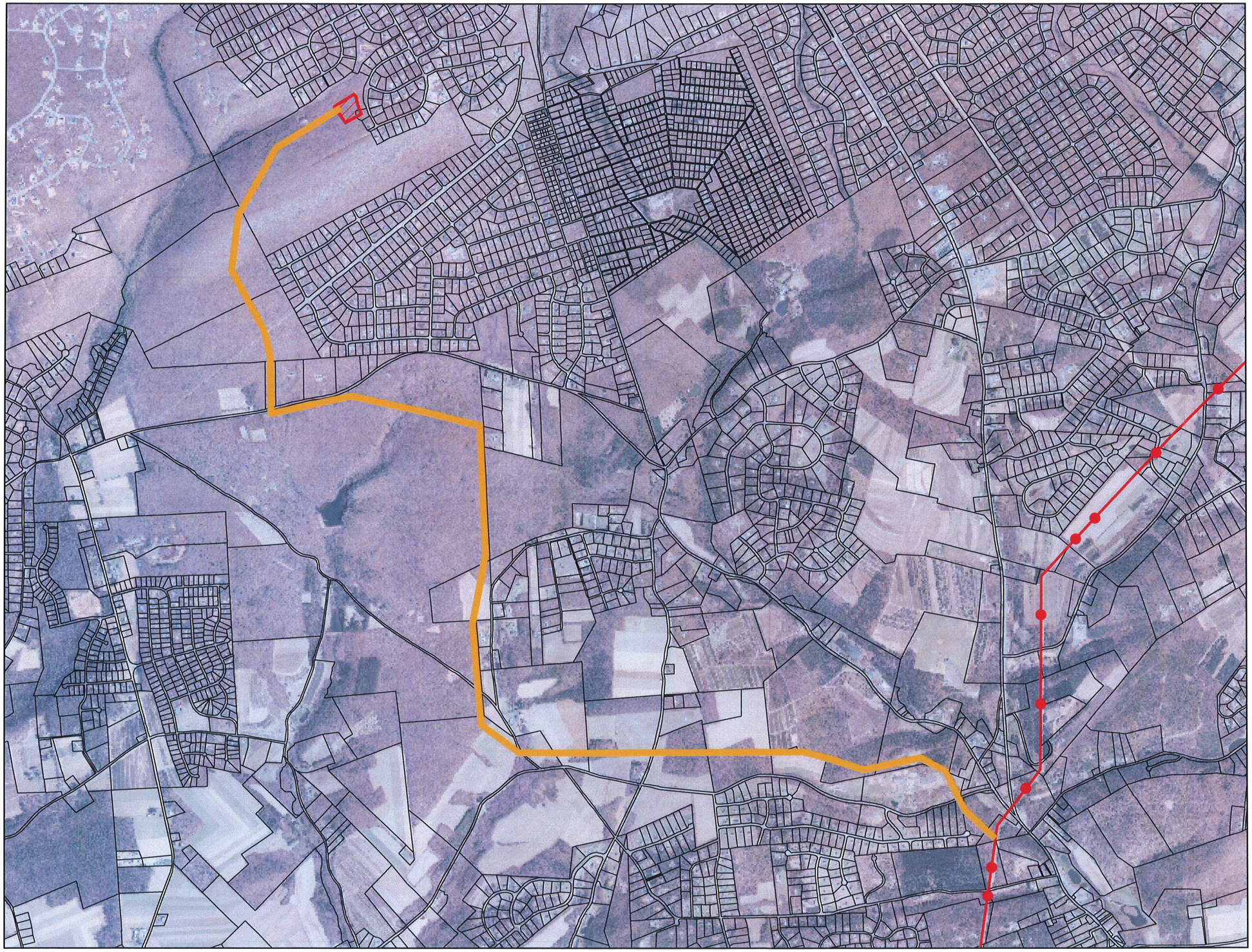
PPL Electric Utilities

URS

Exhibit D - Figure 14
Selected Route Presented at Public Open House Meeting 2
Effort Mountain #1 & #2
138 kV Taps

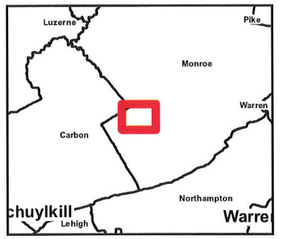
PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: RRM	Checked By: BAB
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\PUCApp\Exhibit D Figure 14.mxd



Legend

- Selected Route B1
- Proposed Substation Area
- Existing Tap Transmission Line
- Parcels



Key Map
Not to Scale

N

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

Aerial Imagery - USDA National Agricultural Imagery Program County Mosaics 2008 Monroe and Carbon Counties

0 500 1,000 2,000 3,000 4,000 Feet

1 inch = 2,000 feet

PPL Electric Utilities

URS

Exhibit D - Figure 15
Selected Route
Effort Mountain #1 & #2
138 kV Taps

PPL Electric
Effort and Sun Valley Areas, Pennsylvania

Prepared By: RRM	Checked By: BAB
Job: 19998145.00002	Map: \\GIS_Data\PPL\EFFORTMTN\Projects\PUCApp\Exhibit D Figure 15.mxd

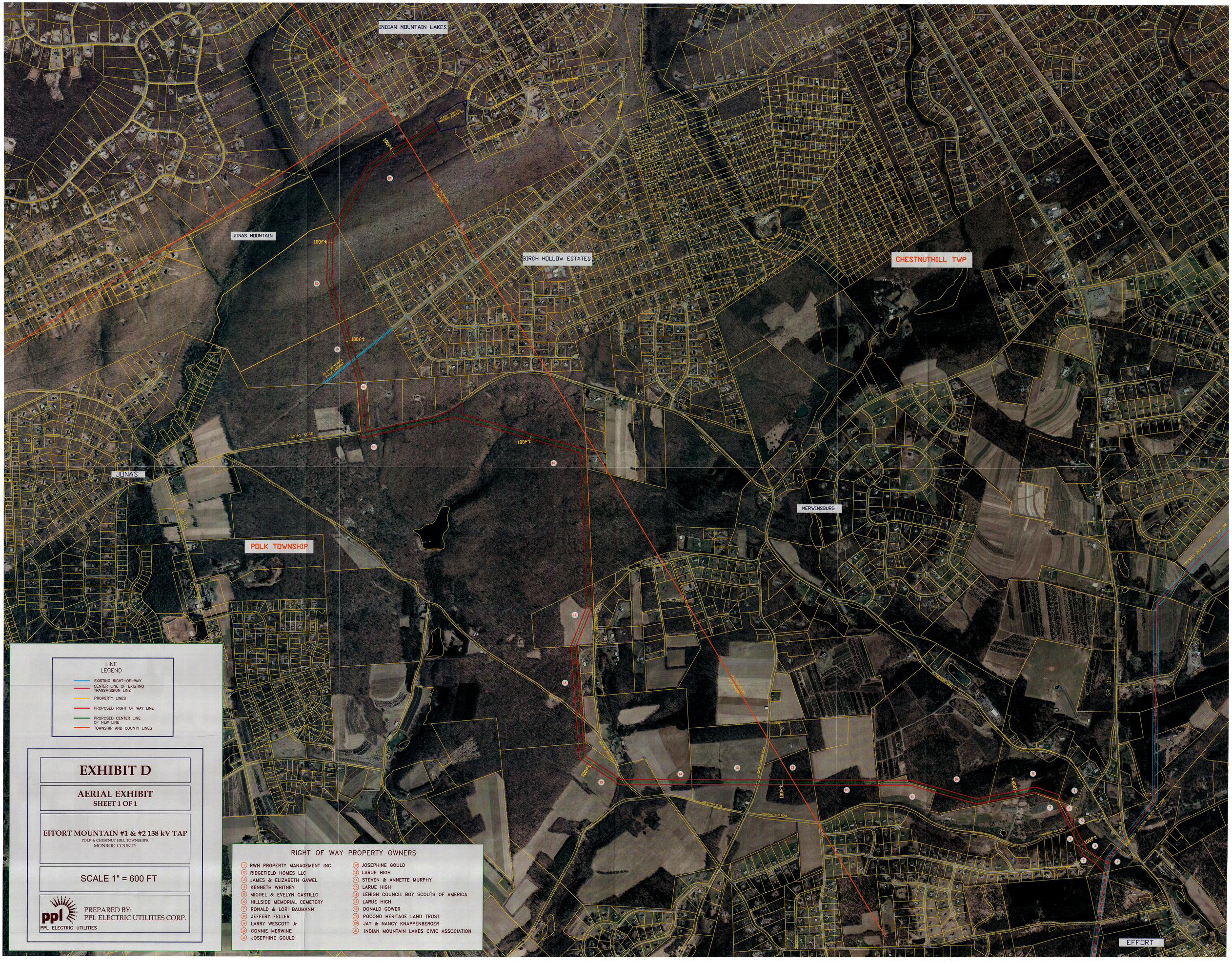

INDIAN MOUNTAIN LAKES
JONAS MOUNTAIN
BIRCH HOLLOW ESTATES
CHESTNUTHILL TWP
JONAS
MERWINSBURG
POLK TOWNSHIP
EFFORT
100ft
LINE LEGEND
EXISTING RIGHT-OF-WAY
CENTER LINE OF EXISTING TRANSMISSION LINE
PROPERTY LINES
PROPOSED RIGHT OF WAY LINE
PROPOSED CENTER LINE OF NEW LINE
TOWNSHIP AND COUNTY LINES
EXHIBIT D
AERIAL EXHIBIT
SHEET 1 OF 1
EFFORT MOUNTAIN #1 & #2 138 kV TAP
POLK & CHESTNUT HILL TOWNSHIPS.
MONROE COUNTY
SCALE 1" = 600 FT
PREPARED BY:
PPL ELECTRIC UTILITIES CORP.
PPL ELECTRIC UTILITIES
RIGHT OF WAY PROPERTY OWNERS
1 RWN PROPERTY MANAGEMENT INC
2 RIDGEFIELD HOMES LLC
3 JAMES & ELIZABETH GAWEL
4 KENNETH WHITNEY
5 MIGUEL & EVELYN CASTILLO
6 HILLSIDE MEMORIAL CEMETERY
7 RONALD & LORI BAUMANN
8 JEFFERY FELLER
9 LARRY WESCOTT Jr
10 CONNIE MERWINE
11 JOSEPHINE GOULD
12 JOSEPHINE GOULD
13 LARUE HIGH
14 STEVEN & ANNETTE MURPHY
15 LARUE HIGH
16 LEHIGH COUNCIL BOY SCOUTS OF AMERICA
17 LARUE HIGH
18 DONALD GOWER
19 POCONO HERITAGE LAND TRUST
20 JAY & NANCY KNAPPENBERGER
21 INDIAN MOUNTAIN LAKES CIVIC ASSOCIATION

Exhibit
E

Exhibit E – Design & Engineering Description:

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1.0 Introduction

PPL Electric Utilities Corporation (PPL Electric), in order to maintain reliable electric service to customers, is required to reinforce both the Transmission and Distribution power systems. As described in Exhibit B, Necessity Statement, an overall reinforcement plan has been developed for the Sun Valley/Jonas area. Part of this plan, and the subject of this filing, requires building approximately 5.7 miles of new 138 kV transmission line which will provide service to a new 138-12 kV substation. Completion of this project will relieve the neighboring Meckesville 69-12 kV substation and distribution lines from it, which serve the Sun Valley/Jonas area.

The cost to site, design and construct this transmission project is approximately $5,721,000. Construction of this project is scheduled to begin in October of 2010 to meet an in-service date of November 2011. A PPL Electric system map showing existing transmission facilities and the proposed new facilities with a design voltage of 35 kV or greater is included **Exhibit B** (see B-Map Pocket).

2.0 Proposed Activity

PPL Electric proposes to construct approximately 5.7 miles of new 138 kV transmission line. The proposed Effort Mountain #1 & #2 138 kV Taps will extend from the existing Siegfried – Jackson 138 kV Line to the site of the new Effort Mountain 138-12 kV Substation. It will be built for double-circuit 138 kV operation although initially, only one circuit will be installed on 4.6 miles of the transmission line. The remaining portion of the line, approximately 1.1 miles in length, will be constructed for double circuit 138 kV operation. One circuit will operate at 138 kV with the second circuit operating at 12 kV. The 12 kV source will be a second distribution line extending from the proposed Effort Mountain Substation to supply relief to the existing Meckesville 36-01 12 kV line. The proposed transmission line will be built in portions of Chestnuthill Township and Polk Township, in Monroe County.

Tangent poles, or poles with no line angle, on the proposed Effort Mountain #1 & #2 138 kV taps will consist of single poles equipped with steel upswept conductor support arms. Angle structures will be either single steel poles or two-pole steel structures depending on severity of the line angle. Some tangent poles will be direct embedded depending on span length, with some tangent poles requiring concrete foundations. All angle poles will be installed on concrete foundations. Some

angle structures may be guyed. Based on preliminary engineering, approximately 44 poles with an average height of 100 feet will be needed for the construction of the Effort Mountain #1 & #2 138 kV Taps.

3.0 Design Considerations

The proposed new line construction described above will be designed according to, and will meet, all National Electric Safety Code standards. Design specifications and safety rules practiced by PPL Electric are described in **Appendix 5**. Three power conductors and one Overhead Ground Wire (OHGW) will be installed for approximately 4.6 miles with 6 power conductors being installed for 1.1 miles. The conductors will be 556.5 KCMIL 24/7 standing ACSR, and the ground wire will be one 3/8 inch high strength steel wire.

Table E-1 shows the design minimum conductor clearances, and **Table E-2** lists the conductor thermal ratings of the proposed line.

TABLE E-1: DESIGN MINIMUM CONDUCTOR CLEARANCES FOR 556.5 KCMIL 24/7 STRANDING ACSR EFFORT MOUNTAIN #1 & #2 138 kV TAP

Condition	Double-Circuit Design Clearance-to-Ground
Normal load; average weather (16°C ambient temperature)	36.0 feet
Predicted extreme thermal load (125°C conductor temperature)	30.0 feet
Predicted NESC Extreme wind load (90 mph, 16°C)	33.5 feet
Predicted extreme weather conditions (1inch ice, 0 lbs. wind, -18°C)	39.1 feet
*Clearances based on a maximum tension of 9000 pounds at 1 inch ice, 0° F, 4# wind And a ruling span of 700 feet.	

TABLE E-2 CONDUCTOR THERMAL RATING 556.5 KCMIL 24/7 STRANDING ACSR (257°F) 125°C MAXIMUM CONDUCTOR			
Condition	Ambient Temperature °C	Wind Speed Knots	Ampacity Amps
Summer Normal	35	0	815
Winter Normal	10	0	926
Summer Emergency	35	1 1/2	1041
Winter Emergency	10	1 1/2	1163

4.0 Magnetic Field Management Plan

PPL Electric's Magnetic Field Management Program, summarized in **Appendix 4**, is applied to new and reconstructed transmission line projects. To reduce magnetic field exposures, the program generally prescribes the use of a line design that provides five feet higher ground clearance and reverses 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.

The company does not believe that the current scientific evidence demonstrates that magnetic fields cause any adverse health effects or pose a health or safety danger to the public. Nevertheless, PPL Electric has determined, as a matter of policy, to design its new and rebuilt transmission lines to reduce magnetic fields when that can be done at low or no cost and consistent with functional requirements. PPL Electric's Magnetic Field Management Program has been developed to implement that policy decision. Consistent with the program, PPL Electric will construct for five feet higher ground clearance for the proposed Effort Mountain #1 & #2 138 kV Taps. Because only one circuit is being installed for 4.6 miles at this time, reverse phasing can not be achieved on this portion of the line. For the 1.1 miles being built for double circuit 138/12 kV, power flow will be in opposite directions thus causing a reduction of magnetic fields. When the second circuit is installed on the remaining line section, reverse phasing can be accomplished.

5.0 Specific Right of Way Requirements

A. Description of Right of Way Requirements

PPL Electric's standard right of way width for a double circuit 138 kV transmission line is 100 feet. The right of way is determined by structure type, design tensions, span length and conductor "blowout" (the distance the wires are moved by a crosswind).

A cross section of the proposed right of way is illustrated in Figure E-5. The aerial map of the proposed line route (see **Exhibit D map pocket**) shows the location of the proposed route, identifies the properties that are traversed by the route, and shows right of way widths. Additionally, a list of all persons owning property within the proposed right of way is included in **Exhibit F**.

B. Status of Right of Way Negotiations

PPL Electric has attempted to negotiate new easements with 18 property owners. To date, agreements have been secured from 15 property owners. PPL Electric will continue to negotiate with the 3 unsigned property owners. PPL Electric anticipates that some of these negotiations will be unsuccessful and it will likely request that the Commission grant the authority for the company to exercise its right of eminent domain across any unsigned properties.

6.0 Construction Techniques and Execution for Typical 138 kV Transmission Lines

The following is a summary, non-technical explanation of the typical construction activity that is associated with new transmission line construction for single poles, which are either a direct burial or with a concrete foundation. This is not to be misconstrued as all encompassing and may vary with specific site/service conditions at each project. Each of the steps listed below will not necessarily be in this particular order:

- The project manager will review the construction plans with PPL Electric personnel that would be constructing the line specifically reviewing all permits and conditions that apply such as erosion and sediment control, wetland encroachments and stormwater management, as well as any agreements made with specific property owners for work done on their lands.

- Professional land surveyors will stake the locations of all poles to be constructed, as well as the edge of rights of way and locate any wetland or streams previously sited in field work.

- All wetlands/waters would have been previously delineated in the field, located by land surveyors and specifically shown to the construction manager prior to work commencing.

- During the installation of the roads, poles, and hanging of the wire, approved "best management practices" will be implemented to assure that the soil will be stabilized and not erode during storm events while under construction. Any temporary wetland encroachments (usually roads) will be removed according to the permit conditions. Whenever practical PPL Electric will utilize timber matting in wetland areas to minimize disturbance to the wetland vegetation and topography.

- PPL Electric has a vegetation management manual which provides specific direction for tree clearing activities. Not all vegetation will be removed. The manual specifies that only vegetation that will hinder the construction of the line or pose a safety or maintenance issue after the line was constructed be removed. Those trees, shrubs and ground cover located on construction roads as well as those at the location of the poles and the crane pads necessary for setting them will be removed. Other selected trees that would interfere with operation of the line will be cut to their stumps and stacked upon the edge of the right of way for the landowner. Brush can be chipped and piled on the right of way for use by the landowner, or spread to allow it to decay while serving as wildlife cover. No trees or chips will be stockpiled in any regulated wetlands and no stumps would be pulled.

- Construction roads will be constructed, usually about 14 feet in width, with a stone surface to support the equipment that will be transporting materials to the pole sites. Those vehicles are usually cranes, concrete trucks (if foundations are involved), boom trucks, and pickups. The roads will be built as provided for in the construction drawings as per the erosion and sediment control plan; the NPDES permit plan, and/or the wetland encroachment permit plan. The plan may require these roads to be temporary in nature, returning back to vegetative cover when the work is complete. Landowners may wish to have the roads remain intact for shared use between PPL Electric for line inspection and maintenance and

property owner use. Much of the routine maintenance to the line, once built, will be by helicopter or 4 wheel drive pickup truck.

- The poles will be installed by the use of auger and then crane. After the hole is drilled, usually 4 foot in diameter, the pole is placed directly into the hole and the remaining sections are installed along with any cross arms. A pole that is at an angle in the line, or for another specialized reason, may be required to have a concrete foundation. These foundations are seldom more than 11 feet in diameter and down to its necessary depth. The top of the foundation may extend above the ground an average of 1 foot.

- Once the poles are in place along the line route, the wires will be installed using bucket trucks to attach the wires to each pole and equipment and manpower will be used to pull the wires along from pole to pole.

- The project manager will oversee the stabilization of the site including the successful establishment of vegetation on all previously disturbed areas during construction. The regulatory agencies will be kept informed of PPL Electric's progress on the project, and regular inspections by the regulatory agencies will occur.

Typical examples of the proposed structures are depicted on Figures (photos) E1 through E4 below. A typical right-of-way cross-section is illustrated in Figure E-5.

FIGURE E-1



TYPICAL ANGLE STRUCTURE, SINGLE POLE
DOUBLE CIRCUIT DESIGN, SINGLE CIRCUIT INITIAL

FIGURE E-2



TYPICAL TANGENT STRUCTURE
DOUBLE CIRCUIT DESIGN, SINGLE CIRCUIT INITIAL





FIGURE E-3

DOUBLE CIRCUIT 138 kV TANGENT STRUCTURE

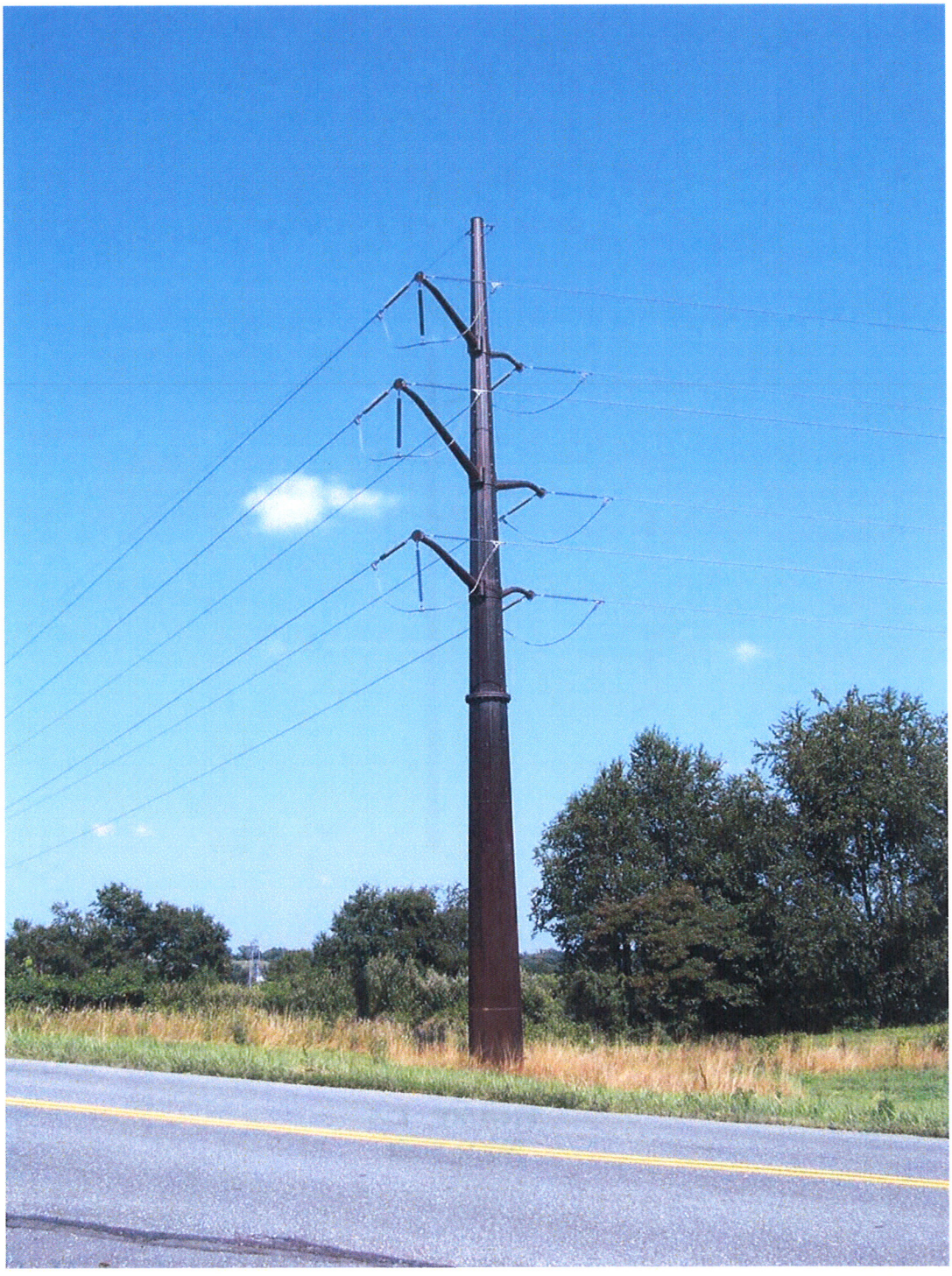

FIGURE E- 4

DOUBLE CIRCUIT 138 kV ANGLE STRUCTURE

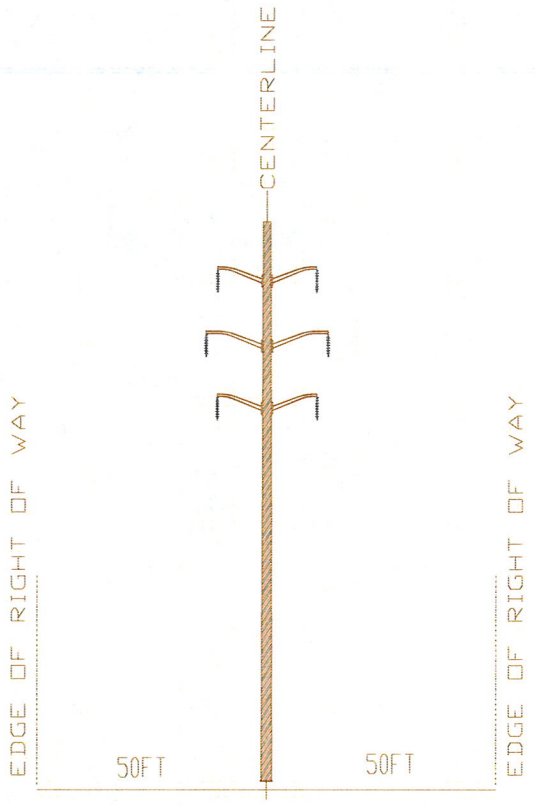

FIGURE E-5
Not to Scale

Exhibit
F

RWN Property Management Inc
314 Lakeshore Dr
Sciota, Pa 18354

Ridgefield Homes LLC
PO Box 80
Effort, Pa 18330

James & Elizabeth Gawel
RR1 box 9
Effort, pa 18330

Kenneth Whitney
PO Box 592
Effort, Pa 18330

Miguel & Evelyn Castillo
RD1 Box 256A
Effort, Pa 18330

Hillside Memorial Cemetery
Effort, Pa 18330

Ronald A & Lori J. Baumann
RR1 box 257A
Effort, Pa 18330

Jeffery Feller
RD1 Box 15
Effort, Pa 18330

Larry A. Wescott Jr.
117 Blue Ridge Drive
Effort, Pa 18330

Connie Merwine
Route 209 Merwine Commons #209
Brodheadsville, Pa 18322

Josephine Gould
RR1 Box 258
Effort, Pa 18330

Larue High
RD1 Box 259
Effort, Pa 18330

Steven S. & Annette L. Murphy
RR1 Box 284
Effort, Pa 18330

Lehigh Council Boy Scouts of America
PO Box 20624
Lehigh Valley, Pa 18002

Donald N. Gower
1HC2 #59
Gilbert, Pa 18331

Pocono Heritage Land Trust
PO Box 553
Pocono Pines, Pa 18350-0053

Jay & Nancy Knappenberger
20 Gower Road
Albrightsville, Pa 18210

Indian Mountain Lakes Civic Association
100 Indian Mt Lakes,
Albrightsville, Pa 18210

Exhibit G

EXHIBIT G- LOCAL, STATE, AND FEDERAL REGULATORY REQUIREMENTS	
Permit or Approval	**Government Agency**
Federal	
Section 404 Permit for Wetlands and Waters of the U.S. (including bog turtle screening)	U.S. Army Corps of Engineers (USACE)
Section 10 Permit for Navigable Waterways (as applicable)	USACE
Internal approvals of some Section 404/Section 10 permit applications	United States Environmental Protection Agency (USEPA)
National Pollutant Discharge and Elimination System (NPDES)	USEPA delegated to PADEP (see below under PAG-2)
Endangered Species Act – Section 7 Consultations	U.S. Fish and Wildlife Service (USFWS)
State	
Siting & Construction Permit	Pennsylvania Public Utility Commission (PUC)
Chapter 105 Water Obstruction & Encroachment Permit	Pennsylvania Department of Environmental Protection (PADEP)
Section 401 Water Quality Certificate	PADEP- state issuance for federal compliance
PAG-2 Stormwater for Construction Permit (NPDES)	PADEP
State-listed Rare, Threatened, and Endangered Species Clearances	• Pennsylvania Game Commission (PGC)- birds/mammals • Pennsylvania Fish and Boat Commission- herps/fish • Pennsylvania Department of Conservation and Natural Resources- plants/habitats of concern
Historic, Archeologic, and Cultural Resource Clearances	Pennsylvania Historic and Museum Commission (PHMC)
Highway Occupancy Permit	Pennsylvania Department of Transportation (PennDOT)
County	
Erosion and Sediment Control Plan Approval	Monroe County Conservation District
Post Construction Stormwater Management Plan Approval	PADEP & Monroe County Conservation District

Appendix 1

LIST OF GOVERNMENTAL AGENCIES, MUNICIPALITIES, AND OTHER PUBLIC ENTITIES RECEIVING A COPY OF THIS APPLICATION

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

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

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

Office of Consumer Advocate
555 Walnut Street
5th Floor, Forum Place
Harrisburg, Pa 17101-1925

Monroe County Planning Commission
1 Quaker Plaza, Rm 106
Stroudsburg, Pa 18360-2169

Monroe County Commissioners
1 Quaker Plaza, Rm 201
Stroudsburg, Pa 18360-2141

Polk Township Board of Supervisors
Polk Township Road
PO Box 137
Kresgeville, Pa 18333

Polk Township Manager
Polk Township Road
PO Box 137
Kresgeville, Pa 18333

Chestnuthill Township Board of Supervisors
PO Box 243, Rt 715 S
Brodheadsville, Pa 18322

Chestnuthill Township Manager
PO Box 243, Rt 715 S
Brodheadsville, Pa 18322

Appendix 2

LIST OF LOCATIONS APPLICATION CAN BE VIEWED BY THE PUBLIC

Offices of Monroe County
1 Quaker Plaza
Stroudsburg, Pa 18360

Polk Township Municipal Building
Polk Township Road
PO Box 137
Kresgeville, Pa 18333

Chestnuthill Township Municipal Building
PO Box 243, Rt 715 S
Brodheadsville, Pa 18322

Appendix 3

LIST OF GOVERNMENTAL AGENCIES, MUNICIPALITIES AND OTHER PUBLIC ENTITIES CONTACTED

Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Commonwealth Keystone Building, Second Floor
400 North Street
Harrisburg, Pa 17120-0053
File No. 2009-1897-042-A
Contact: Mr. Steve McDougle

US Fish and Wildlife Service
315 South Allen Street, Suite 322
State College, Pa 16801-4850
USFWS Project # 2009-0917
Contact: Bonnie Dershem

Pennsylvania Game Commission
2001 Elmerton Avenue
Harrisburg, Pa 17110-9797
Contact: James R. Leigey

Pennsylvania Fish and Boat Commission
450 Robinson Lane
Bellefonte, Pa 16823-9620
SIR # 31392
Contact: Christopher A. Urban

Pa Department of Conservation and Natural Resources
Rachel Carson State Office Building
PO Box 8767
400 Market Street
Harrisburg, Pa 17105-8767
PNDI # 020108
Contact: Joy VanDervort-Sneed

Monroe County Commissioners
1 Quaker Plaza, Rm 201
Stroudsburg, Pa 18360-2141
Contacts: Suzanne McCool- Chairperson
Theresa Merli- Vice Chairperson
Robert Gress- Chief Clerk/Administrator

Monroe County Planning Commission
1 Quaker Plaza, #106
Stroudsburg, Pa 18360
Contact: John Woodling

Polk Township Board of Supervisors
Polk Township Road
PO Box 137
Kresgeville, Pa 18333
Contacts: H. Lee Everett
Nancy May

Chestnuthill Township Board of Supervisors
Route 715 South
PO Box 243
Brodheadsville, Pa 18322
Contact: Dave Albright

Monroe County Conservation District
8050 Running Valley Road
Stroudsburg, Pa 18360
Contact: Craig Todd

Pocono Mountain Economic Development Corporation
300 Community Drive, Suite D
Pocono Mountains Corporate Center East
Tobyhanna, Pa 18466
Contact: Charles Leonard

The Nature Conservancy
Northeast Office
Hauser Nature Center
PO Box 55, Long Pond Road
Long Pond, Pa 18334
Contact: Bud Cook

ELECTED OFFICIALS

State Representative Mario Scavello
Greater Pocono Chamber of Commerce
556 Main Street
Stroudsburg, Pa 18360

State Representative Mike Carroll
P.O. Box 619, Route 209
Gilbert, Pa 18331

State Representative Keith McCall
Frosty Mountain Plaza
2681 SR 903
Albrightsville, Pa 18210

State Representative Hon. John J. Siptroth
4 Jay Park
PO Box 1188
Marshalls Creek, Pa 18335

State Senator Ray Musto
81 S. Main Street, PO Box 786
Pittston, Pa 18640

State Senator Pat Brown
PO Box 16
Saylorsburg, Pa 18353

U.S. Representative Paul Kanjorski
102 Pocono Boulevard
Mount Pocono, Pa 18344-1412

Senator Arlen Specter
228 Walnut Street
Room 1104, Federal Building
Harrisburg, Pa 17101

Senator Bob Casey
409 Lackawanna Avenue, Suite 301
Scranton, Pa 18503

Senator David Argall
PO Box 16
Saylorsburg, Pa 18353

Appendix 4



MAGNETIC FIELD MANAGEMENT

PPL Electric Utilities Corporation

Appendix 4

DECEMBER 2004

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INTRODUCTION

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

PPL EU's View

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

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

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

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

EMF Are All Around Us

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

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

Electric Fields

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

Magnetic Fields

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

Figure 1

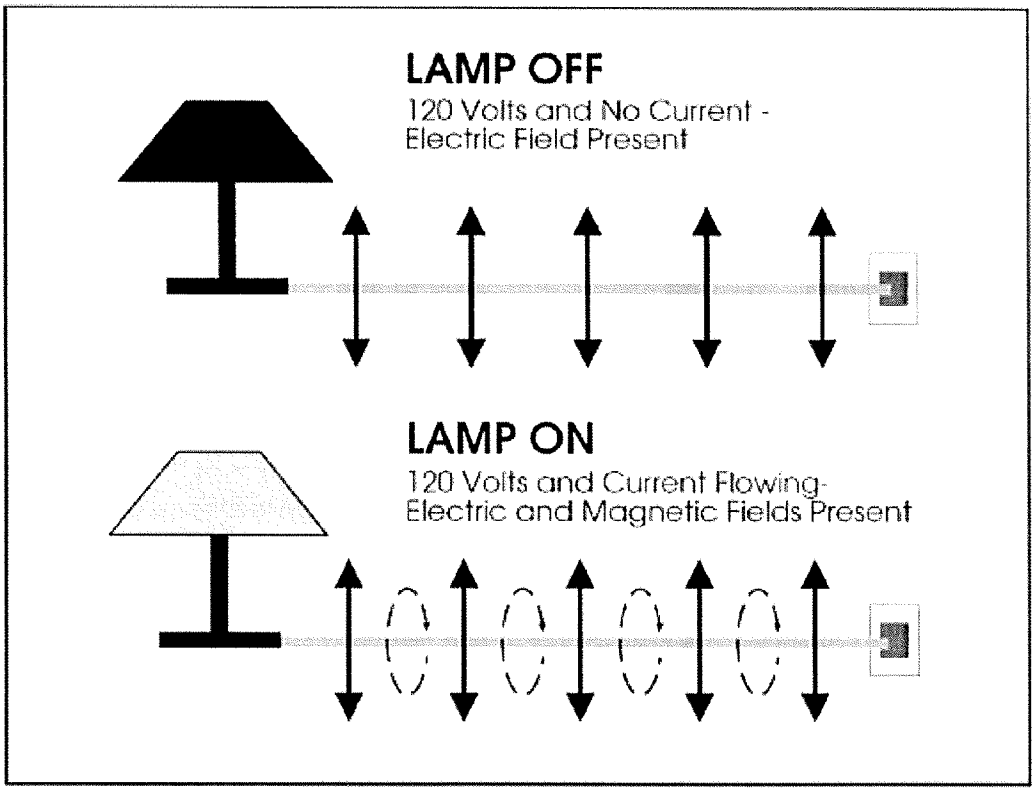

LAMP OFF
120 Volts and No Current -
Electric Field Present
LAMP ON
120 Volts and Current Flowing-
Electric and Magnetic Fields Present

Figure 2

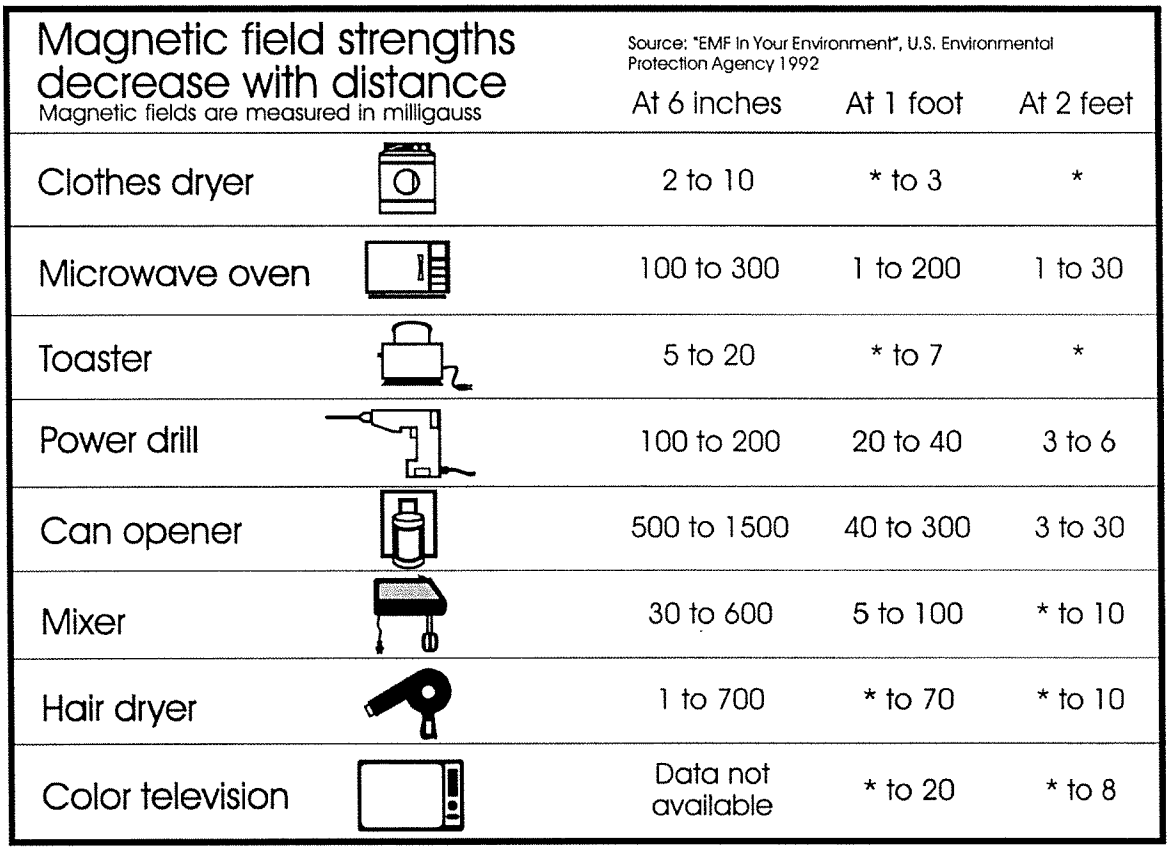


FIGURE 2 * The magnetic field measurement at this distance from the operating appliance could not be distinguished from background measurements taken before the appliance had been turned on.

Measuring Magnetic Fields

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

Figure 3

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

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

DEVELOPMENT OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

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

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

VARIABLES THAT AFFECT MAGNETIC FIELDS

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

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

EFFECT OF PHASE CURRENT ON MAGNETIC FIELDS

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

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

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

Effect of Conductor Configuration on Magnetic Fields

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

Effect of Distance From the Magnetic Field Source

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

SUMMARY OF PPL EU's MAGNETIC FIELD MANAGEMENT PROGRAM

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

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

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

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

MAGNETIC FIELD MANAGEMENT PROGRAM GUIDELINES

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

OVERHEAD LINES

NEW OR REBUILT TRANSMISSION LINES

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

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

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

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

Chart VI illustrates the compact design structure.

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

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

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

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

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

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

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

138/69 kV Transmission Lines

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

230 kV Transmission Lines

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

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

500 kV Transmission Lines

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

RECONDUCTORING OR ADDING ADDITIONAL CIRCUITS TO EXISTING TRANSMISSION LINES

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

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

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

DISTRIBUTION LINES

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

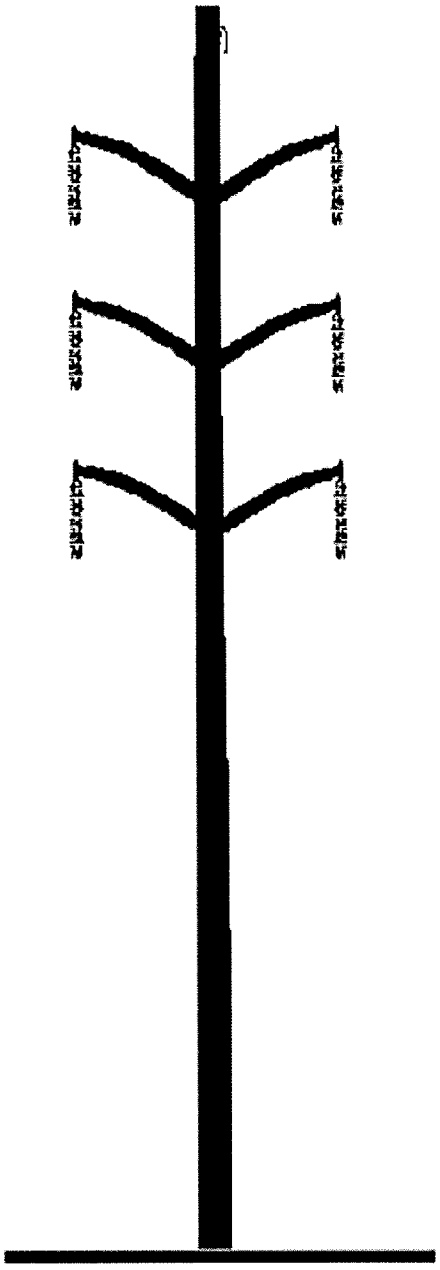
- Main lines are the most heavily loaded sections of a distribution line and therefore have the highest magnetic fields associated with them.
- Increasing the ground clearance by five feet reduces the magnetic field under the line from 14 mG to 11 mG using the standard eight-foot crossarm design. These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

UNDERGROUND TRANSMISSION LINES

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

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

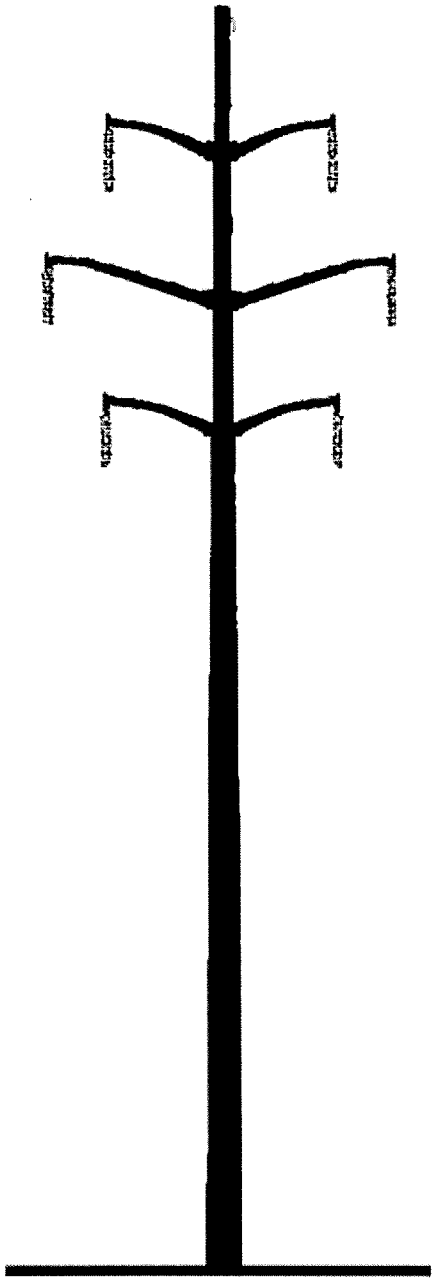
Short-Span Construction



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

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

Long-Span Construction Remains PPL EU 138 kV Standard



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

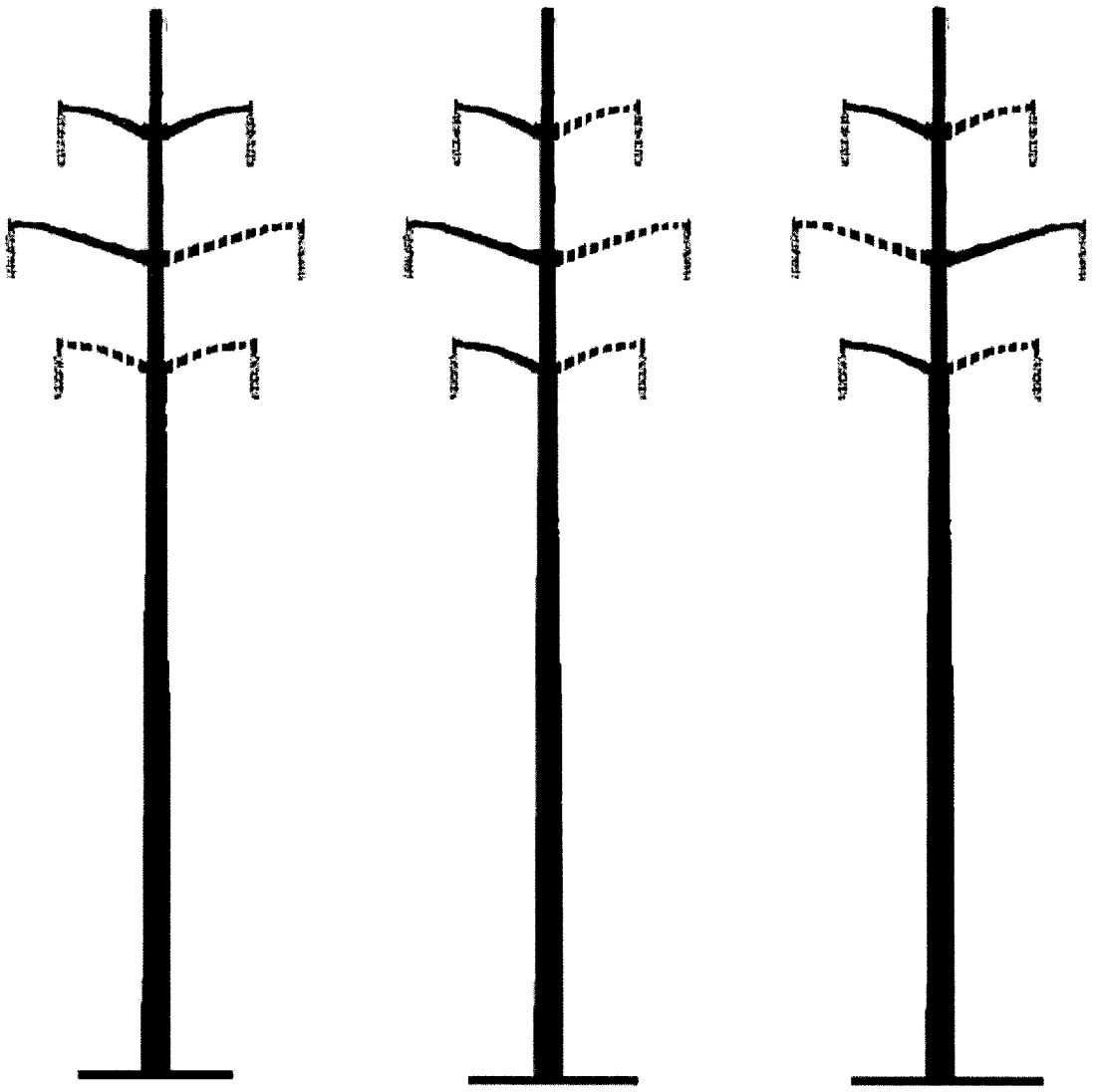
  1 3/8" HS steel overhead ground wire - 17.3 feet sag
  6-556.5 KCMIL 24/7 ACSR power conductors - (PARAKEET) 23.0 feet sag
  Average span - 600 feet

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

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

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

Typical Single-Circuit Structure Designs

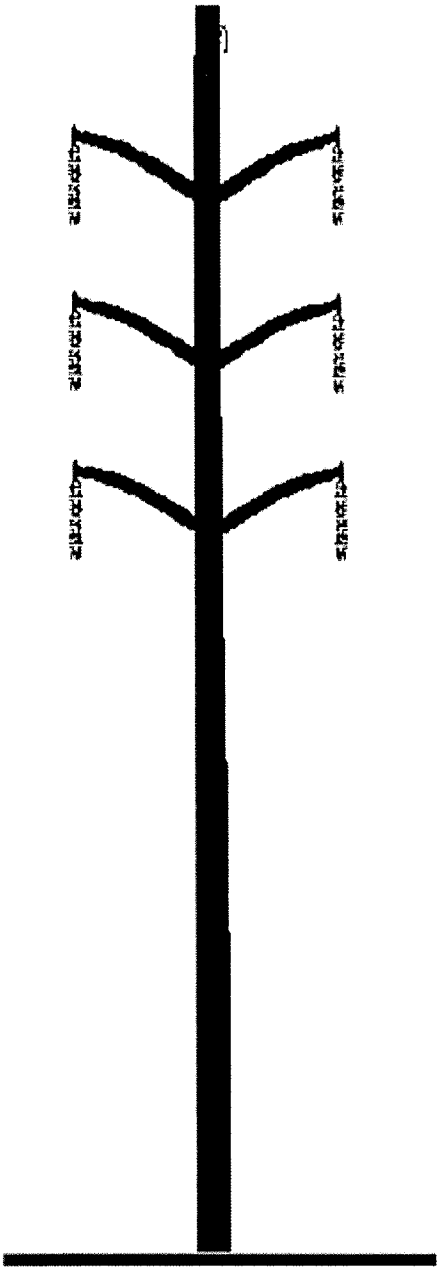


138/69 kV SINGLE CIRCUIT TRANSMISSION LINES
CALCULATED MAGNETIC FIELDS AT 400 AMPERES

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

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

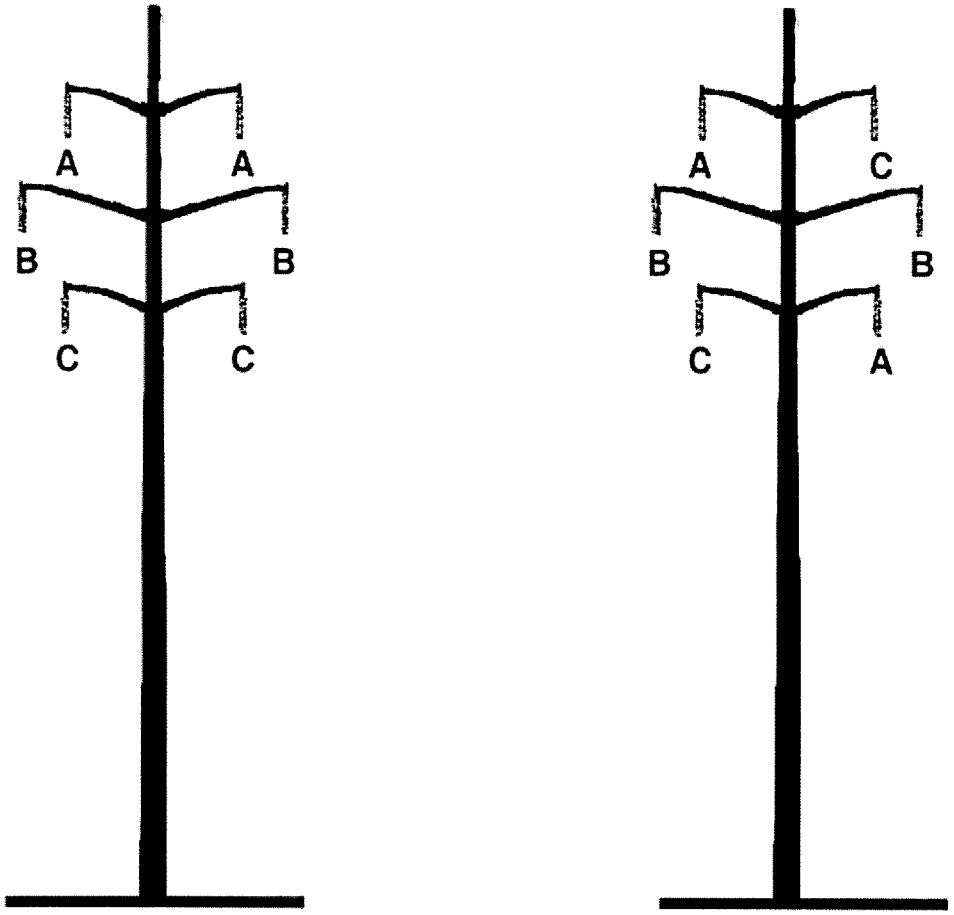
Compact Design Structure



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

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

Reverse Phasing of Double-Circuit Transmission Lines



From: → → → → To:

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

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

CHART VIII

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

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

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

CHART IX

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

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

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

CHART X

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

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

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

CHART XI

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

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

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

CHART XII

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

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

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

12 kV DISTRIBUTION LINES
CALCULATED MAGNETIC FIELDS AT 300 AMPERES

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

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

Siting/Magnetic Field Management.doc/mlt

Appendix 5

APPENDIX 5

PPL 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) has developed design specifications and safety rules which meet or surpass all requirements specified by the NESC.

Engineering Design Criteria and Parameters

The NESC includes loading requirements and clearances for the design, construction, and operation of power lines. The "loads" on conductors and supporting structures are the mechanical forces that develop from the weight of the conductors, the weight of ice on the conductors, plus wind pressure on the conductors and supporting structures. Loading requirements are the loads on the conductors and structures that are anticipated assuming certain ice and wind conditions. Loading requirements always contain "safety factors" to allow for unknown or unanticipated contingencies. The clearances and loading requirements contained in the NESC were developed to ensure public safety and welfare.

PPL 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 designs all of its transmission lines for Grade B construction. The use of Grade B design and construction specifies enhancements such as larger-minimum crossarm dimensions, larger-minimum conductor size, and increased safety factors.

Another example is the design parameters utilized to account for ice and wind loadings on the overhead ground wire (OHGW) and power conductors. The NESC standard ice and wind design magnitudes for the PPL 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 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 lines are designed to operate safely and reliably during inclement weather even more severe than assumed by the NESC. In addition, PPL transmission lines are designed with more clearance to the ground than required by the NESC. The tables below compare PPL and NESC ground clearances for lines of various voltages.

138 kV

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

230 kV

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

500 kV

Surface Underneath Conductors	Vertical Clearance to Ground NESC Standard	PPL 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 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.

Appendix 6

Wetlands Report

EFFORT MOUNTAIN #1 & #2 138 kV LINE WETLANDS/WATERS MANAGEMENT SUMMARY AND RECOMMENDATIONS

September 15, 2009

PPL Electric Utilities Corporation
Doug Haupt, Transmission Siting Coordinator
2 N 9th St., Genn4
Allentown, PA 18101

RE: Federal & Commonwealth Regulated wetlands & waters
Effort Mt. 138 kV Taps & Substation
Polk & Chestnut Hill Townships, Monroe County PA

Dear Mr. Haupt:

Please allow this correspondence to summarize my initial findings regarding the above referenced project and topic. On August 6th & 31st of 2009, I conducted an on-site survey of any and all regulated wetlands/waters along the proposed line route and substation site for the Effort Mountain 138 kV Taps.

Subsequently, 11 locations were identified as areas A through K. It should be noted that areas A through C were identified from east to west on August 6th while areas D through K were identified west to east on August 31st.

Those identified as waters were: Area A (a perennial stream) an un-named tributary to Pohopoco Creek; Area B (an intermittent stream); Area C (an un-named, perennial stream): and Area K (an un-named perennial stream). All 4 of these waters have varying narrow wetland fringe along their banks.

Areas D & J are isolated vernal pools and Areas E, F, G, H, & I are wetlands that extend outside and are part of bigger wetland areas located along Jonas Road.

Based upon these site visits, coupled with my 17 years of continual activity in wetland/waters encroachment permitting for PPL Electric, It is my opinion that PPL's policy of avoidance/ minimization of impact of regulated wetland/waters will dictate that these regulated areas be spanned with overhead wires and that there is no need to locate a structure or place a construction road within any of them.

Please find attached a USGS map which identifies Areas A through K. These areas will be surveyed by PPL Electric and added to the construction plans. Once the project has received PUC approval, and then subsequently authorized by PPL EU, our firm will move ahead to prepare a final wetland delineation report and apply for any necessary environmental permitting.

Should you have any additional questions, regarding this professional opinion of the subject as it relates to other matters on this project; please do not hesitate to give me a call.

Sincerely,

Michael C. Wood, RLA, Principal
WOODLAND DESIGN ASSOCIATES, INC.
Phone: 570-729-8524 □ Fax: 570-729-8080 □ woodland@ptd.net □ www.woodlanddesign.cc

Appendix 7

EFFORT MOUNTAIN PHASE I ARCHAEOLOGY MANAGEMENT SUMMARY AND RECOMMENDATIONS

PPL Electric Utilities has proposed the development of a 5.7 mile long new power line corridor in Monroe County, Pennsylvania. Maps of the proposed line route or corridor were submitted for review to the Pennsylvania Bureau for Historic Preservation (PABHP). Mr. Steven McDougal, Review Archaeologist for the PABHP subsequently determined that three areas (A, B and C) would require Phase I testing. Area A lies is that part of the corridor which lies south of Jonas Road and which then trends southeast across a small unnamed tributary to a higher divide. The area is wooded and the parcel is part of the Minsi Trails Trexler Boy Scout Camp. Area B is that portion of the corridor which trends southward along the western valley slopes of Middle Creek lying just west of New York Blvd. Road along much of its length. The area is partially wooded along the summit of the hill and contains high grasses and scrubs along the lower valley slopes. Area C lies along Pheasant Run Road and includes a portion of the extreme eastern part of the corridor near the cemetery and where the line crosses a small unnamed tributary of Pohopoco Creek. The objective of the Phase I study was to determine if there will be any impact to potentially significant prehistoric cultural resources within the proposed construction corridor for the transmission line. Given the fact that the line will not cross any streams which have the potential to contain deeply buried prehistoric cultural resources, deep testing was no warranted or recommended by the PABHP.

Geologically, the area is situated in the Glaciated Appalachian Plateaus province. The soils along the proposed transmission line corridor are primarily formed in late Wisconsin glacial till of Olean Subage (22,000 to 18,000 yrs. B.P.). The soils formed in this till are typically poorly to very poorly drained. Texturally, the soils are extremely rocky with large cobbles and boulders scattered on the ground surface and within the soil profile. A typical profile encountered in all three areas consisted of a 2 cm to 3 cm thick organic O horizon which was then underlain by a 5 cm to 10 cm thick dark brown cobbly pebbly sandy loam to silt loam A horizon. The A horizon was in turn underlain by a brown to gray brown (often mottled) cobbly pebbly loam sand to sandy loam C horizon. Occasionally a thin, grayish eluviated horizon (E horizon) was noted at the base of the A horizon. The bedrock units which are capped by the Olean till are ascribable to Walcksville Member and Beaver Dam Run Member in Area C and the Long Run Member in Areas A and B. All three members are primarily comprised of thick sandstone beds, not surprisingly the large rock clasts in the Olean Till and the associated soils developed on the till are chiefly comprised of these sandstones. The soils encountered on the two small stream crossings in Area C and Area A both contained a very thin (less than 1 meter) package of coarse grained alluvium of recent age. The coarse nature of these immature Entisol order soils documents the effects of historic deforestation and flood scouring along these small first order streams.

Testing along the proposed power line corridor in Areas A, B and C were accomplished by standard shovel test probes. As noted earlier, none of the landforms along the proposed power line corridor have the potential to contain thick Holocene age

soils. All of the investigated soils to date either have formed in late Wisconsin age glacial till or occur along the narrow, recently constructed valley bottom zone of the two first order tributaries. All shovel test probes were excavated at least 20 cm into the subsoil (C horizon) or to a nominal depth of 40 cm below ground surface. The soil fill material from each probe was screened thru ¼ inch mesh hardware cloth. All probes were mapped in the field using standard soil nomenclature as defined in Soil Taxonomy (1970).

Prior to and concurrent with Phase I archaeological field investigations, extensive Phase I background research was undertaken and completed for the study area. The types of Phase I research that were conducted included informant interviews; archival searches, literature reviews and a P.A.S.S. site file examination. A search was also made for information available on previously known and/or recorded archaeological sites located within or adjacent to the project area. Examined sources included unpublished research papers and regional survey reports, published articles and tomes, previous cultural resource management reports completed on other project situated in or bordering the general project area. Finally, topographic maps, soil reports, geologic reports and attendant site forms maintained at the William Penn Museum in Harrisburg were reviewed.

To date, a continuous line of shovel test probes excavated at 15 meter intervals were emplaced along the proposed power line corridor in Areas A and C. The results of this exhaustive shovel testing program were negative for the identification of any potentially significant prehistoric cultural resources. The only artifacts found to date were several fragments of a white ware cup found in a shovel test excavated on the small unnamed tributary of Pohopoco Creek. The absence of any prehistoric cultural resources was not unexpected given the extremely poor soil drainage conditions present within the study area and the absence of any moderate to large drainage line. While numerous springs and seeps occur within the study area these are generally on slopes or in areas of extremely poor soil drainage conditions. Additional testing needs to be completed in Area B; however, the soils in this area are mapped as hydric soils and are ascribable to the soil series as those encountered and tested in Areas A and C.

Given all levels of inquiry and while there is additional testing to be completed (especially in Area B), based upon the study to date the project area corridor offers little potential to contain potentially significant prehistoric cultural resources. Any sites which might occur within the study area are likely very, small, geographically restricted hunting or foraging camps that can easily be avoided during construction of the proposed power line corridor.

Sincerely,

Dr. Frank J. Vento
PG-001831-G, Professor of Geology
Clarion University of Pennsylvania

Appendix 8

Threatened & Endangered Species Summary

EFFORT MOUNTAIN #1 & #2 138 kV LINE EFFORT TRANSMISSION LINE SPECIES OF SPECIAL CONCERN STATUS REPORT

To: **Doug Haupt**

From: **Richard Mellon, Senior Scientist**

Subject: **Effort Transmission Line Species of Special Concern Status Report**

Date: **October 30, 2009**

Background

Agency responses to PNDI requests regarding Species of Special Concern listed the following species:

- Bog Turtle (*Glyptemmys mulhenbergii*) - federally threatened
- Variable Sedge (*Carex polymorpha*) – state endangered
- Pale Duckweed (*Lemna valdiviana*) – state extirpated
- Toothed Apharetra Moth (*Apharetra dentate*) – state imperiled
- Pine-barrens (*Zanclognatha martha*) – state imperiled – critically imperiled
- Barrns Itame (*Itame* sp. 1 near *inextricata*) – state critically imperilled

Current Status:

Field studies indicate no appropriate habitat for any of the target species was found, with the possible exception of Pale Duckweed. Shallow water does exist in vernal pools and wetlands in the forested habitats near Jonas Road (Wetlands D – K). However, field searches failed to locate any duckweed. Therefore, no species of special concern or habitat for species of special concern was found or is expected. Reports to the agencies are currently being prepared.