

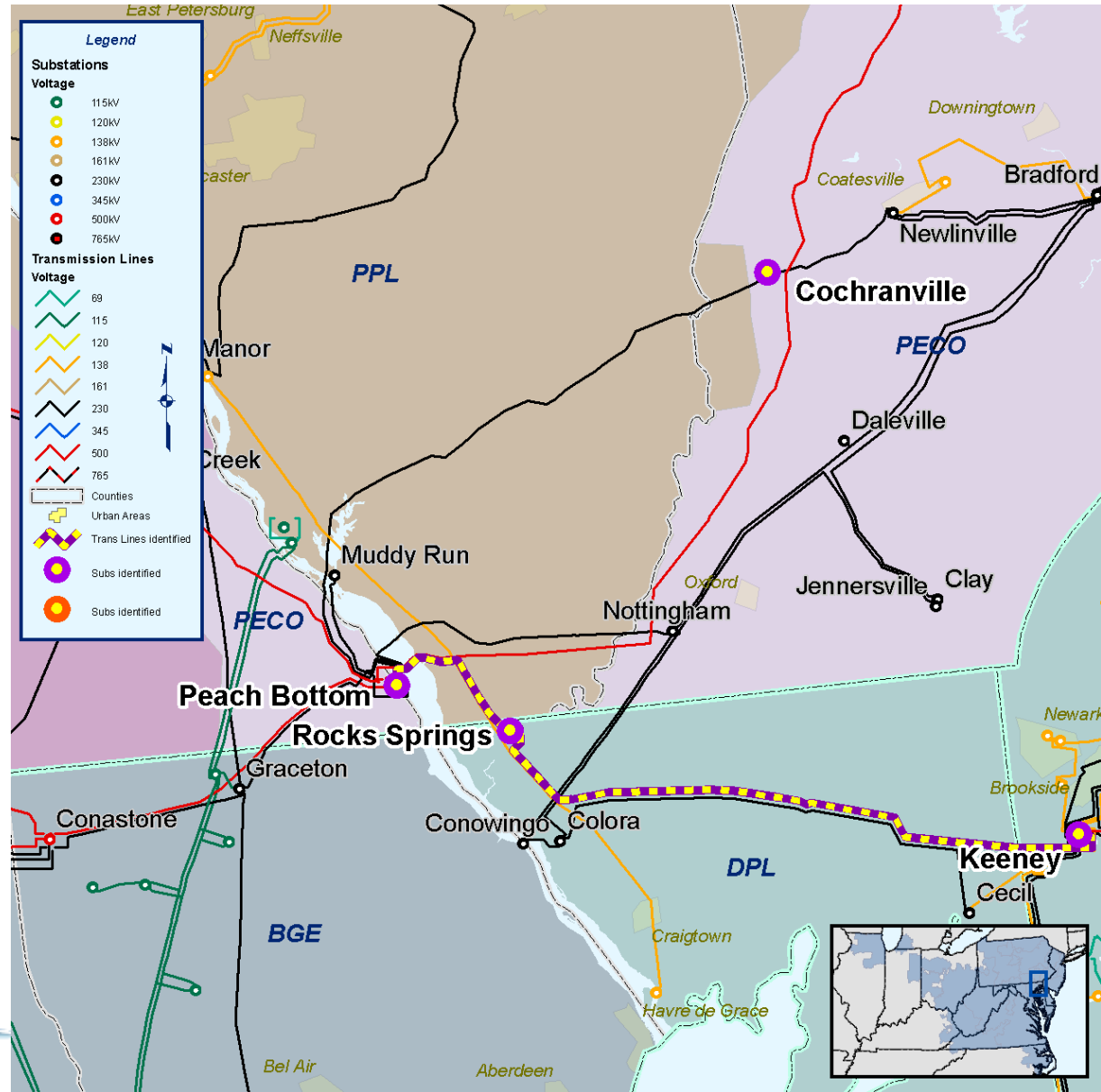
Reliability Analysis Update

TEAC Meeting
September 17, 2008

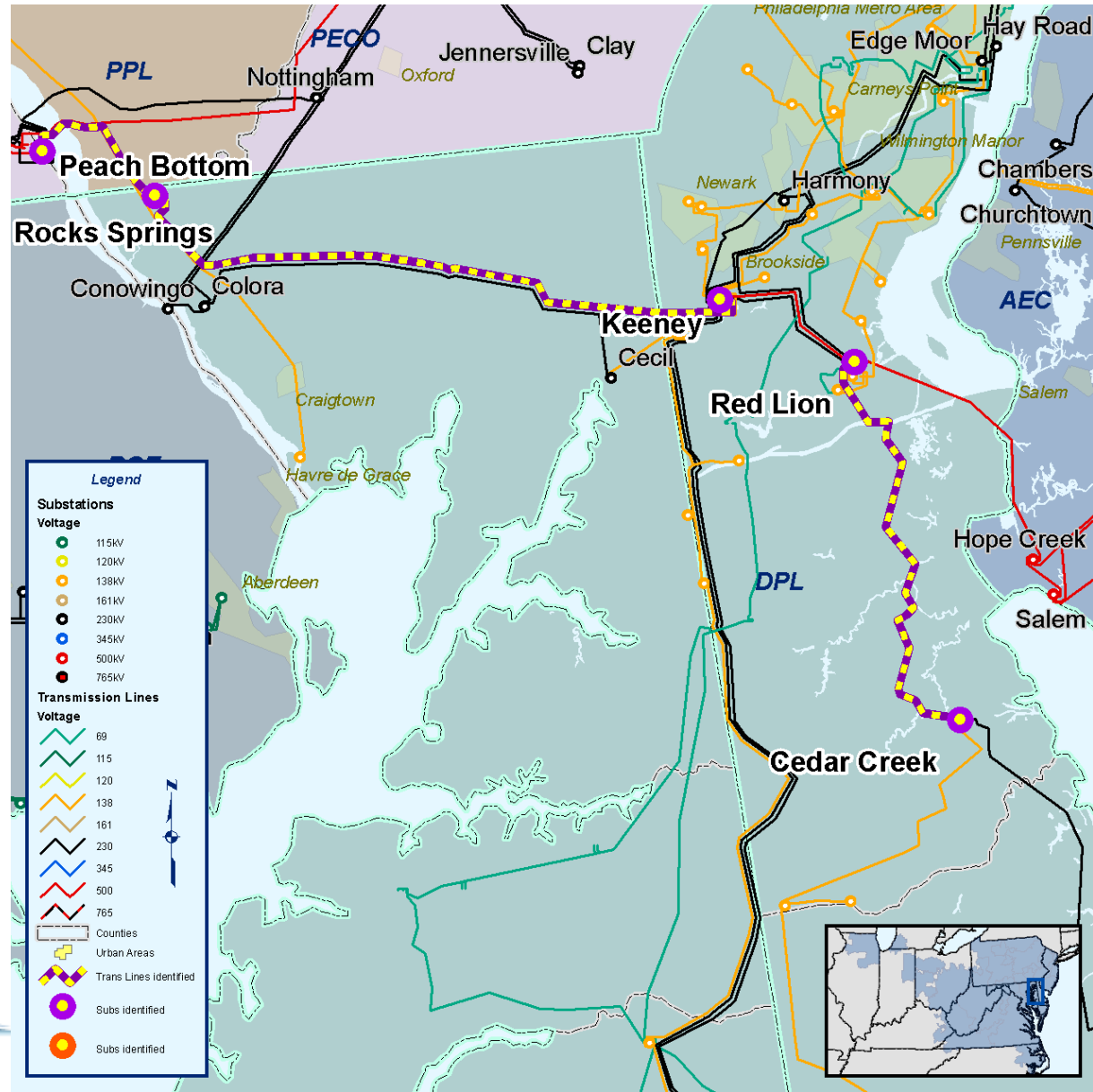


Reactive Analysis Update

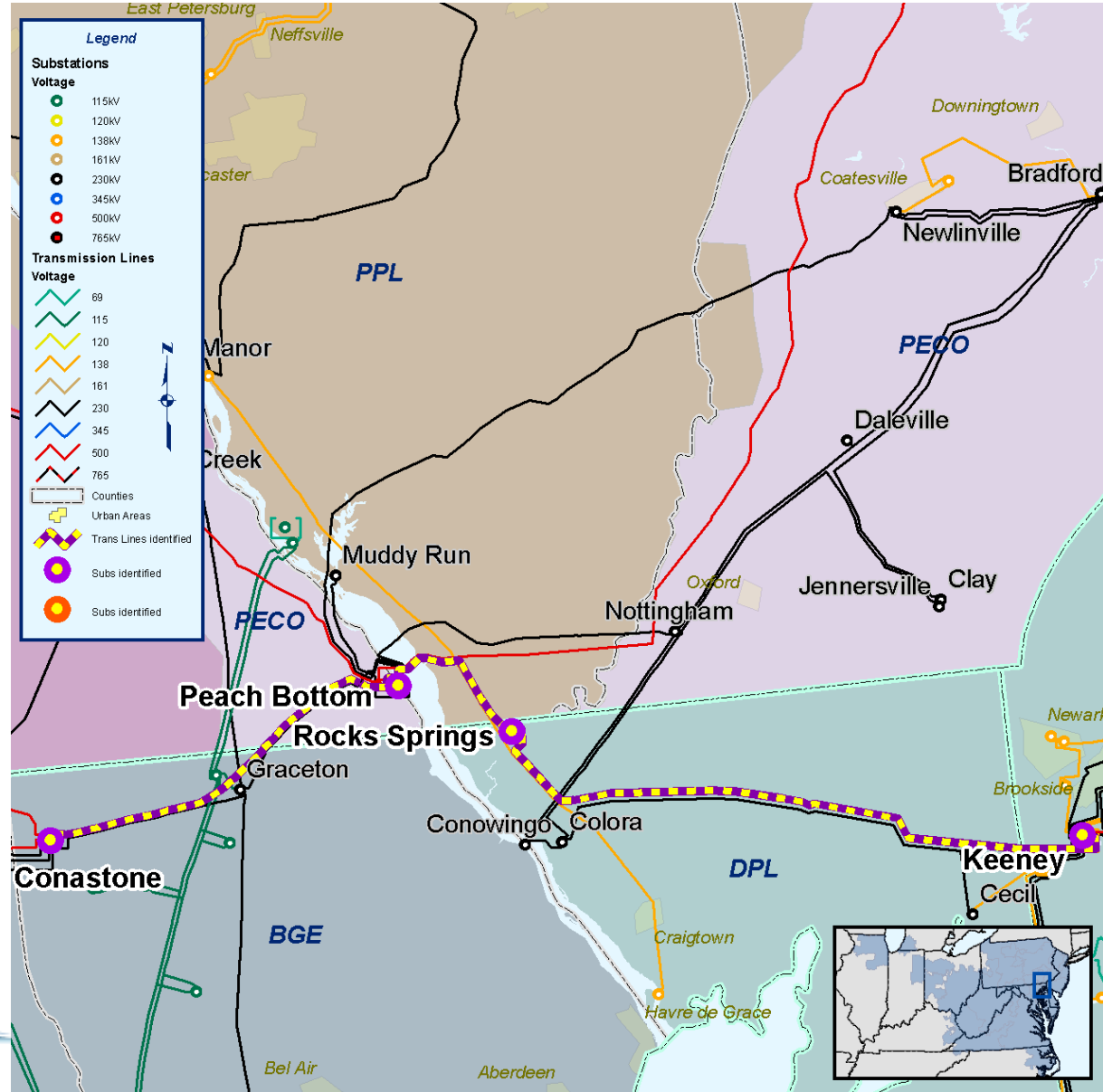
- Low Voltage Violations
 - Cochranville 230 kV bus / Loss of Keeney - Rock Spring 500 kV line
 - Cochranville 230 kV bus / Loss of Peach Bottom - Rock Spring 500 kV line



- Voltage Collapse
 - Loss of Cedar Creek – Red Lion 230 kV line
 - Loss of Keeney – Rock Spring 500 kV line
 - Loss of Peach Bottom – Rock Spring 500 kV line



- Voltage Collapse
 - Loss of Conastone – Peach Bottom 500 kV line
 - Loss of Peach Bottom – Rock Spring 500 kV line
 - Loss of Keeney – Rock Spring 500 kV line



- PV study scenario:
 - Study Case: MAAC CETO Voltage case
 - Contingency: Loss of Conastone – Peach Bottom
 - Transfer: Generation in PJM West and South ⇒ Generation in MAAC
 - **Last MW transfer: -338 MW**

- Reactive loss:
 - 230 kV and 500 kV SW shunts fully are utilized at -338 MW transfer.

Facility	Post Cont MVAR Loss	Pre Cont MVAR Loss	dMVAR
Keystone - Airydale Ckt 1	1141.7	746.4	395.3
Conemaugh - Airydale Ckt 1	727	396.3	330.7
Airydale - Juniata Ckt 1	610.2	370.6	239.6
Airydale - Juniata Ckt 2	591.1	356.8	234.4
Juniata - Alburdis	475.9	300.1	175.8
Juniata - TMI	172.5	10.8	161.7
Total	3718.4	2181	1537.5

- PV study scenario:
 - Study Case: MAAC CETO Voltage case
 - Contingency: Loss of Keeney – Rock Springs
 - Transfer: Generation in PJM West and South ⇒ Generation in MAAC
 - Last MW transfer: -850 MW

- Reactive loss:
 - Most effective 230 kV and 500 kV SW shunts are fully utilized at -850 MW transfer.

Facility	Post Cont MVAR Loss	Pre Cont MVAR Loss	dMVAR
Peachbottom - Limerick Ckt 1	953.3	322.2	631.2
Alburtis - Branchburg Ckt 1	521.4	295.9	225.5
TMI - Hosensak Ckt 1	312.4	93.8	218.7
Peachbottom - Cochrnvl Ckt 1	384.0	183.1	200.9
Juniata – Alburtis Ckt 1	449.4	269.2	180.1
Elroy – Branchburg Ckt 1	334.4	176.3	158.1
Branburg- Deans Ckt 1	200.2	60.0	140.1
Lackaw- Jefferson Ckt 1	153.7	47.2	106.6
Total	3308.8	1447.7	1861.2

- Develop solutions to resolve the reactive problems noted on the previous pages
 - Backbone transmission lines are being considered to address the identified problems
 - MAPP
 - Conastone to Peach Bottom
 - Peach Bottom to Keeney
- Reactive analysis for common mode failure contingencies such as bus faults and stuck breaker faults

- N-2 study summary:
 - # of 2013 single contingencies: 5379
 - Analysis: voltage magnitude and drop
 - All potential violations are tabulated by each area, and sent to TOs for verification.
- # of buses with voltage magnitude/drop violations (PJM West and South)

(# of buses with low voltage / # of buses with voltage drop)

	Dominion	APS	AEP	Dayton	Duquesne	ComED
69 kV	0 / 0	0 / 1	0 / 29	25 / 33	2 / 2	18 / 0
115 kV	49 / 63	0 / 1	0 / 1	0 / 0	0 / 0	0 / 0
138 kV	1 / 4	127 / 123	5 / 5	16 / 18	4 / 4	293 / 0
161 kV	0 / 0	0 / 0	3 / 3	0 / 0	0 / 0	0 / 0
230 kV	24 / 11	15 / 19	0 / 0	0 / 0	0 / 0	0 / 0
235 kV	0 / 0	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0
345 kV	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	71 / 0
500 kV	0 / 0	1 / 2	1 / 1	0 / 0	0 / 0	0 / 0
765 kV	0 / 0	0 / 0	0 / 5	0 / 0	0 / 0	3 / 0
Blown Up	11 / 11	26 / 26	4 / 23	3 / 3	0 / 0	31 / 0

- # of buses with voltage magnitude/drop violations (MAAC)

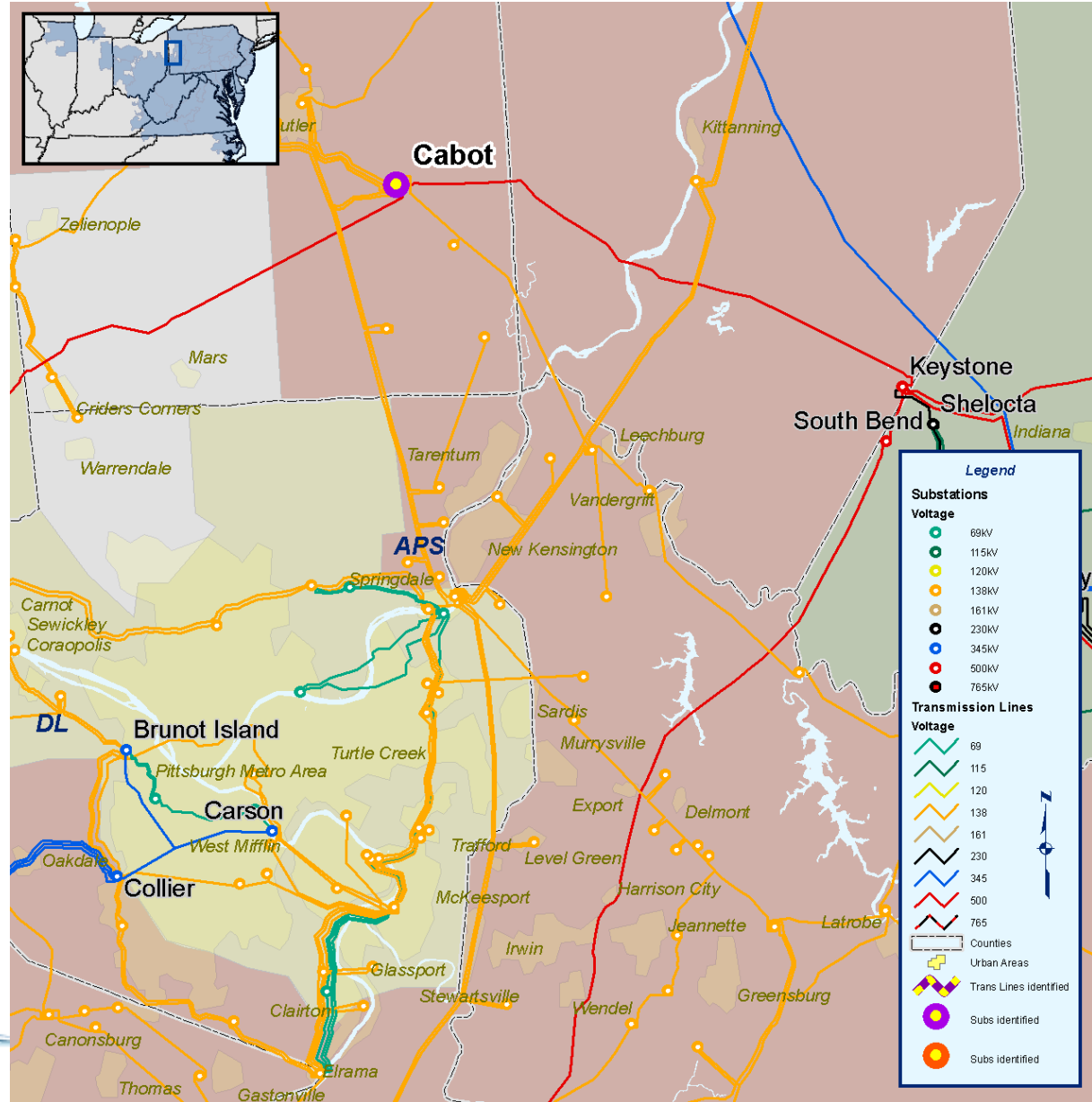
(# of buses with low voltage / # of buses with voltage drop)

	PJM 500	PN	ME	JCPL	PPL	PECO	PSEG	BGE	PEPCO	AE	DPL	UGI	RE
69 kV	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	31 / 29	0 / 9	0 / 0	0 / 0	74 / 83	71 / 104	0 / 0	0 / 0
115 kV	0 / 0	70 / 90	19 / 57	0 / 16	0 / 0	0 / 0	0 / 0	0 / 20	1 / 1	0 / 0	0 / 0	0 / 0	0 / 0
138 kV	0 / 0	1 / 2	2 / 2	0 / 0	0 / 0	30 / 25	10 / 48	0 / 0	0 / 7	9 / 9	12 / 23	0 / 0	0 / 0
161 kV	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
230 kV	0 / 0	11 / 13	7 / 10	11 / 14	18 / 26	23 / 21	9 / 22	0 / 0	1 / 2	2 / 1	0 / 2	0 / 0	0 / 0
235 kV	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
345 kV	0 / 0	3 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
500 kV	0 / 8	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
765 kV	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
Blown Up	1 / 1	59 / 56	4 / 3	8 / 10	5 / 4	19 / 13	8 / 10	3 / 3	21 / 20	2 / 3	16 / 12	0 / 0	0 / 0

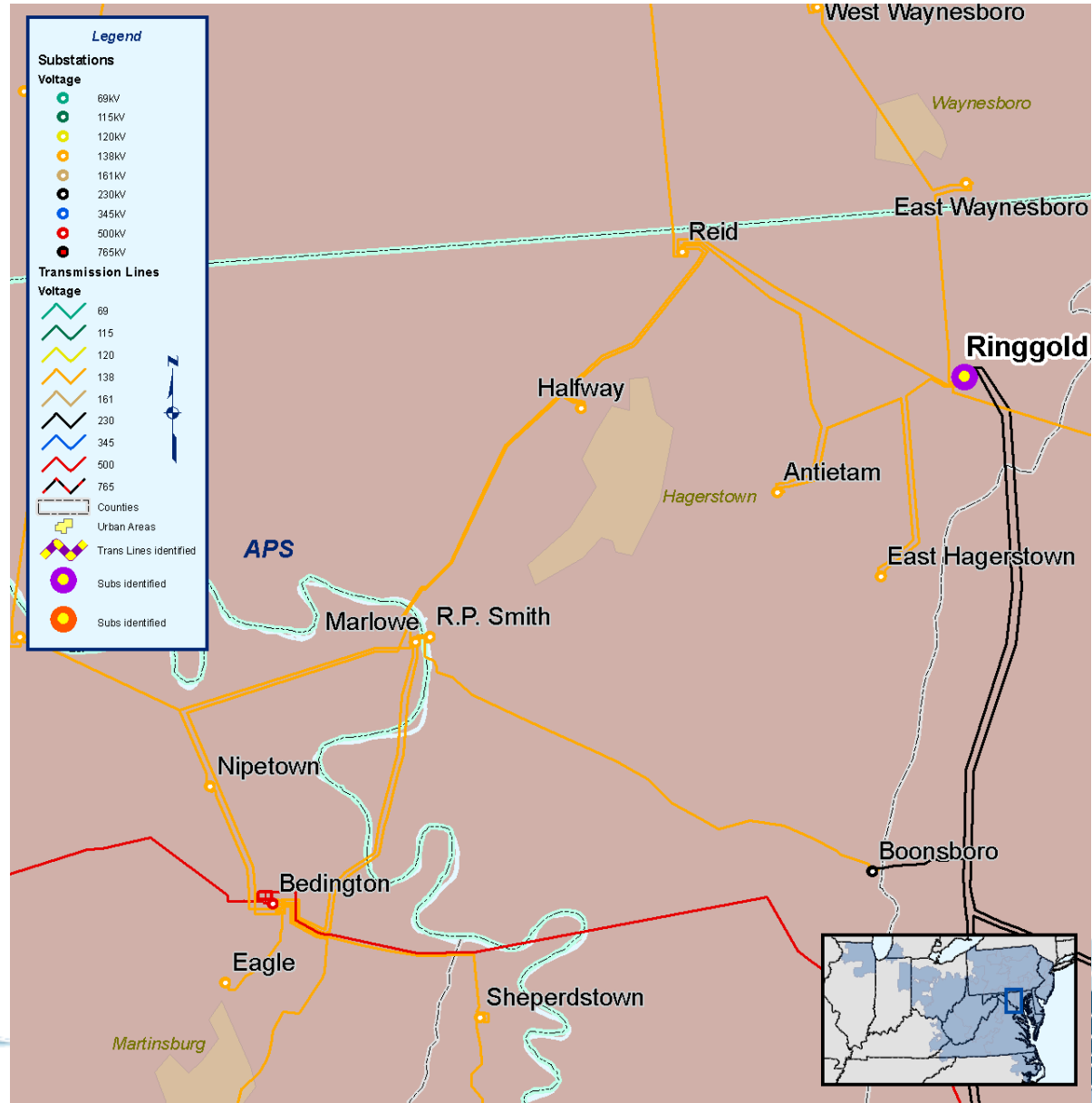


Baseline Upgrades

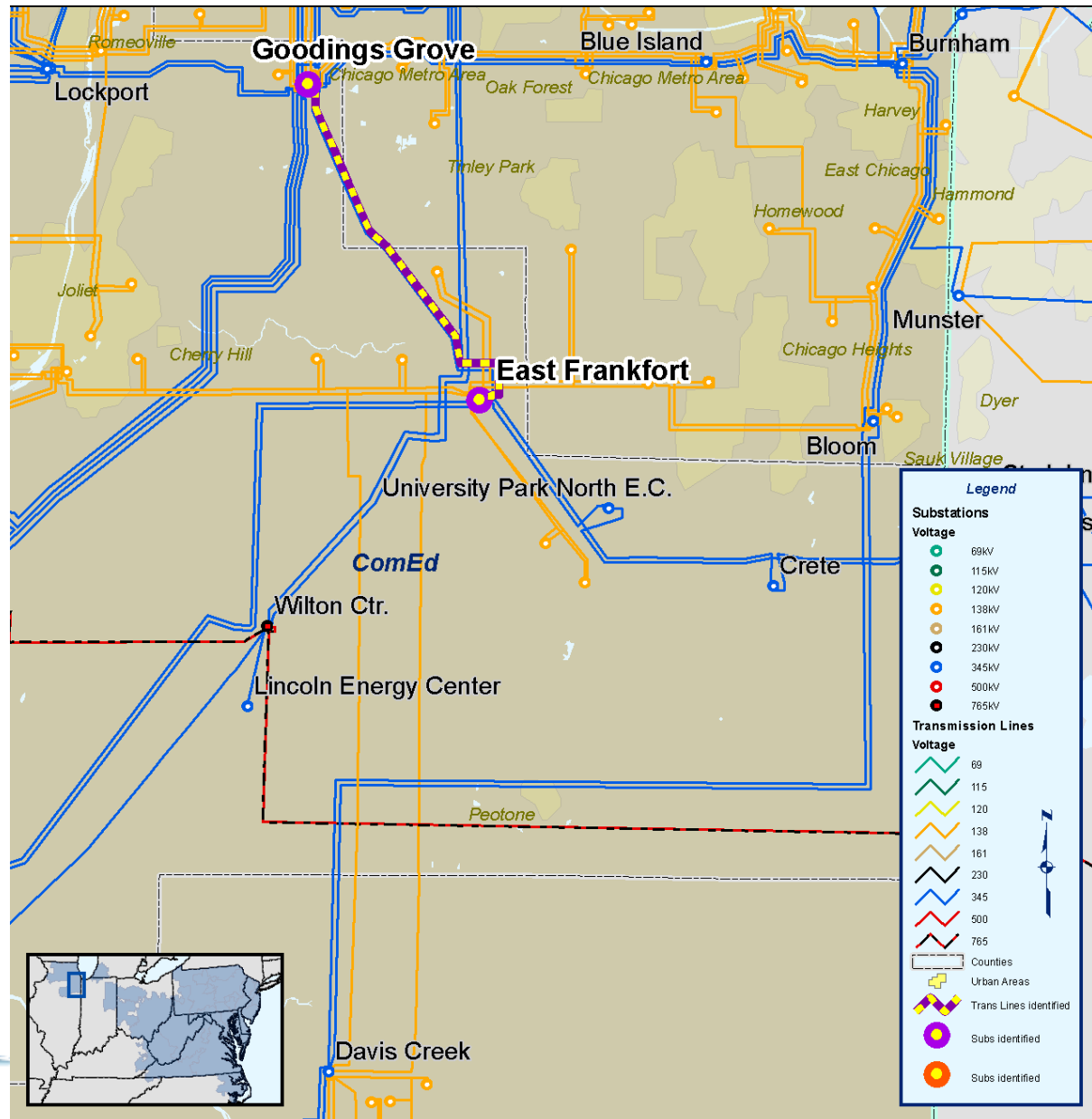
- Thermal Overload of Cabot #1 500/138 kV transformer
- Bus fault contingency of the #2 Main 500 kV bus resulting in loss of the #2 and #4 banks
- APS Criteria
- Solution: Install a third Cabot 500/138kV autotransformer
- Estimated Cost: \$8.07M
- IS Date: 6/1/2011



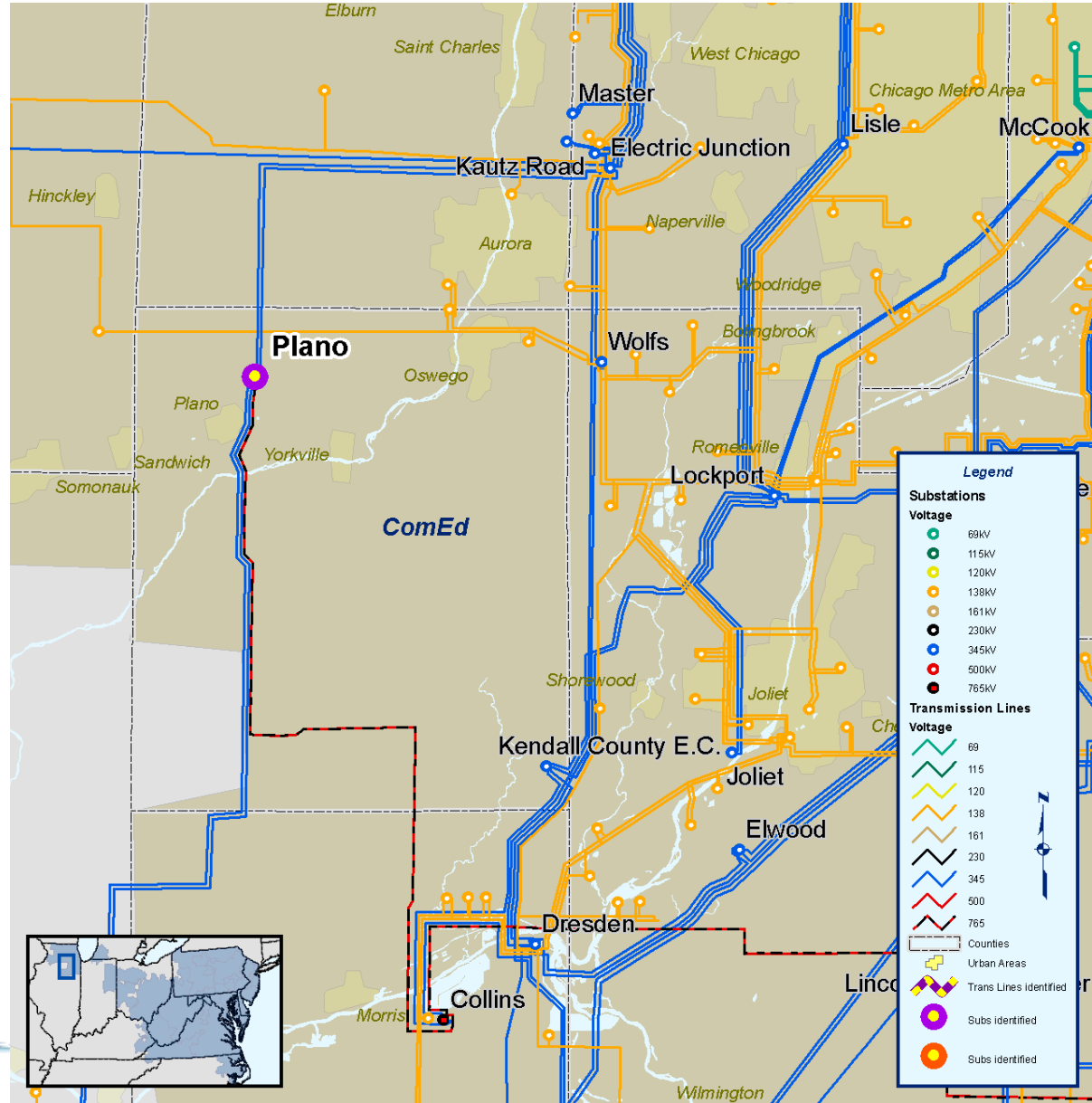
- In 2013, the Ringgold #3 230/138 kV transformer is overloaded for the tower outage of Reid - Nipetown 138 kV and Marlowe - Halfway 138 kV
- Solution: Replace the Ringgold #3 230/138 kV transformer with a larger transformer
- Generator deliverability
- Estimated Project Cost: \$5.8
- IS Date: June 2013



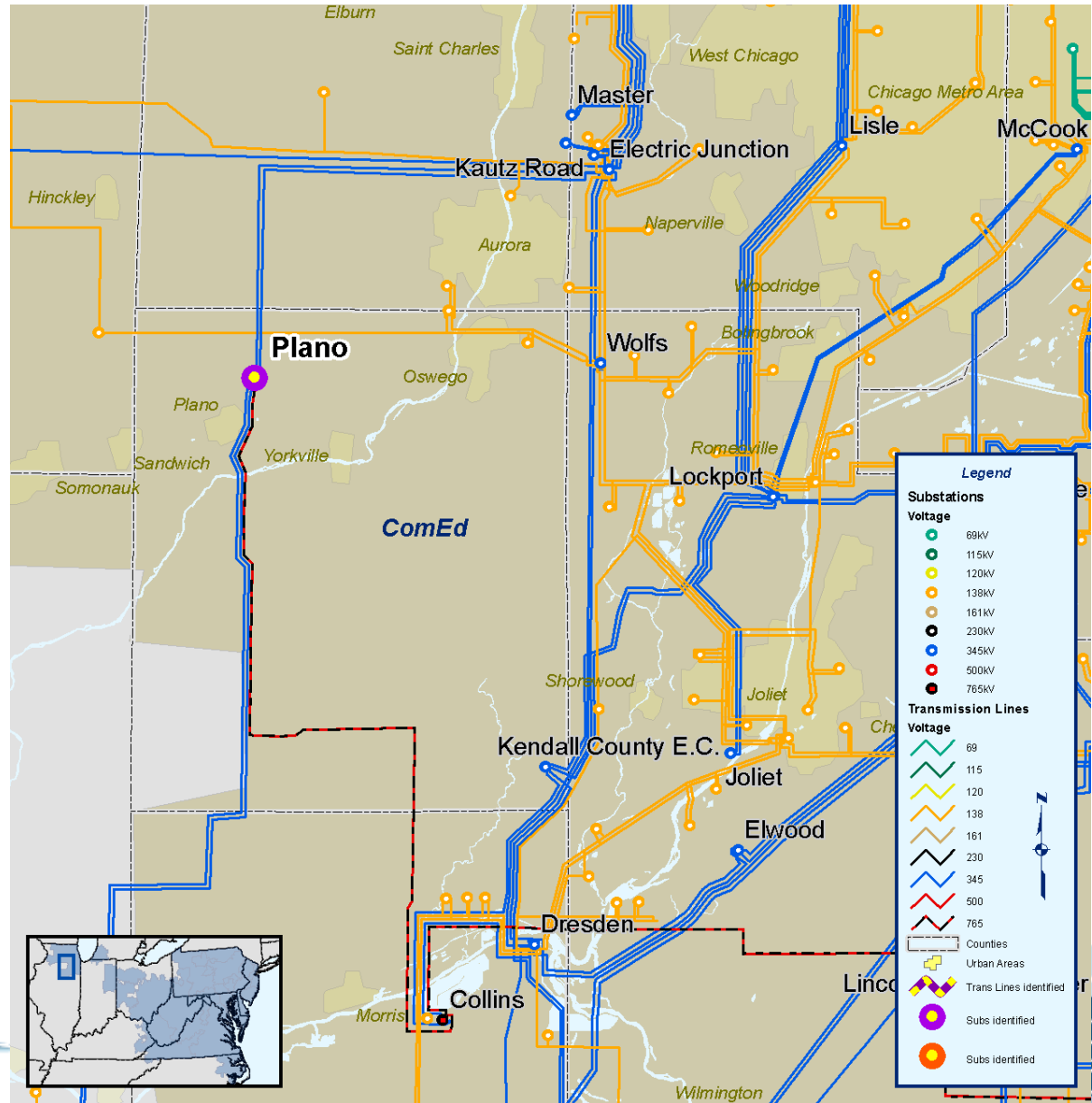
- Thermal Overload of East Frankfort – Goodings Grove 345 kV “Red”
- No contingency – all facilities in Service
- Solution: Reconductor East Frankfort - Goodings Grove 345 kV "Red" line 11602
- Generator and Load Deliverability
- IS Date: 6/1/2013
- Cost Estimate: \$15M



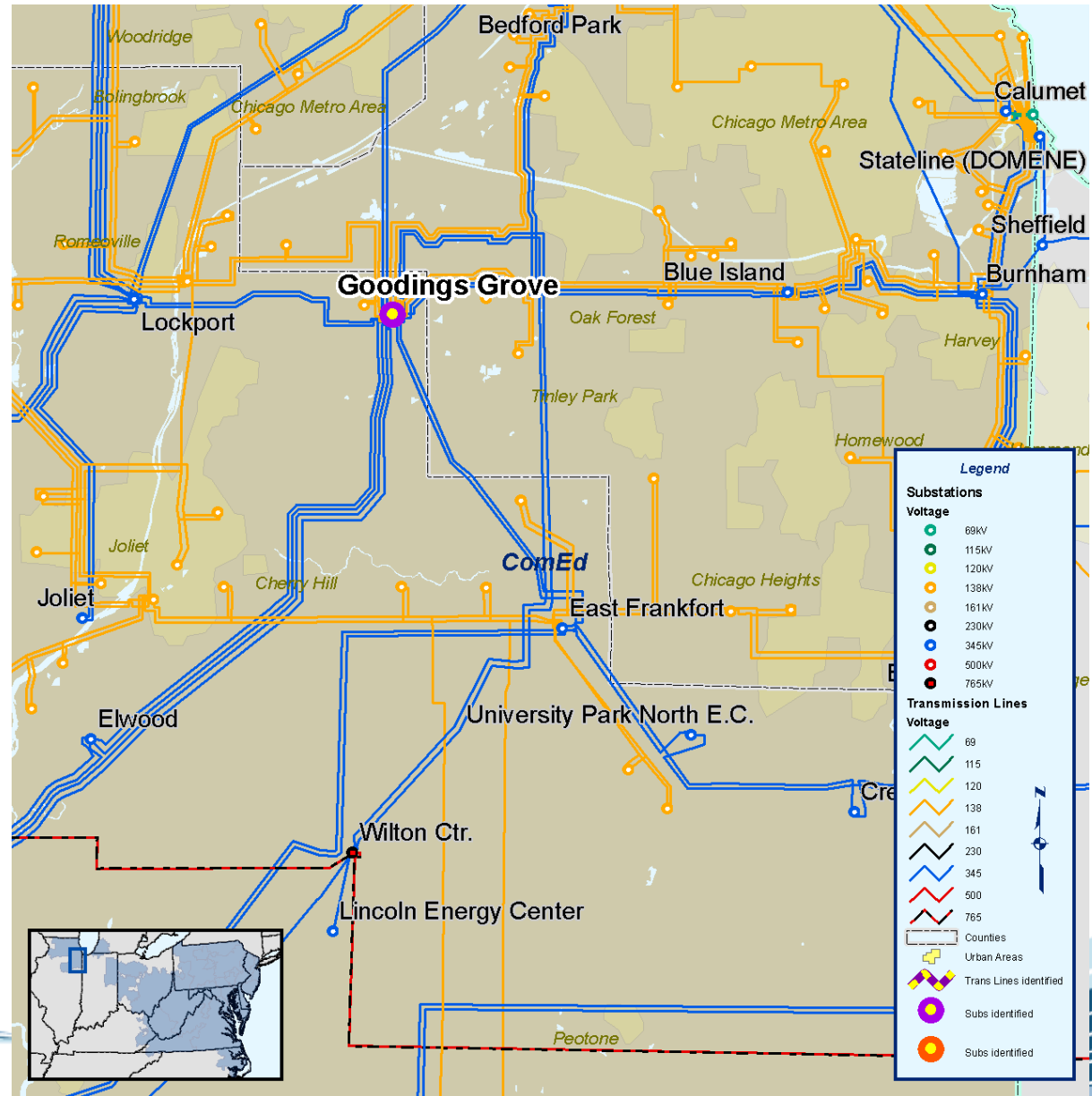
- Thermal overload of Wolfs 345/138 kV “Blue” transformer for the loss of the Wolfs 345/138 kV “Red” transformer
- Thermal overload of Wolfs – Oswego 138 KV “Blue” for the outage of Wolfs – Oswego 138 kV “Red”
- Solution for both violations: Replace the existing baseline to install a 2nd Wolfs 345/138 kV transformer. The replacement project is a 345/138 kV transformer at Plano “Red”
- Generator Deliverability
- Cost Estimate: \$20M
- IS Date: 6/1/2013



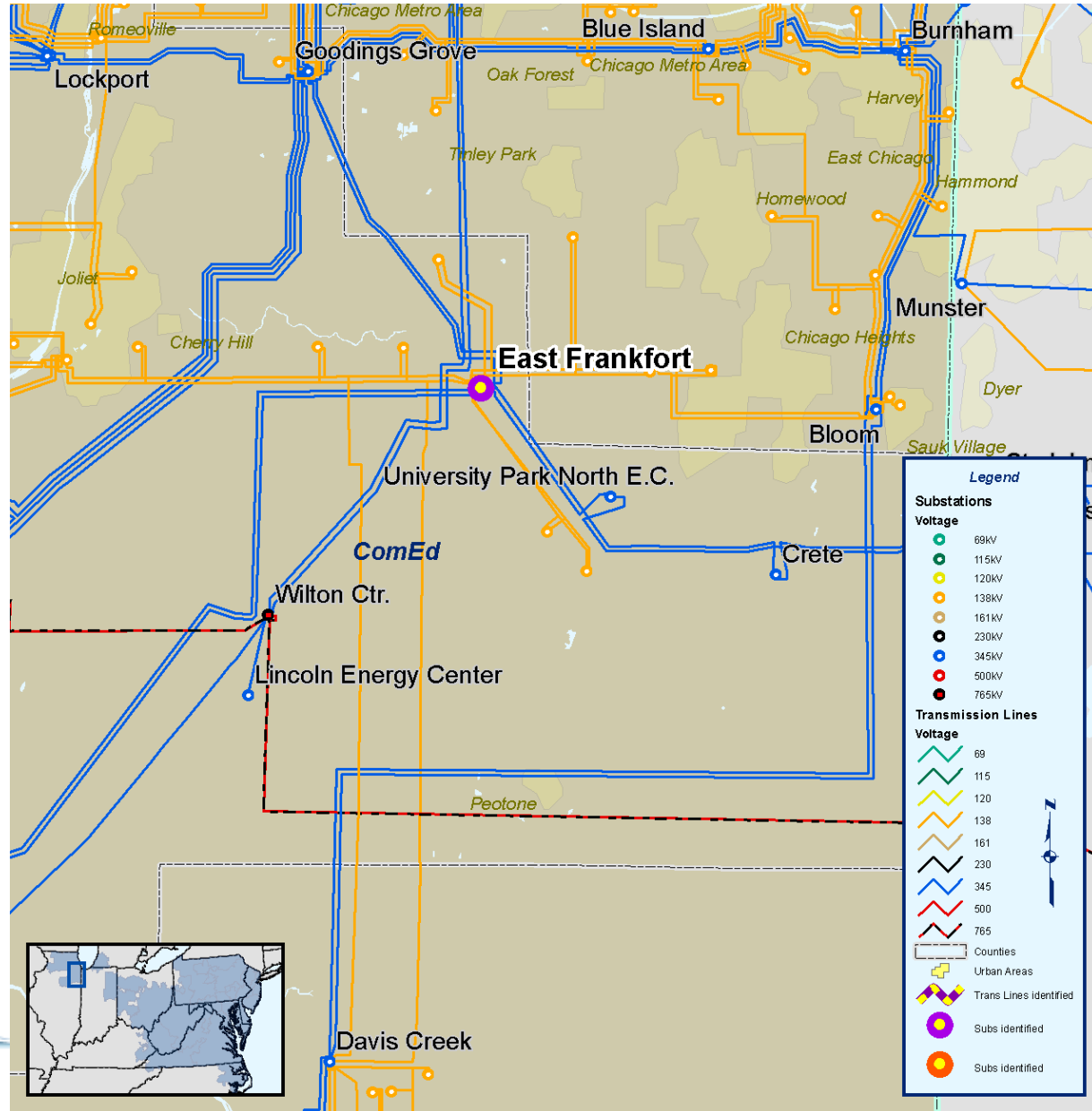
- Thermal overload of Electric Jct 345/138 kV TR84 for the loss of the parallel TR83 and vice versa
- Solution: Install a second 345/138 kV transformer at Plano “Red”
- Generator Deliverability and Load Deliverability
- Estimated Cost: \$10M
- IS Date: June 2013



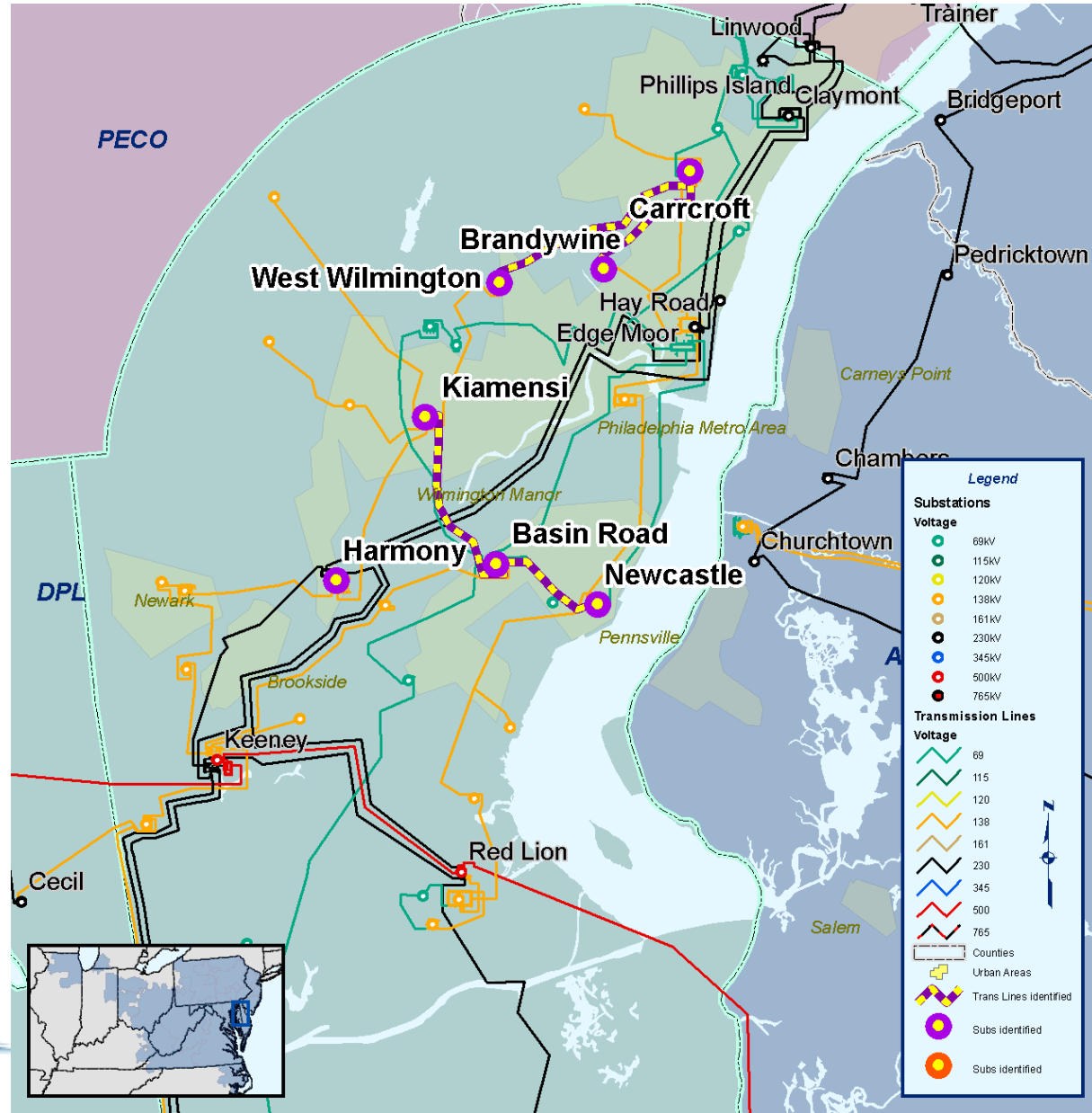
- Thermal overload of Goodings Grove 345/138 kV “Red” transformer for the loss of Blue Island – Alsip 138 kV
- Solution: Install a third 345/138 kV transformer at Goodings Grove “Red”
- Generator Deliverability & Load Deliverability
- IS Date: 6/1/2013
- Cost Estimate: \$15M



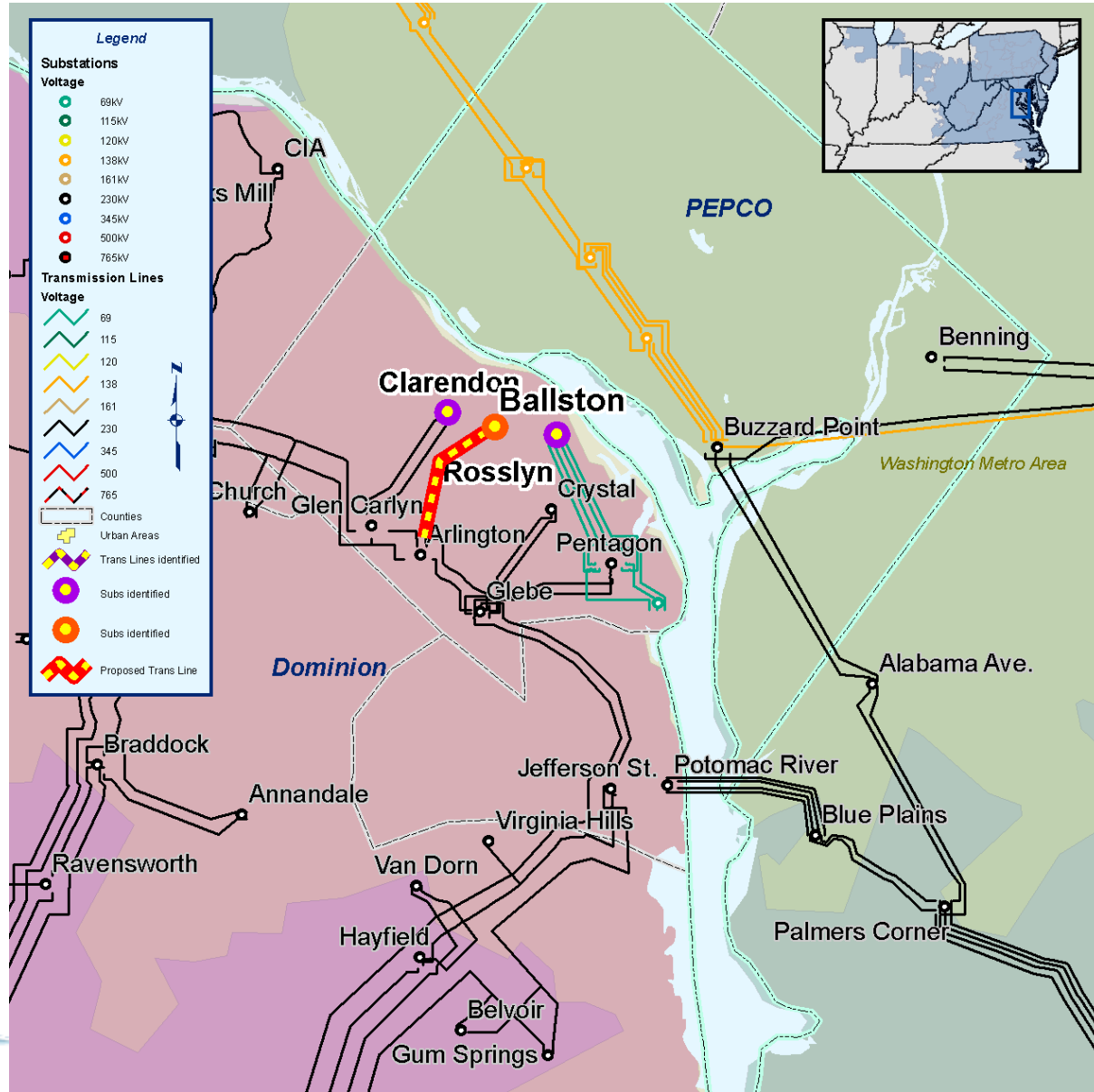
- Thermal overload of East Frankfort – Goodings Grove 345 kV “Blue”
- No contingency – all Facilities in Service
- Solution: Install a 2nd East Frankfort 345/138 kV Autotransformer and reconductor Country Club Hills – Matteson 138 kV
- Generator Deliverability & Load Deliverability
- IS Date: 6/1/2013
- Cost Estimate: \$11.25M



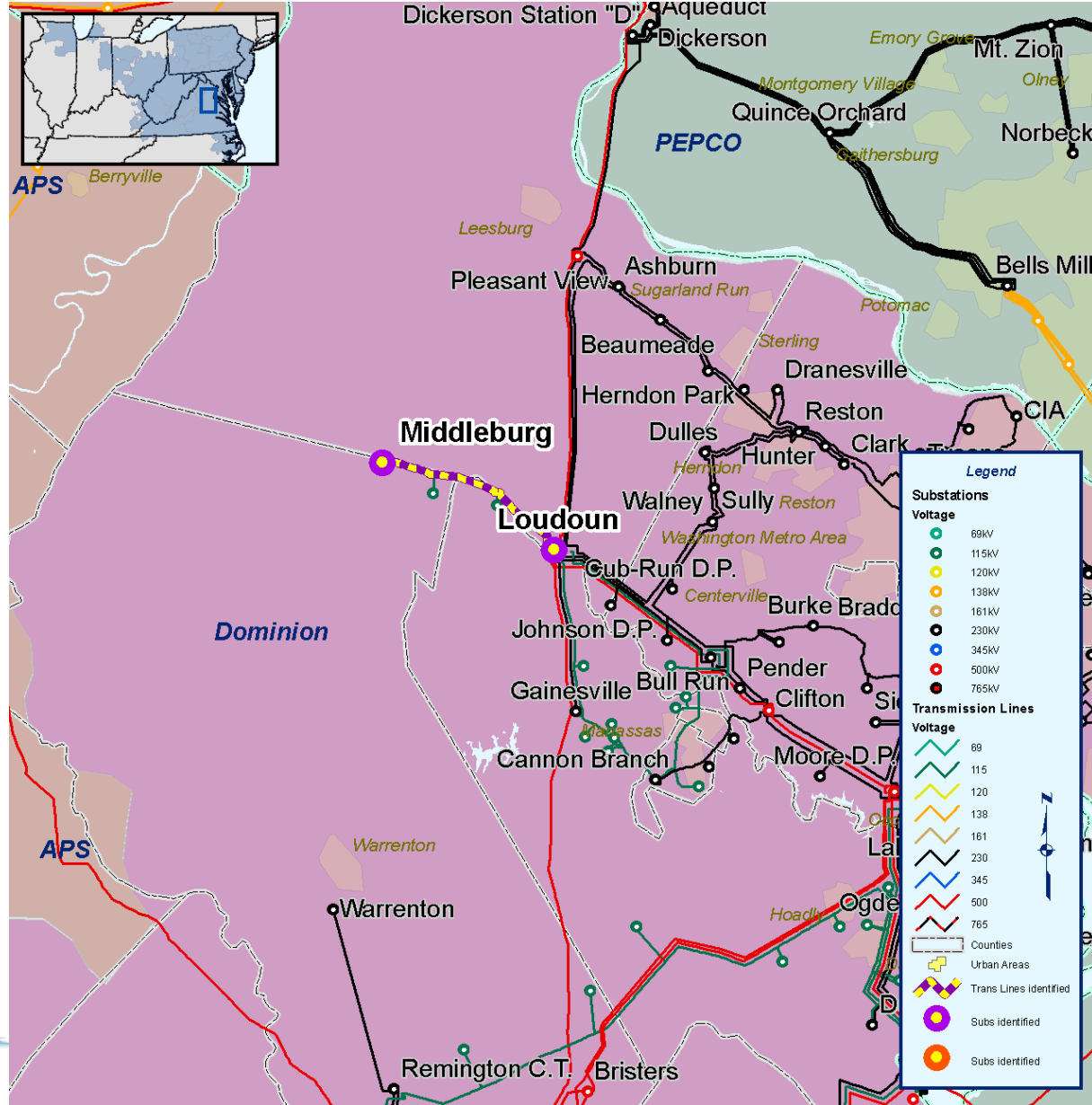
- Basin Road – Kiamensi 138 kV line / loss of Carrcroft – Edgemoor 138 kV line + loss of Harmony 230/138 kV transformer
- Brandywine – West Wilm 138 kV line / loss of Harmony 230/138 kV transformer + loss of Basin Road – Kiamensi 138 kV line
- Carrcroft - Brandywine 138 kV line / loss of Harmony 230/138 kV transformer + loss of Basin Road – Kiamensi 138 kV line
- Basin Road - Newcastle 138 kV line / loss of Harmony 230/138 kV transformer + loss of Keeney 230/138 kV transformer
- Recommended Solution: Add 2nd 230/138 kV transformer at Harmony
- Estimated Project Cost: \$7.5M
- Expected IS Date: 6/01/2013



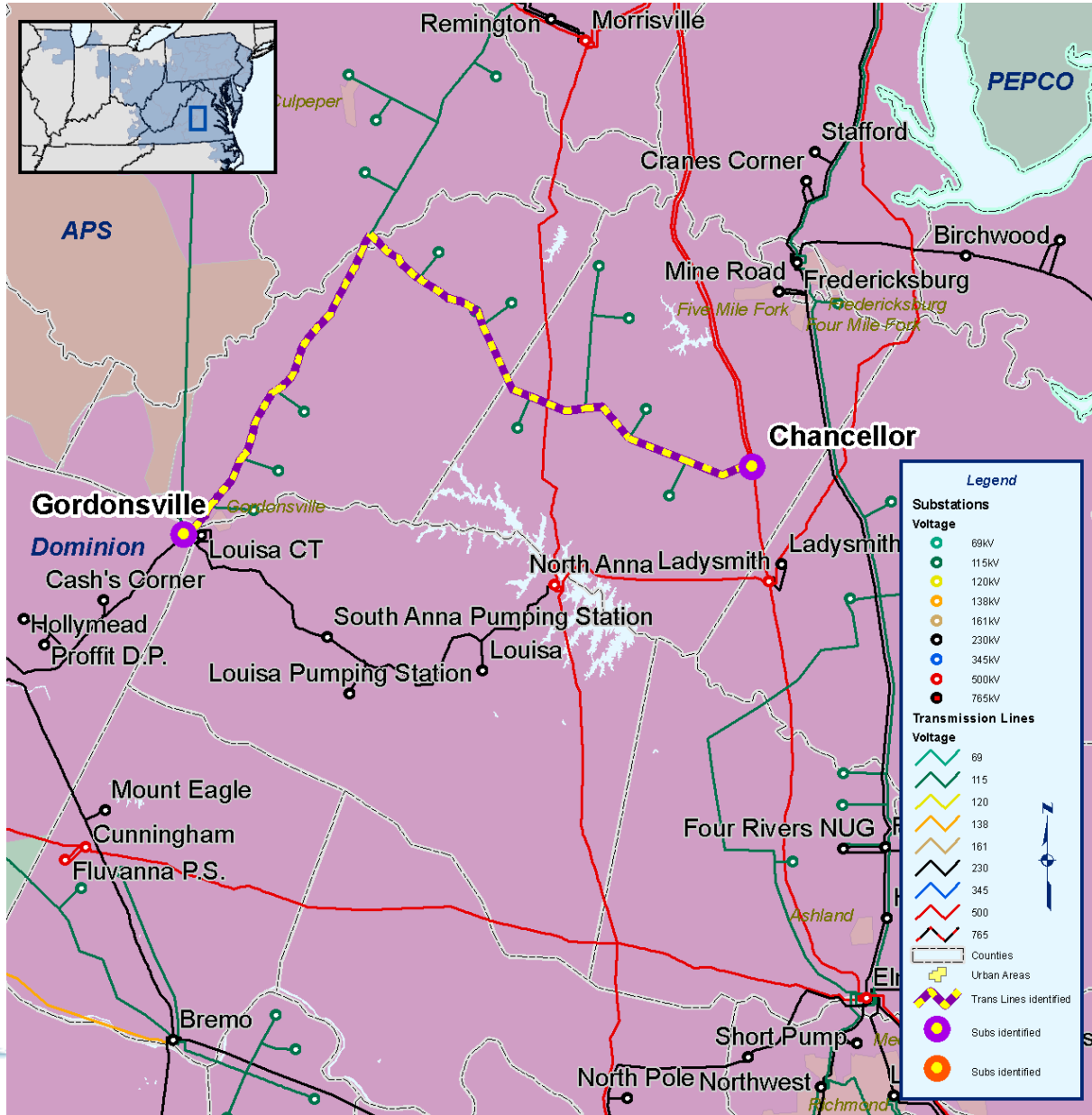
- High load area currently fed by two 230 kV underground lines originating from same substation
- N-2 contingency loss of UG transmission lines #277 and 278 from Glen Carlyn to Clarendon causes the loss of all load at Clarendon and Ballston Substations. Restoring this load via 69 kV lines #122 and #143 will cause loading on UG transmission lines #179 and #180 Pentagon to Rosslyn 69 kV to exceed their STE ratings.
- Solution: Build new UG 230 kV circuit from Arlington to Ballston
- Expected in-service date: June 2013
- Estimated cost: \$80 M



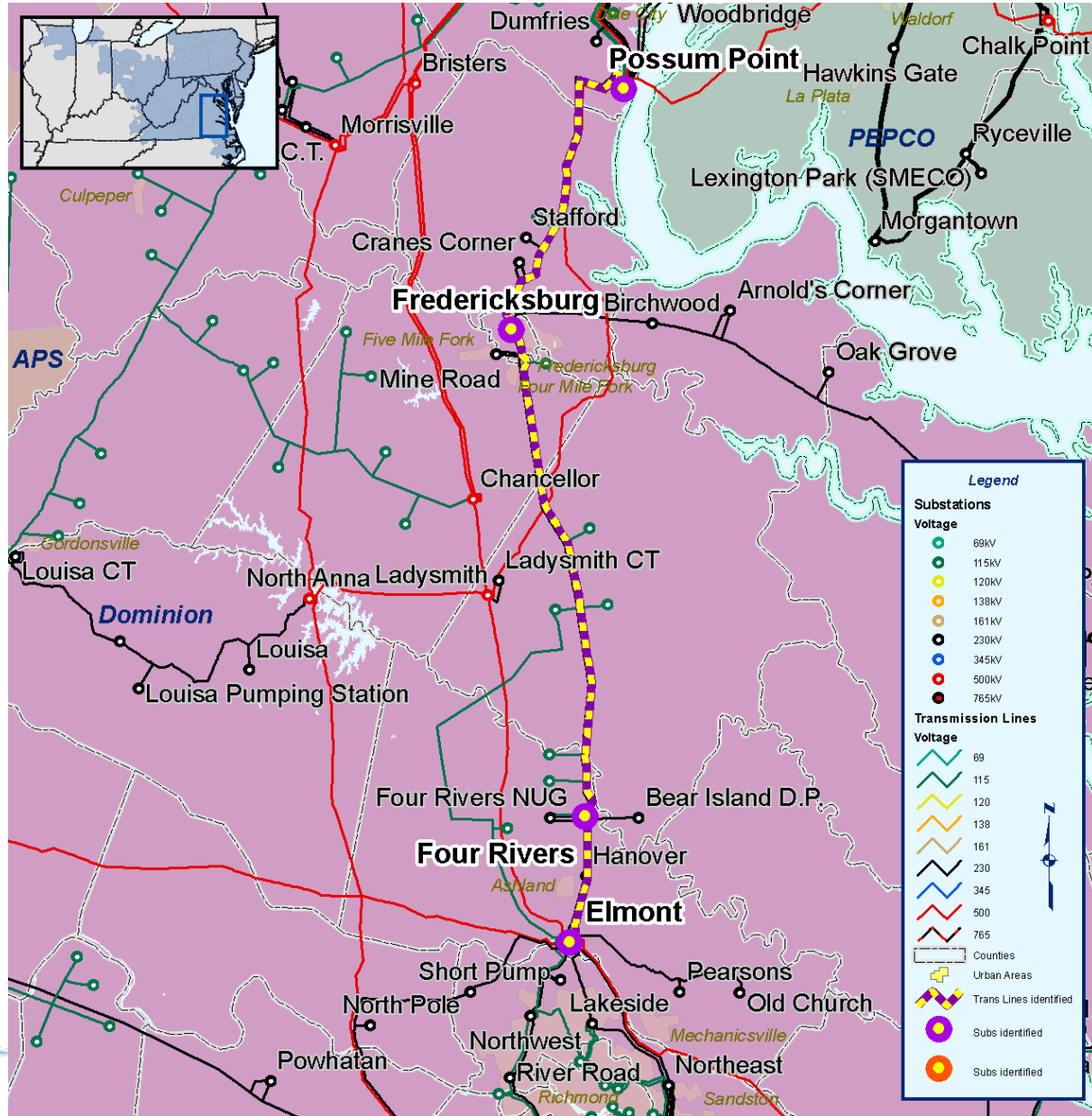
- Radial lines #49 Loudoun to Middleburg 115 kV and #2098 Pleasant View to Hamilton 230 kV line loading exceed Dominion Criteria Radial line load greater than 100 MVA.
- Solution: Build a 15-mile long 230 kV line from Hamilton to Middleburg and convert Line #49 to 230 kV (10 miles).
- Expected service date: May 2013
- Est. Cost: \$125M



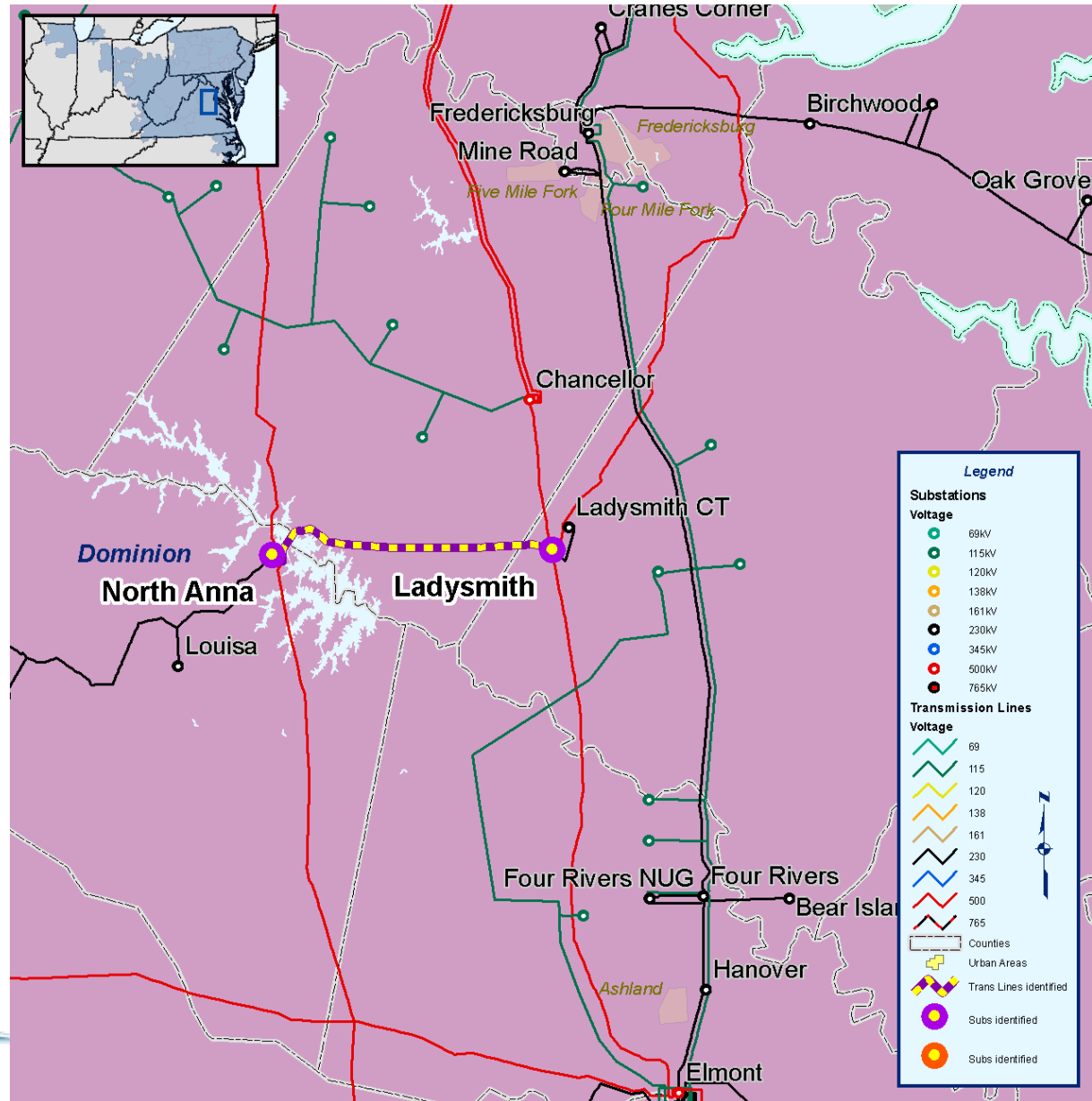
- Lines #11 Gordonsville to Oak Green and #198 Oak Green to Chancellor overloads for the loss of line #552 Ladysmith-Chancellor-Bristers 500 kV or the Chancellor 500-115 kV Tx.
- Recommended Solution: Install two 500 kV breakers and a 2nd 500-115 kV AutoTx. at Chancellor Substation
- Expected service date: May 2013
- Est. Cost: \$16.0 M



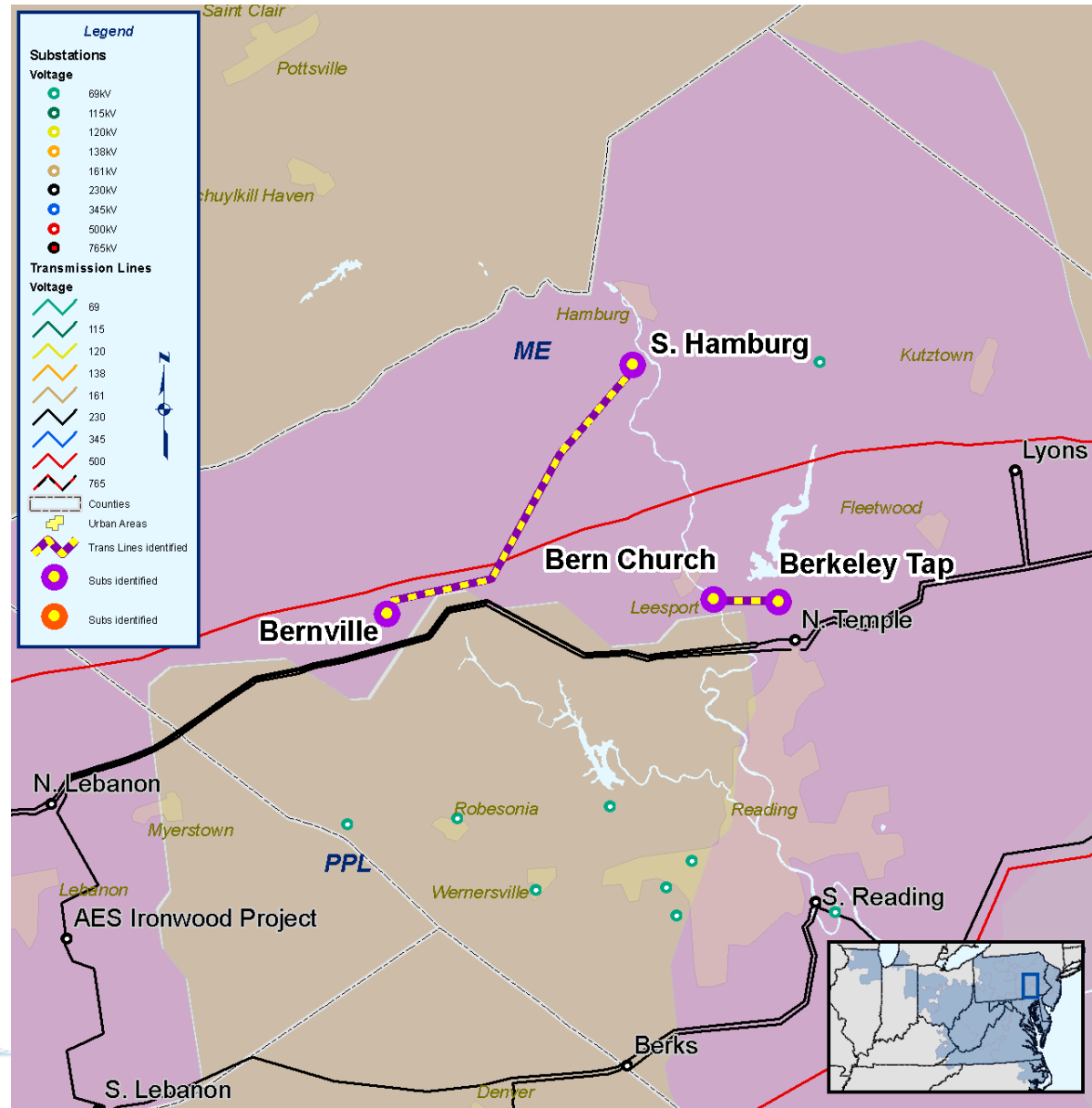
- The outage of line #73 Four Rivers to Elmont with Four Rivers 115 kV generation off causes low voltages at line #45 Four Rivers to Fredricksburg 115 kV.
- Also Line #47 Four Rivers to Fredricksburg overloads for the outage line #29 Fredricksburg to Possum Pt and Fredricksburg 230-115 kV
- Recommended Solution: Install 2nd Fredricksburg 230-115 kV AutoTx.
- Expected service date: May 2013
- Est. Cost: \$5.5 M



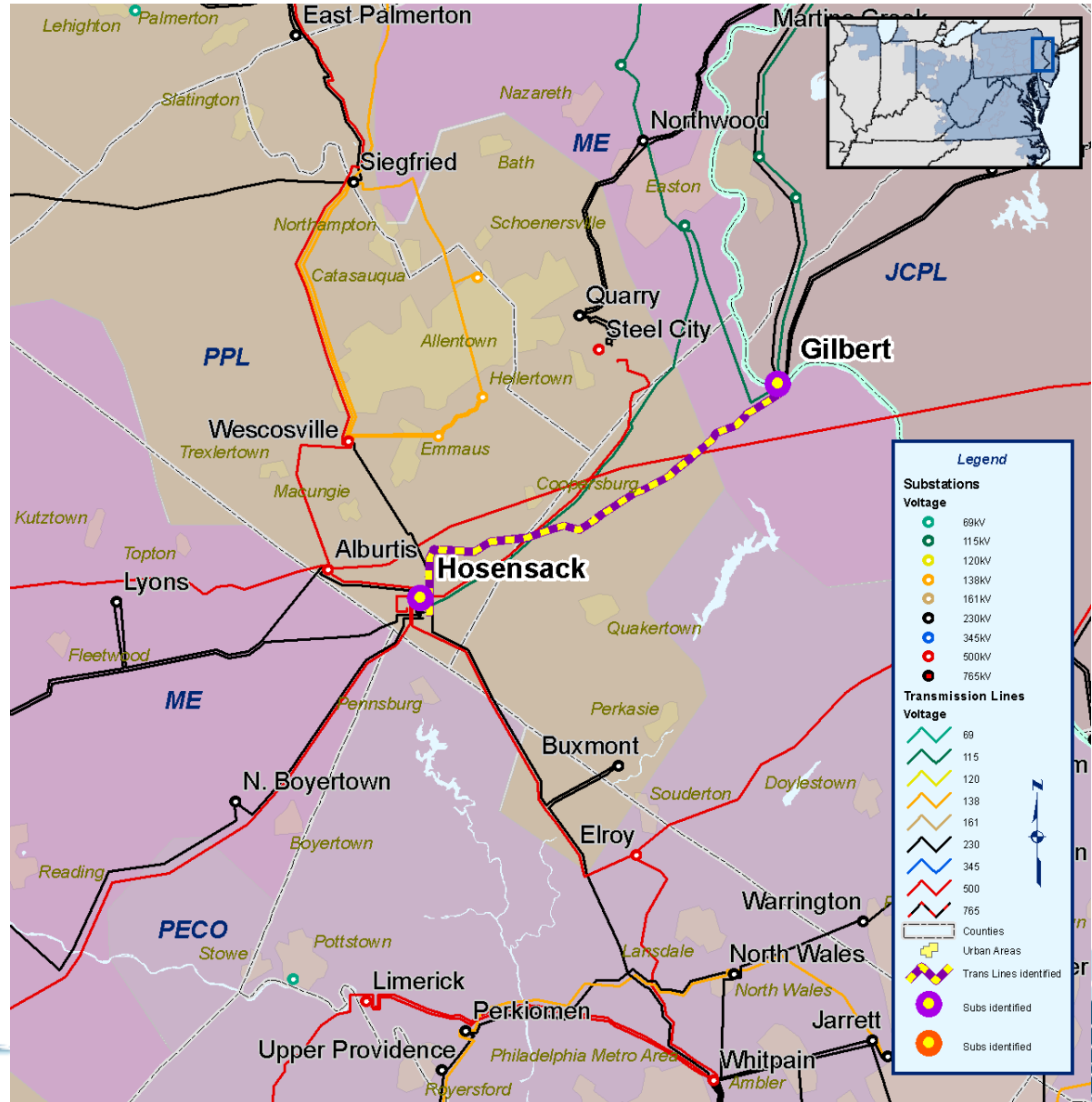
- North Anna to Ladysmith 500 kV overloads for the outage of North Anna to Morrisville 500 kV
- Solution: Replace wave traps on North Anna to Ladysmith 500 kV
- Generator Deliverability
- Expected service date: May 2013
- Est. Cost: \$0.3 M



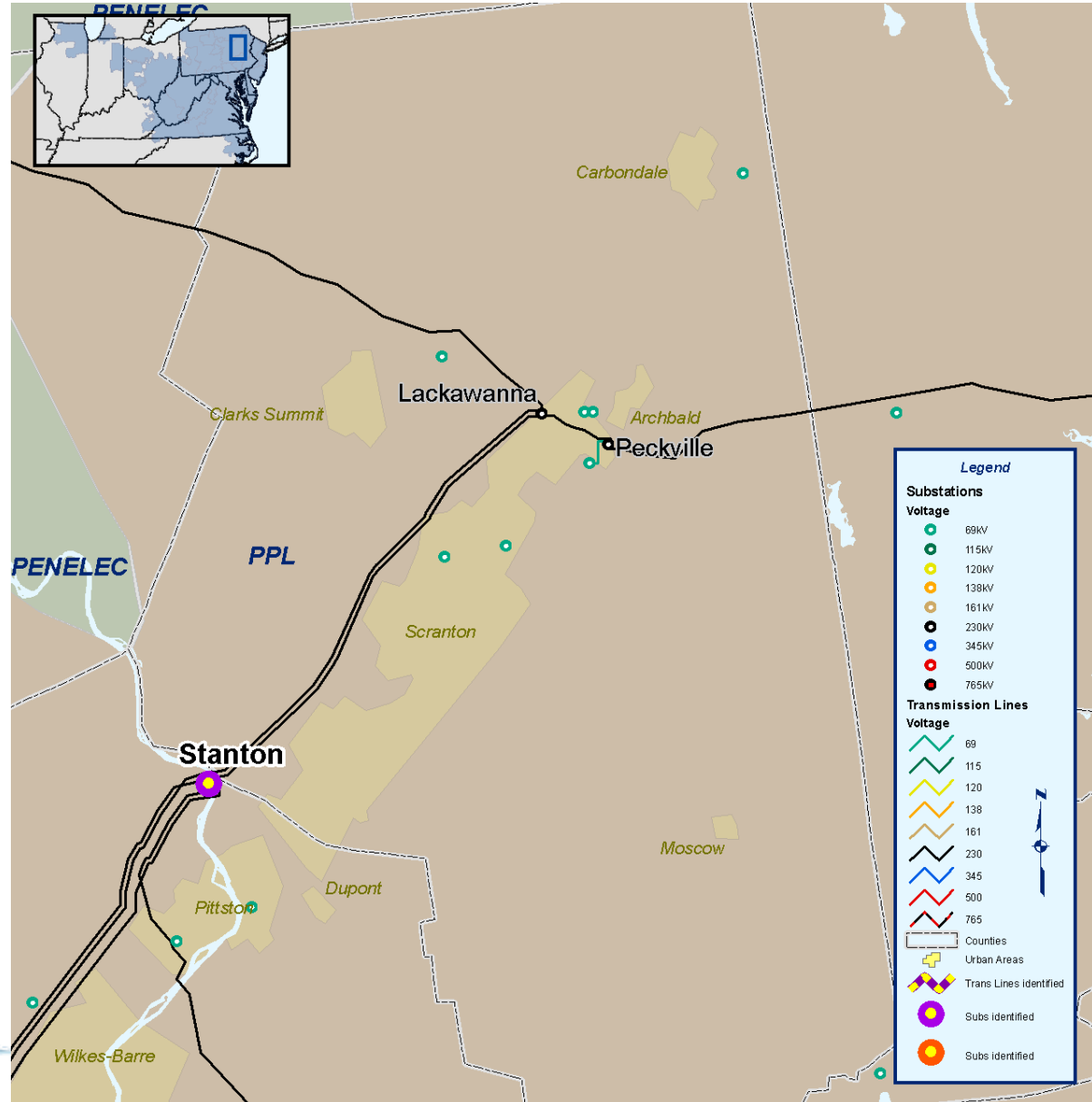
- North Temple 230/69 kV transformer #4 / loss of North Temple 230/69 kV transformer #6
- Berkeley Tap-Bern Church 69 kV line / loss of North Temple-Royal Green 69 kV line
- Bernville-South Hamburg 69 kV line / loss of North Temple-Berkeley Tap 69 kV line
- Construct a 230 kV Bernville station by tapping the North Temple-North Lebanon 230 kV line
- Install a 230/69 kV transformer at existing Bernville 69 kV station
- Estimated Project Cost: \$5.73 M
- Expected IS Date: 5/01/2010



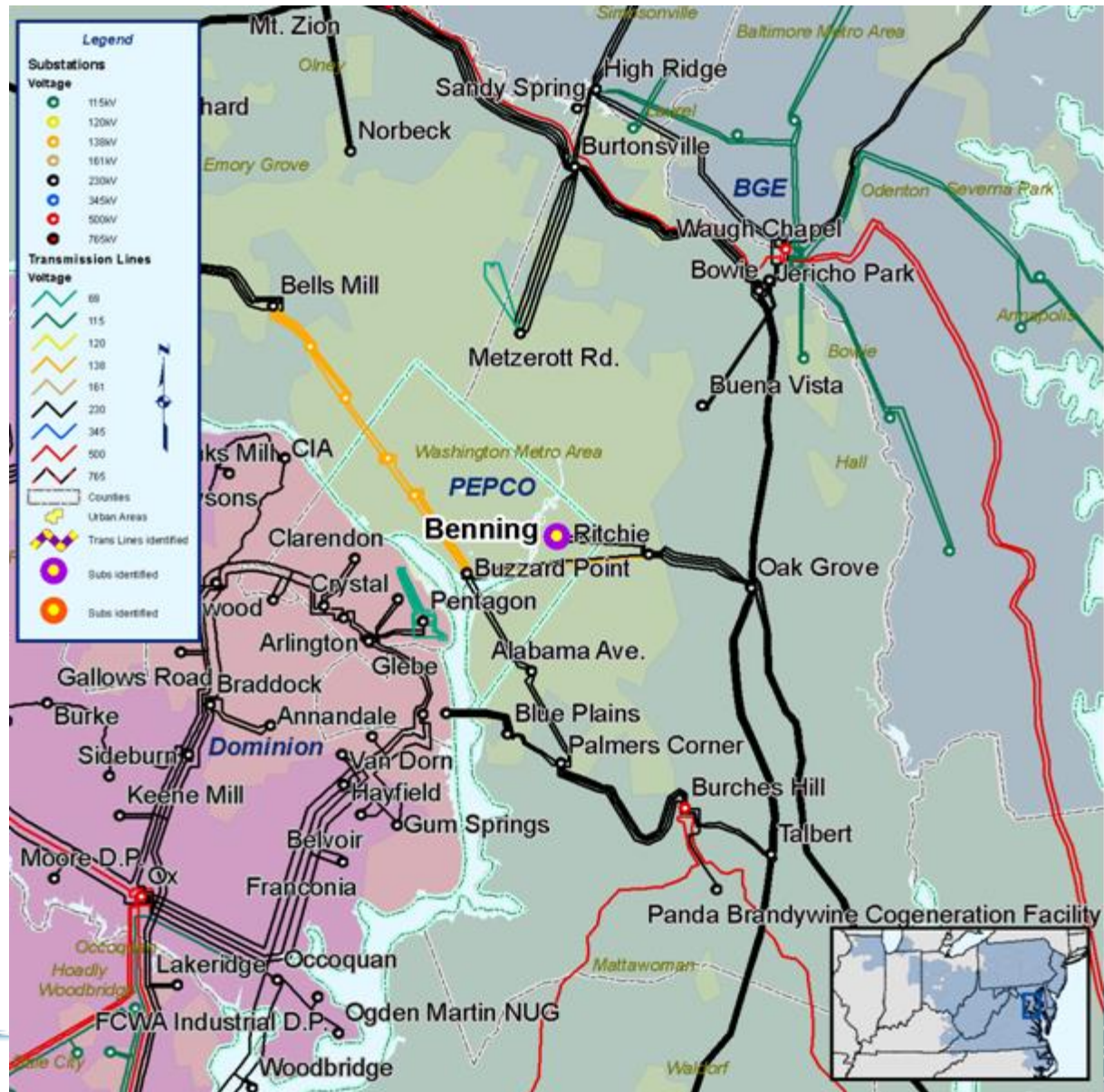
- Buxmont-Quakertown #2 69 kV line / loss of Buxmont-Quakertown #1 69 kV Line
- New Springfield 230/69 kV Substation and Transmission Line Connections
- Estimated Project Cost: \$16.40 M
- IS Date: 5/1/2011



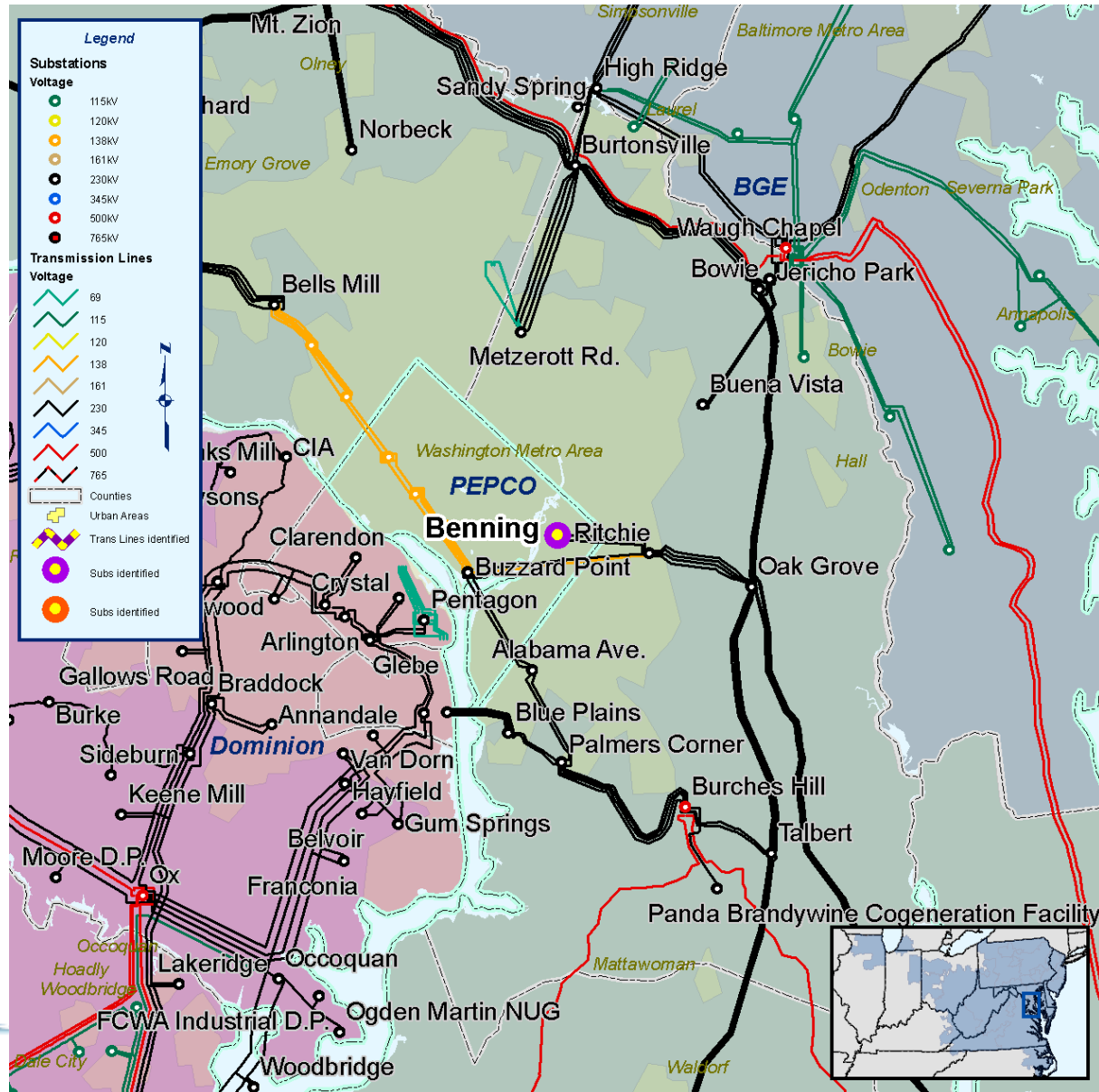
- All 3 Stanton 230/69 kV transformers / loss of DCTL Stanton-Lackawanna and Mountain-Lackawanna 230 kV lines
- Add a 4th 230/69 kV transformer at Stanton
- Estimated Project Cost: \$5.90 M
- Expected IS Date: 11/01/2011



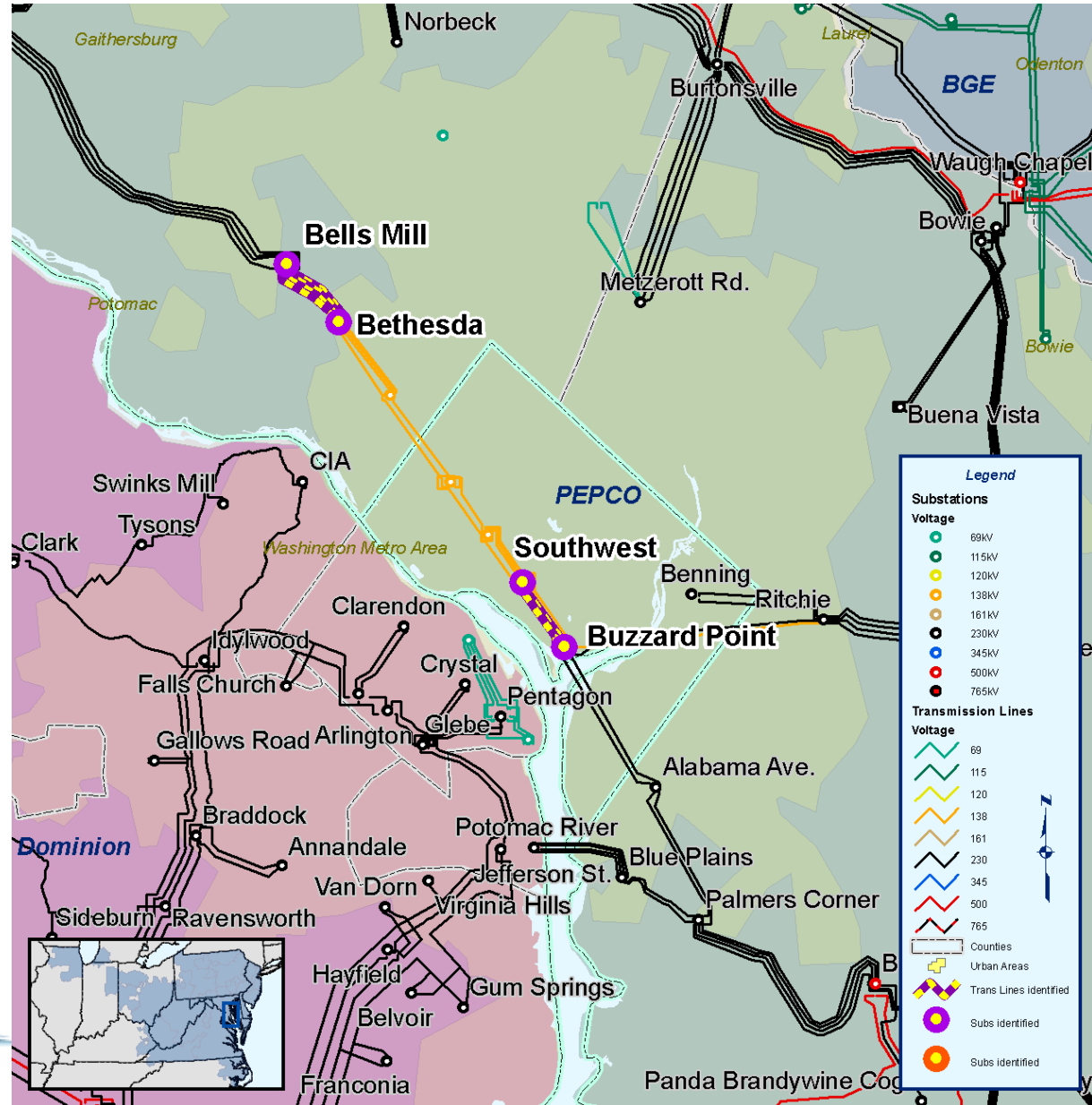
- Benning Station "A"
230/69 kV
transformer / loss of
parallel transformer
- Expand Benning 230
kV station; add a
new 230/69 kV, 250
MVA transformer at
Benning Sta. "A";
new 115 kV Benning
switching station
- Estimated Project
Cost: \$54.0 M
- Expected IS Date:
6/01/2012



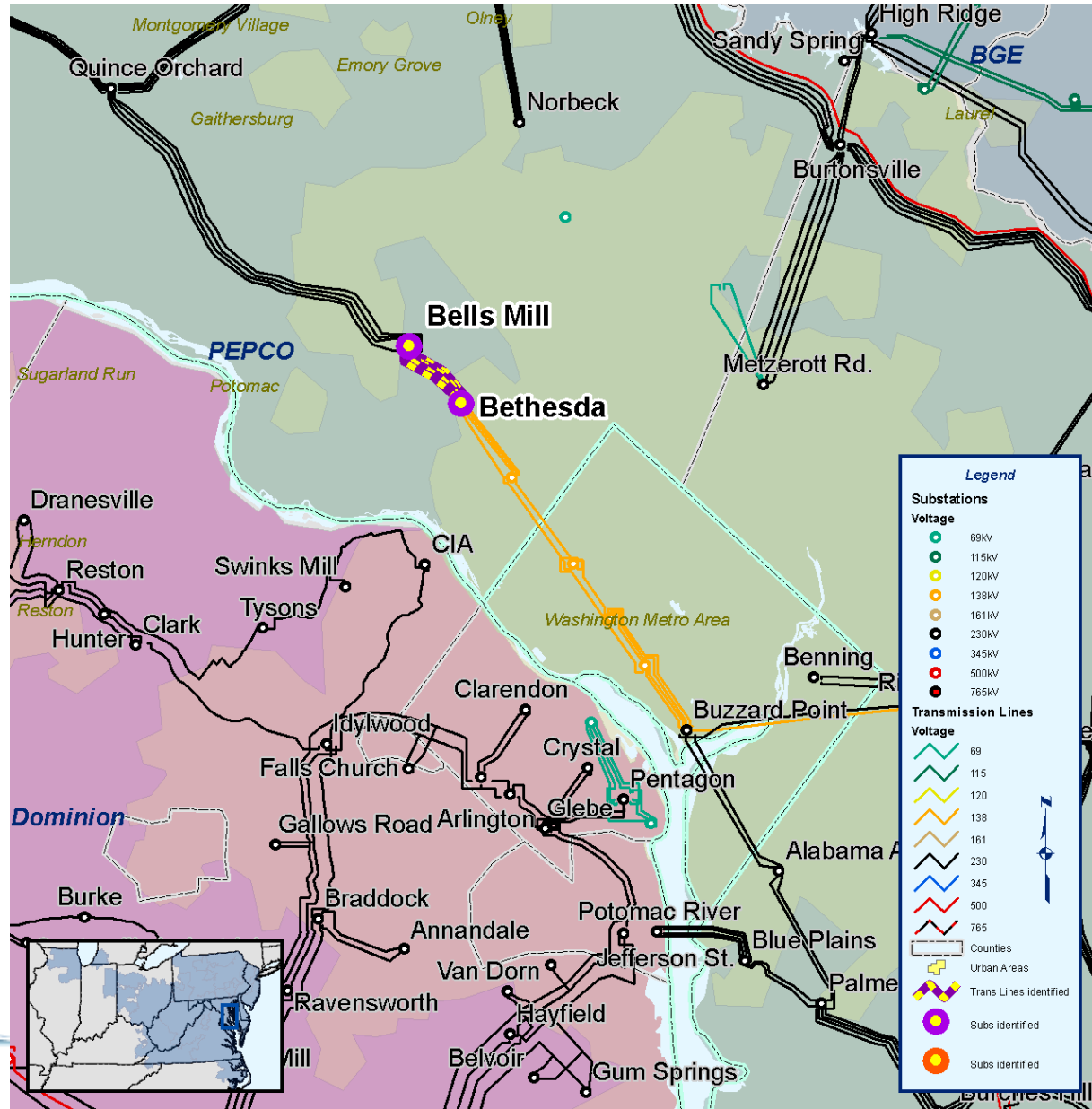
- Operational issues related to the installation of two additional 230 kV underground feeders at Benning
- Add a second 50 MVAR 230 kV shunt reactor at the Benning 230 kV substation
- Estimated Project Cost: \$6.4 M
- Expected IS Date: 6/01/2012



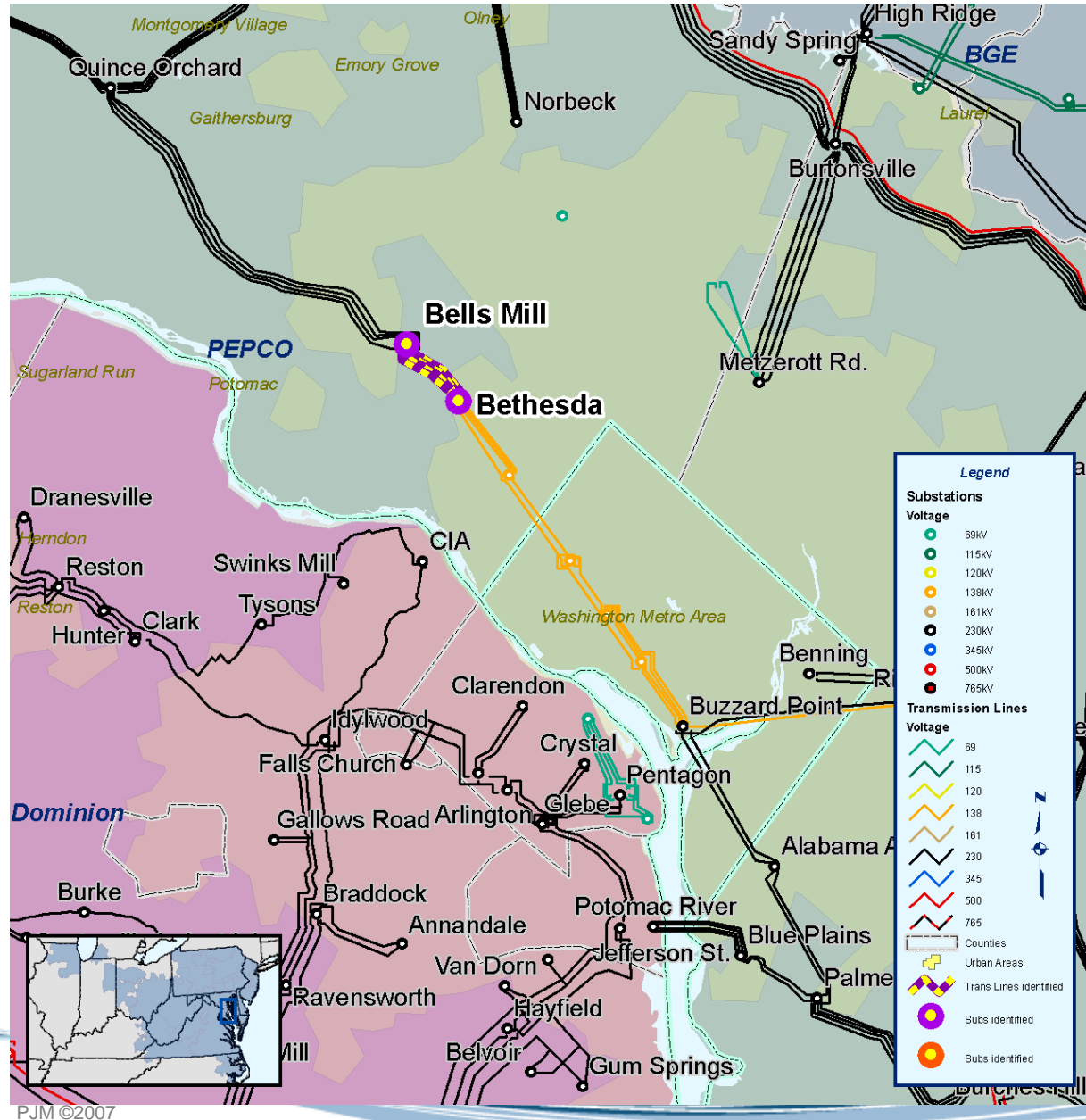
- Multiple N-2 Violations in the Bells Mill, Bethesda, Southwest, and Buzzard point 138 kV areas
- Recommended Solutions:
- Add Slow Oil Circulation to the 4, Bells Mill Road – Bethesda 138 kV lines
- Add Slow Oil Circulation to the 2, Buzzard Point – Southwest 138 kV lines
- Estimated Project Cost: \$6.0 M
- Expected IS Date: 6/01/2013



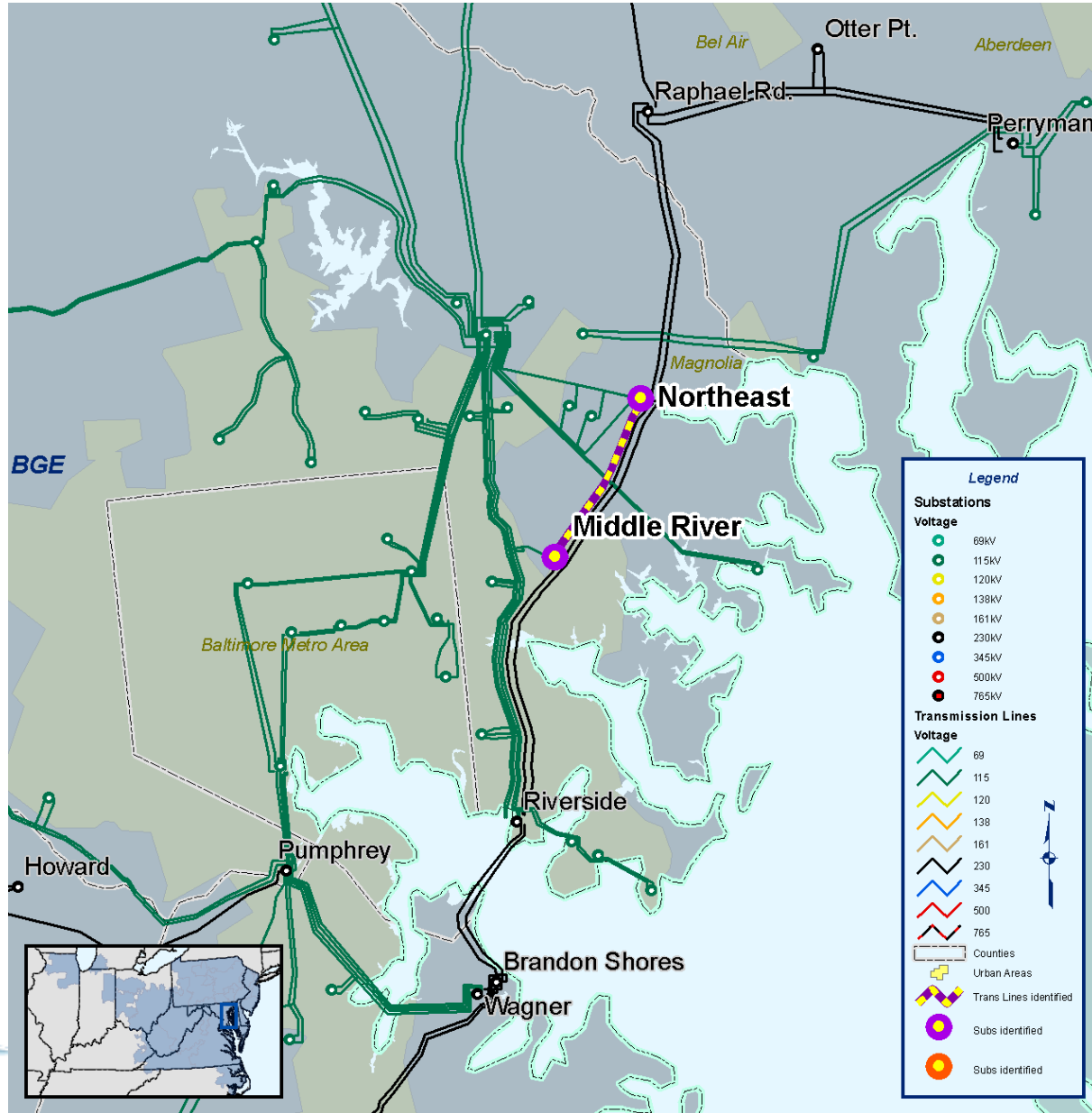
- Bells Mill Road 031
230/138 kV transformer /
loss of Bells Mill Road 028
230 kV bus + loss of Bells
Mill Road 029 230 kV bus
- Bells Mill Road 030
230/138 kV transformer /
loss of Bells Mill Road 028
230 kV bus + loss of Bells
Mill Road 029 230 kV bus
- In addition to the Slow Oil
Circulation upgrades and
Phase Shifter
adjustments, the following
upgrade is needed to
relieve these transformer
overloads:
- Implement an SPS to
automatically shed load
on the 34 kV Bells Mill
Road bus for this N-2
condition.



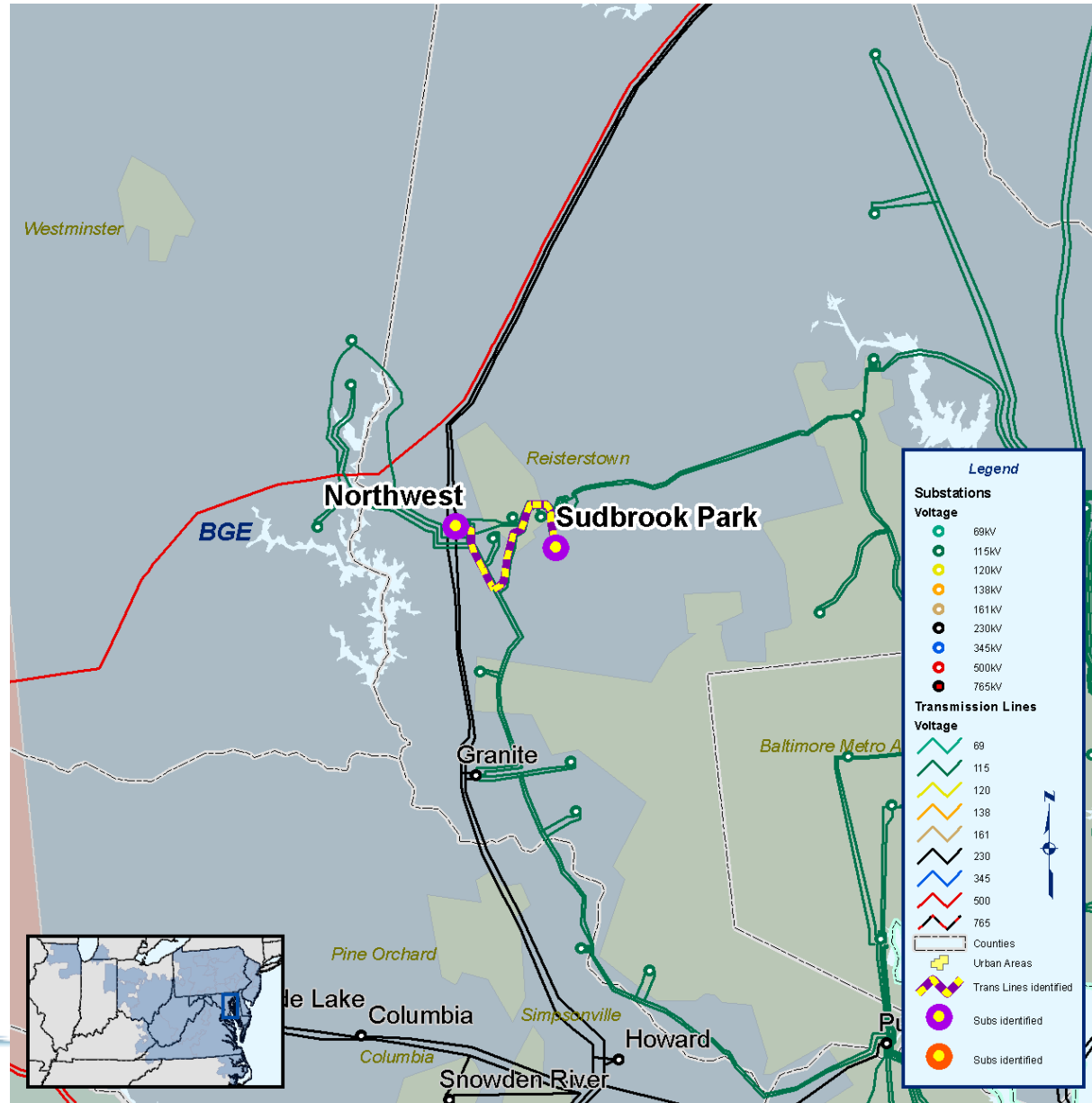
- The SPS will be in effect for years 2013 & 2014 until a 3rd Bells Mill 230/34 kV transformer is placed in-service in 2015.
- Cost Estimate: \$10.7
- Expected IS Date: 6/01/2015



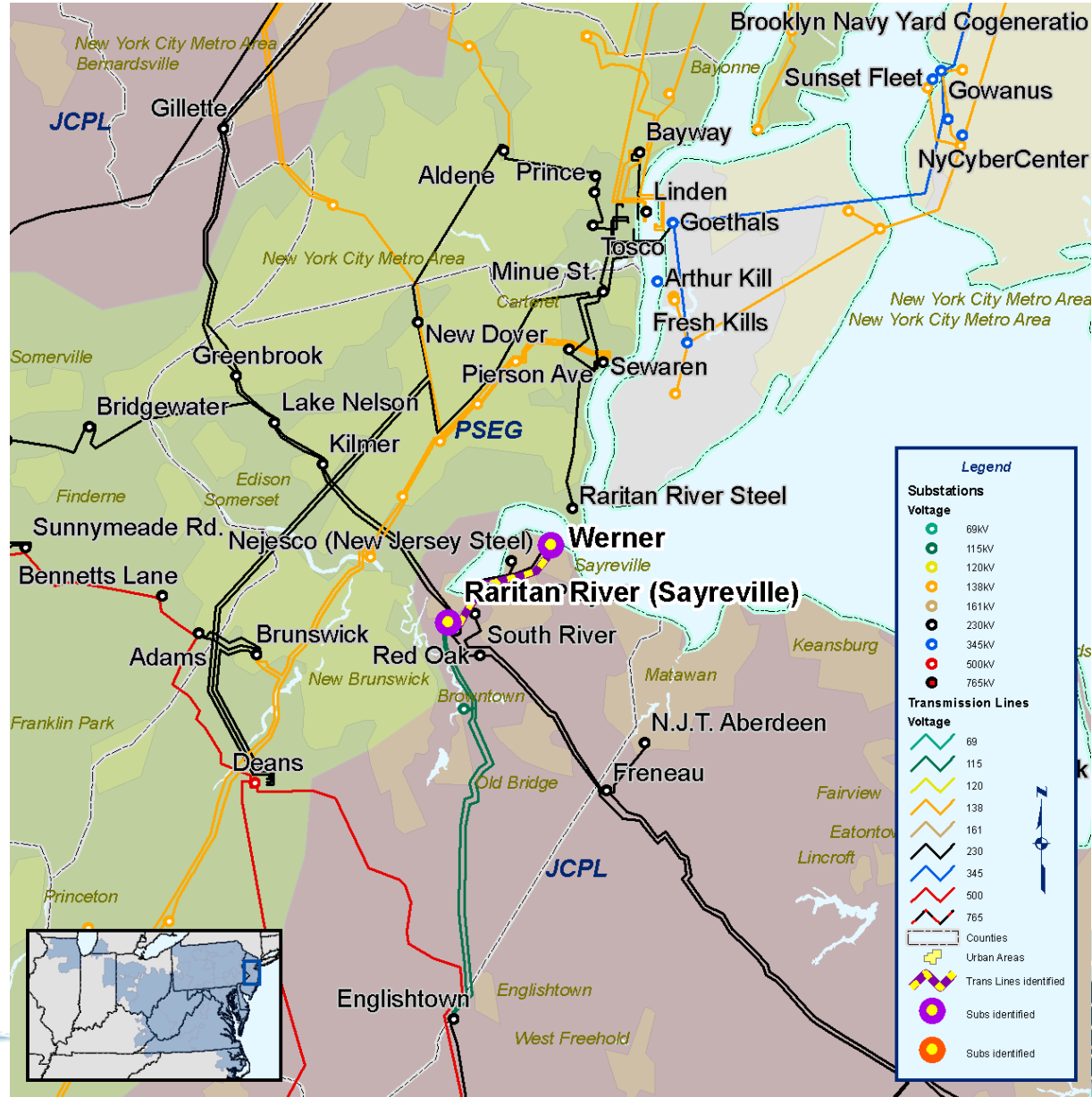
- Middle River – Chesaco Park 115 kV line / loss of Middle River - Northeast 115 kV line + Basecase
- Still working through upgrade plan to resolve this violation.
- Expected IS Date: 6/01/2013



- Gwynnbrook - Sudbrook 110579-E 115 kV line / loss of Northwest – Sudbrook 110578 115 kV line + Basecase
- Still working through upgrade plan to resolve this violation.
- Expected IS Date: 6/01/2013



- Werner – Raritan River 115 kV line / loss of Smithburg-Englishtown 230 kV line + loss of Raritan River 230/115 kV transformer
- Werner 230/115 kV transformer / loss of Smithburg-Englishtown 230 kV line + loss of Raritan River 230/115 kV transformer
- Add a 2nd Raritan River 230/115 kV transformer
- Estimated Project Cost: TBD
- Expected IS Date: 6/01/2013



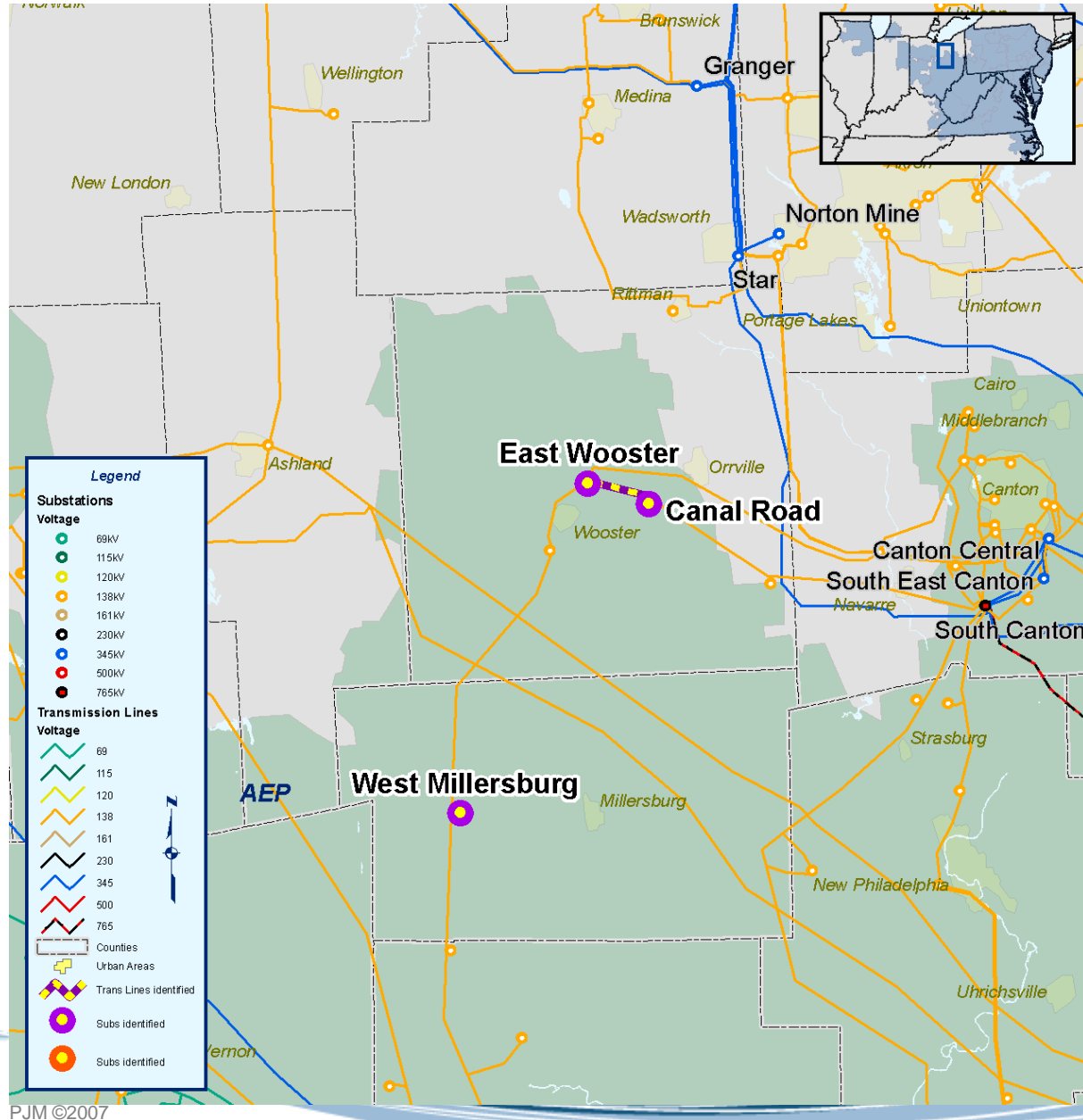


Previously Reviewed Upgrades for PJM Board Approval

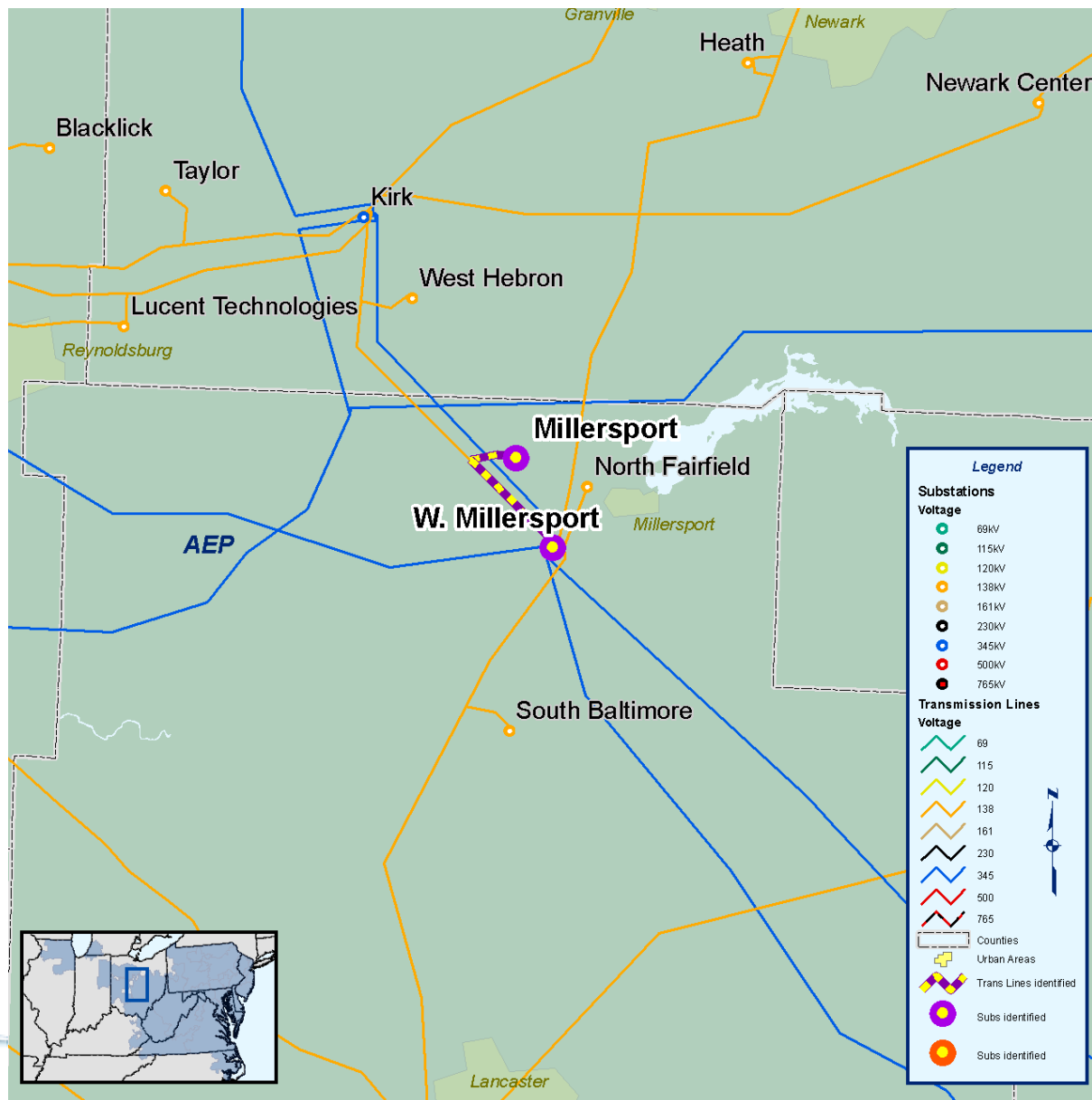


American Electric Power Baseline Upgrades

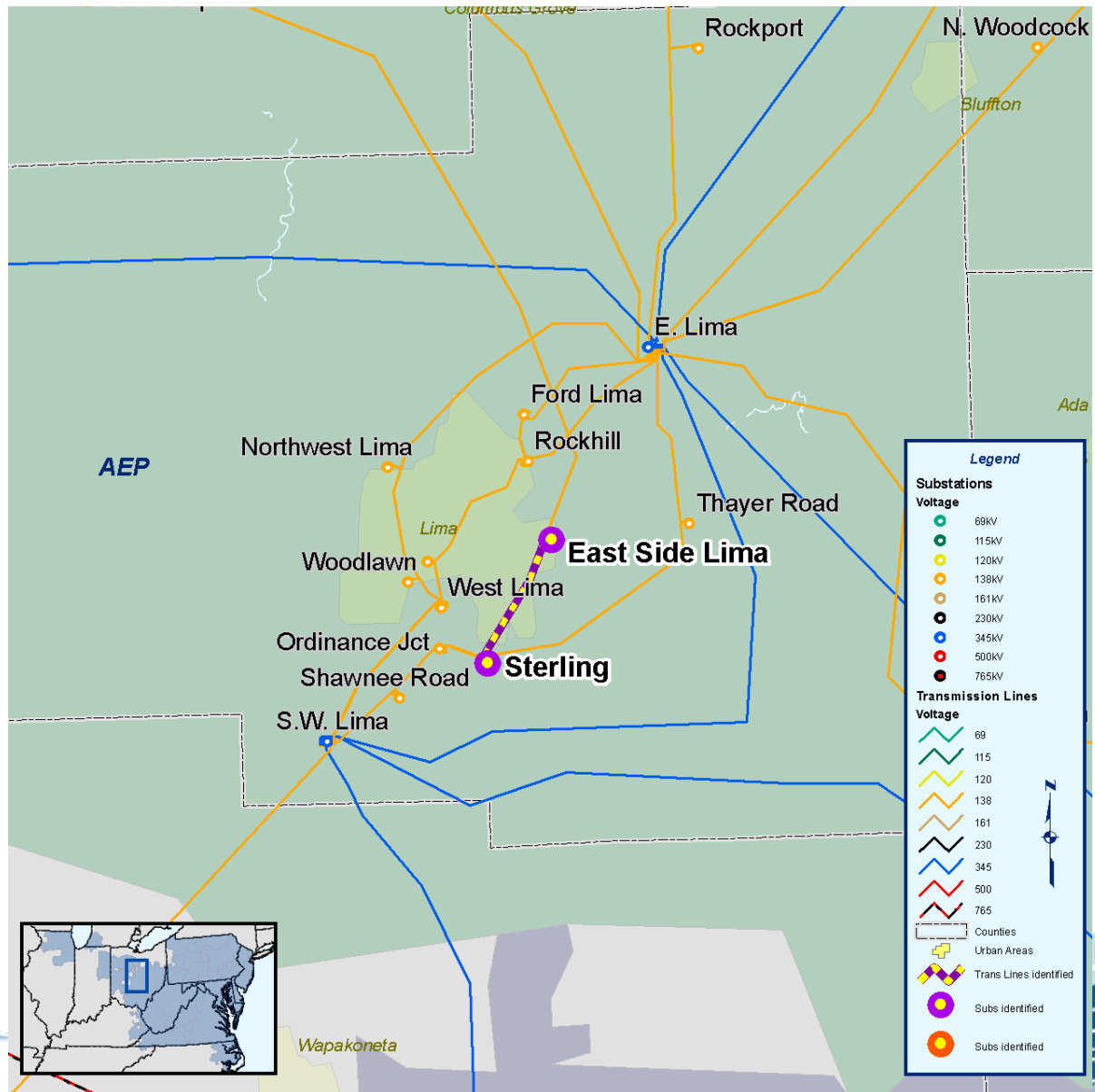
- 69 kV system in the Wooster-Moreland area of AEP (Northern Ohio) is no longer single contingency reliable
- Recommended Solution (major components):
 - Establish a new 69 kV circuit between the Canal Road and East Wooster stations
 - Establish a new 69 kV circuit between the West Millersburg and Moreland Switch stations (via Shreve)
 - Add reactive support VIA cap banks
- AEP Criteria
- Estimated cost: \$27M
- Expected in-service date: 12/1/2010



- Generator Deliverability Problem: The tower outage of West Millersport – Kirk 345 kV and West Millersport – Hyatt 345 kV overloads West Millersport – Millersport 138 kV
- Generator Deliverability
- Solution: Reconductor West Millersport - Millersport 138 kV
- Estimated Project Cost: \$6.5M
- IS Date: 6/1/2012



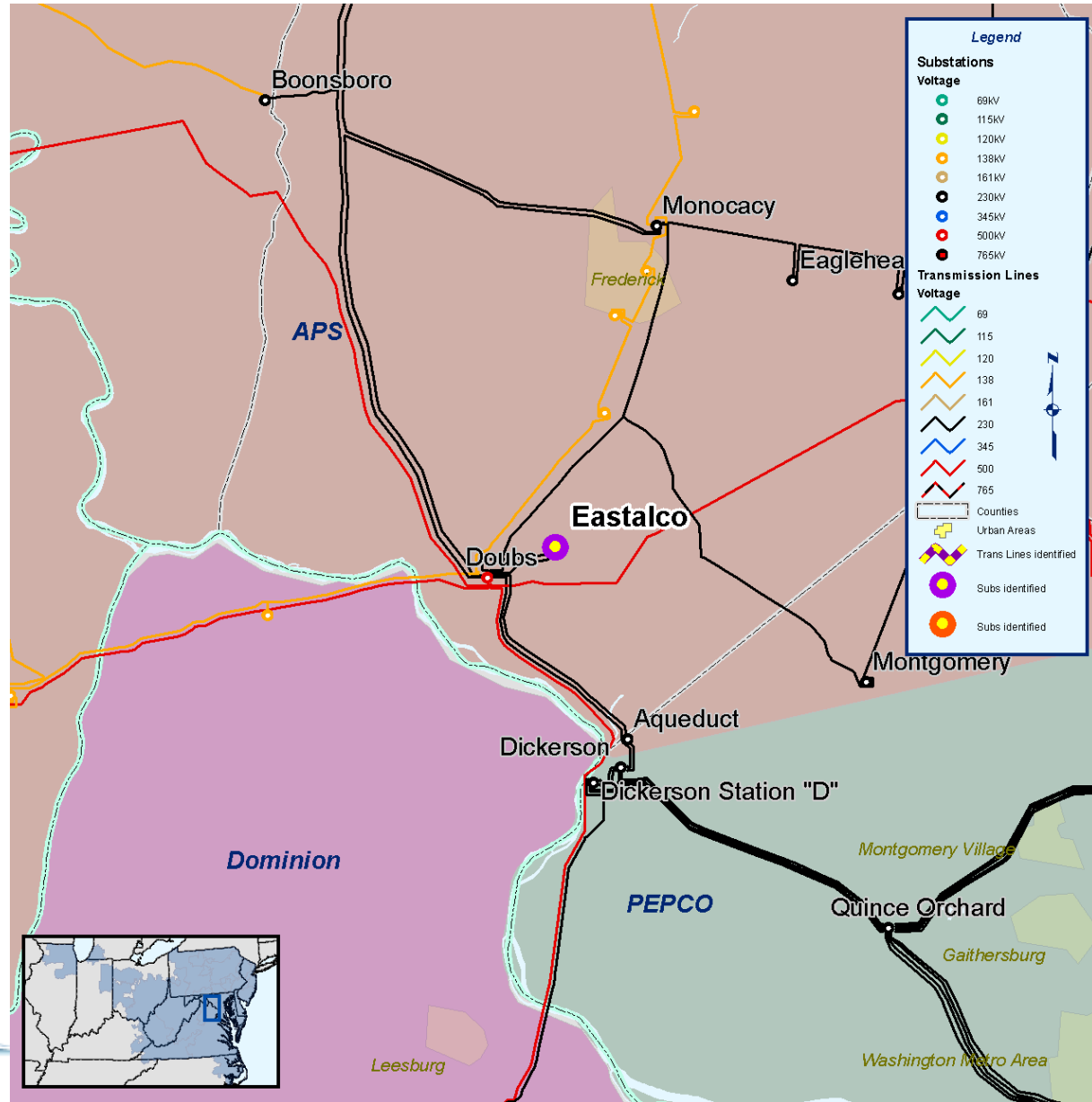
- Problem: The tower outage of Allen – Sorensen 345 kV and Convoy – Robinson Park 345 kV overloads East Side Lima – Sterling 138 kV
- Generator Deliverability
- Solution: Reconductor East Side Lima - Sterling 138 kV
- Estimated Project Cost: \$5M
- IS Date: 6/1/2012



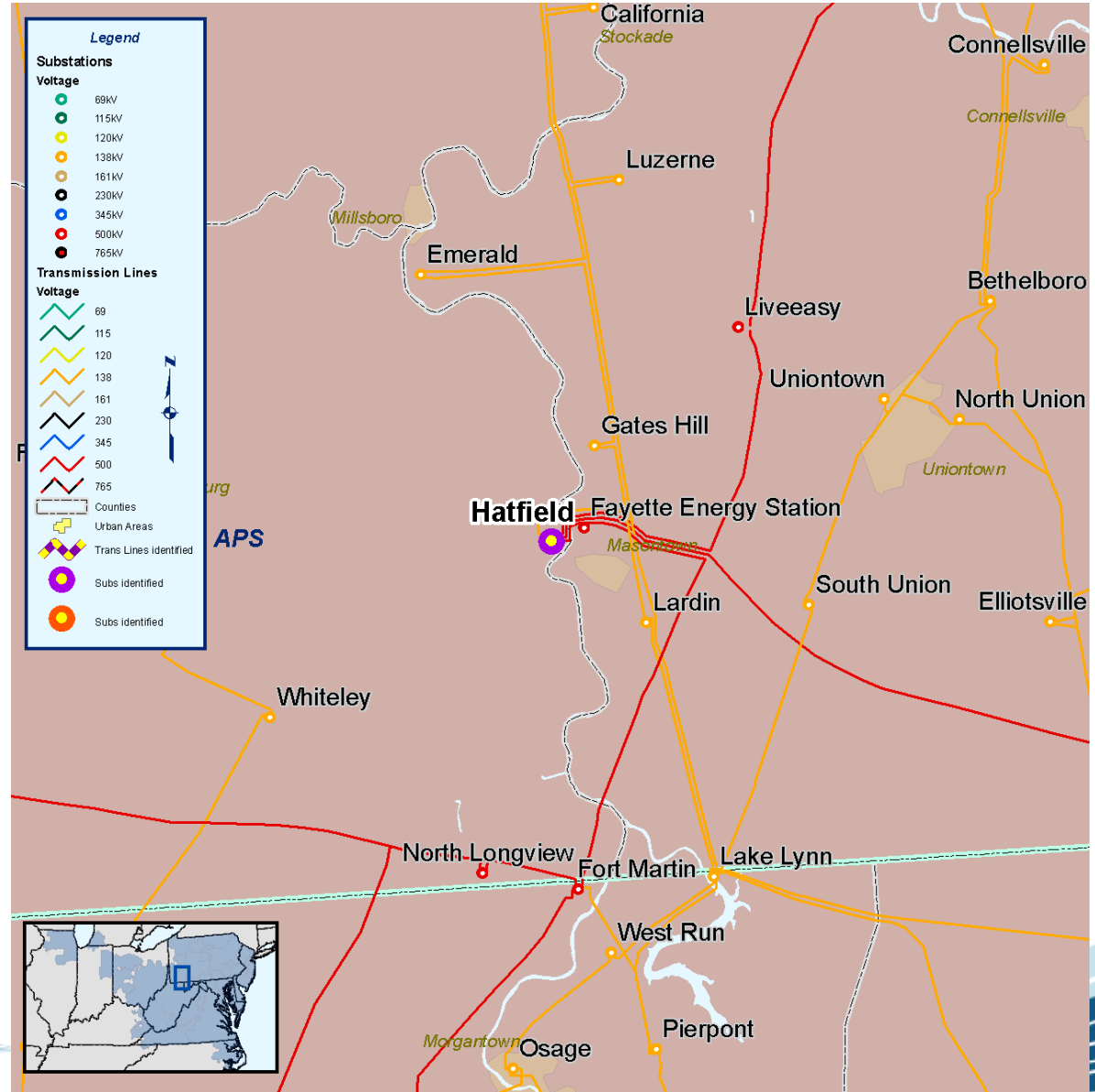


APS Baseline Upgrades

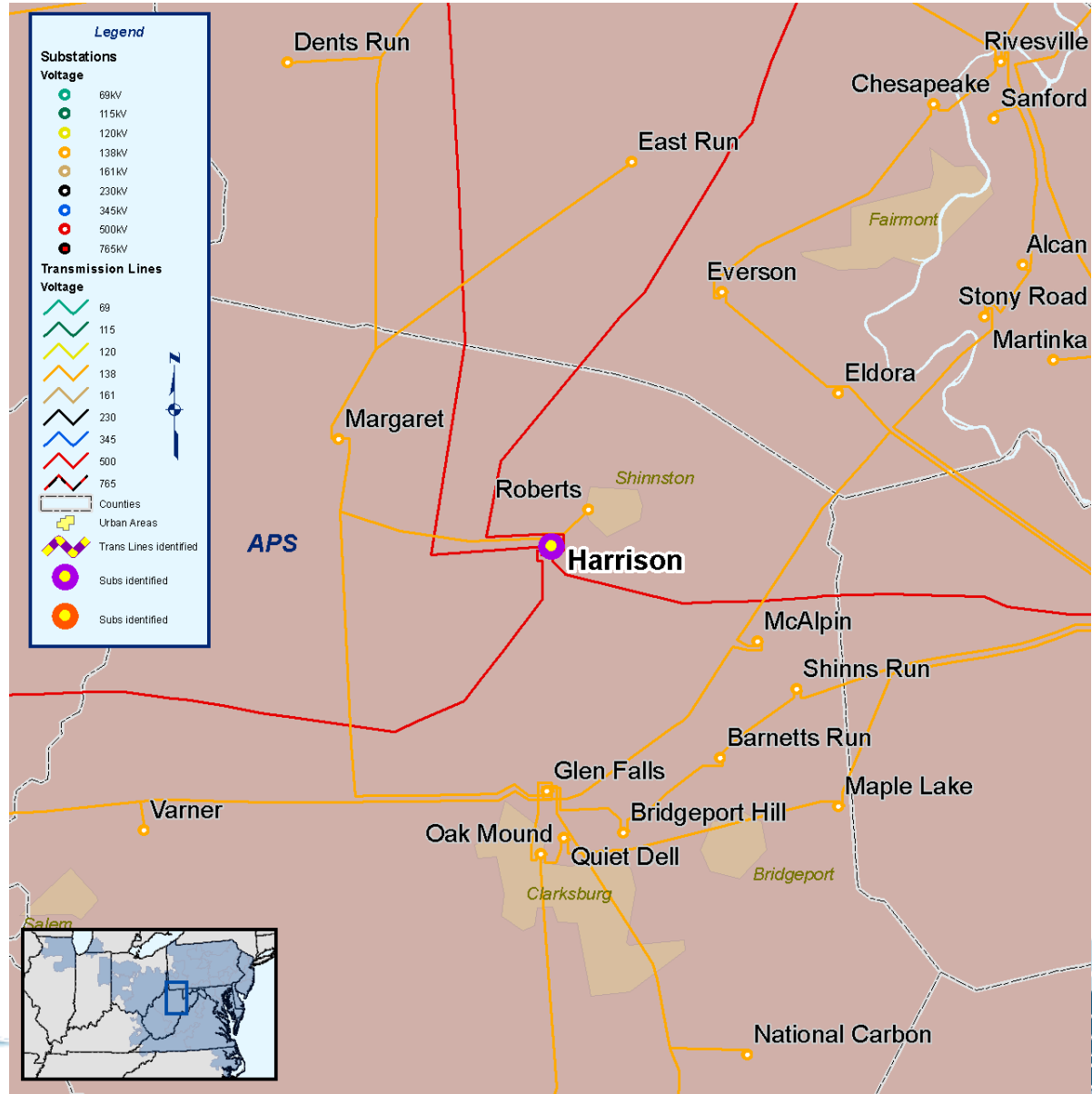
- Replace Eastalco 230 kV breaker D-26, D-28, and D-31
- Estimated Project Cost: \$0.300 M per breaker
- Expected IS Date: 6/01/2012



- Upgrade (per ABB inspection) Hatfield 500 kV breakers due to Short Circuit
 - HFL-1
 - HFL-3
 - HFL-4
 - HFL-6
 - HFL-7
 - HFL-9
- Estimated Project Cost: \$60K per breaker
- IS Date: 6/1/2011



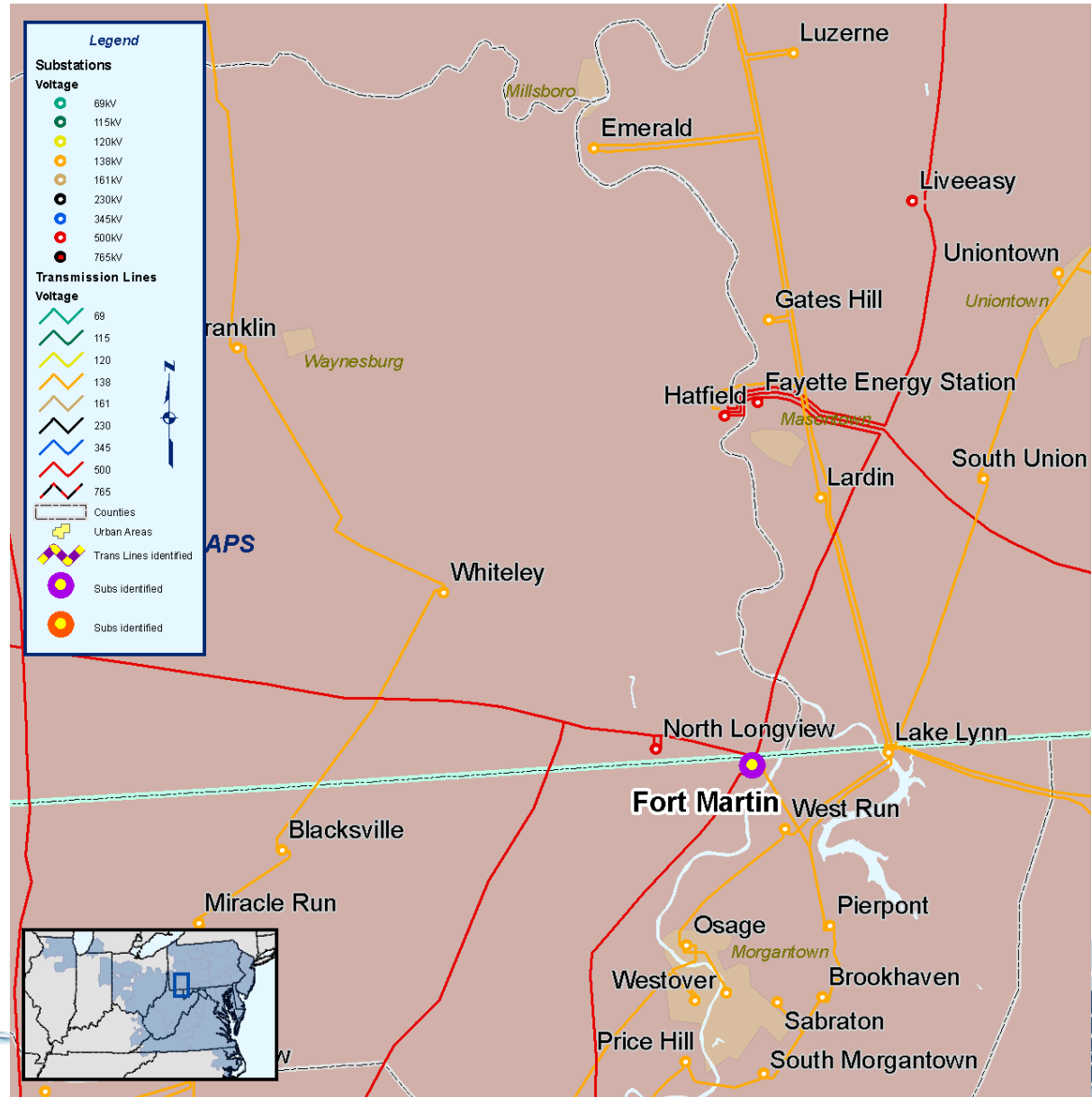
- Replace Harrison 500 kV breaker HL-3
- Estimated Cost: \$0.7M
- Upgrade (per ABB inspection) Harrison 500 kV breakers due to Short Circuit
 - HL-6
 - HL-7
 - HL-8
 - HL-10
- Estimated Cost: \$60K per breaker
- IS Date: 6/1/2011



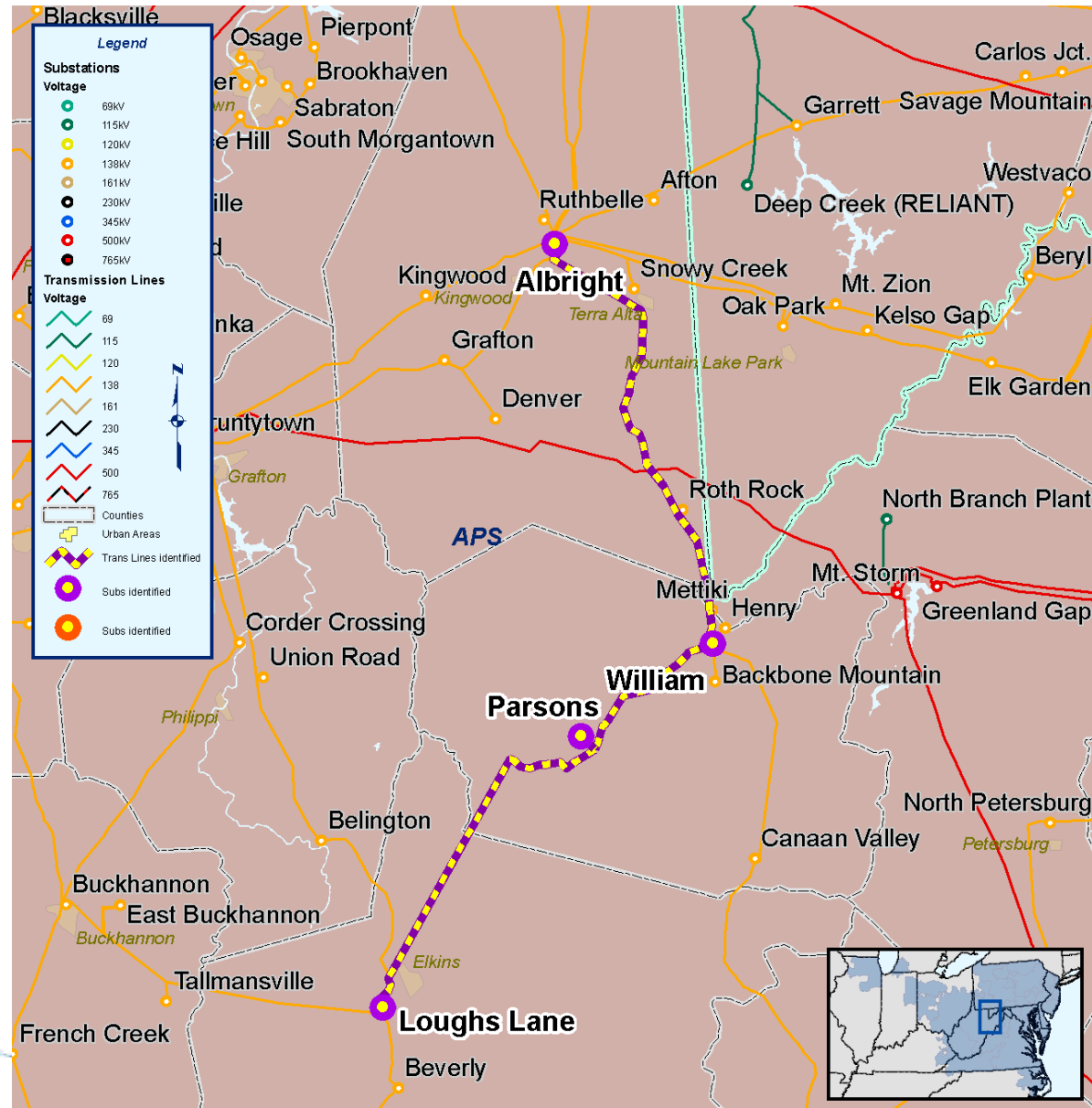


APS Short Circuit Baseline Upgrades

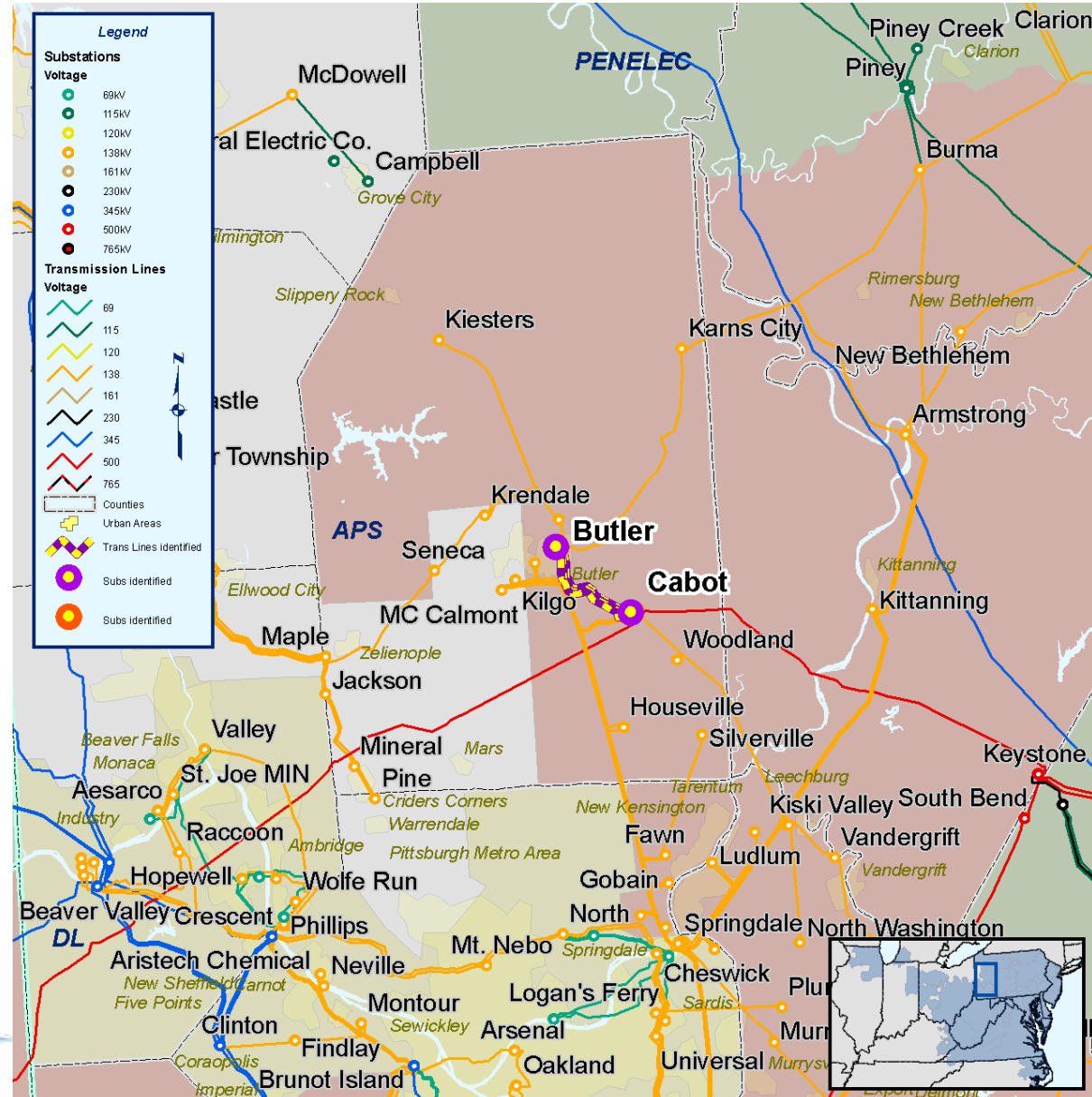
- Replace Fort Martin 500 kV breaker 'FL-1' due to Short Circuit
- Estimated Project Cost: \$ 0.7 M
- IS Date: 6/1/2011



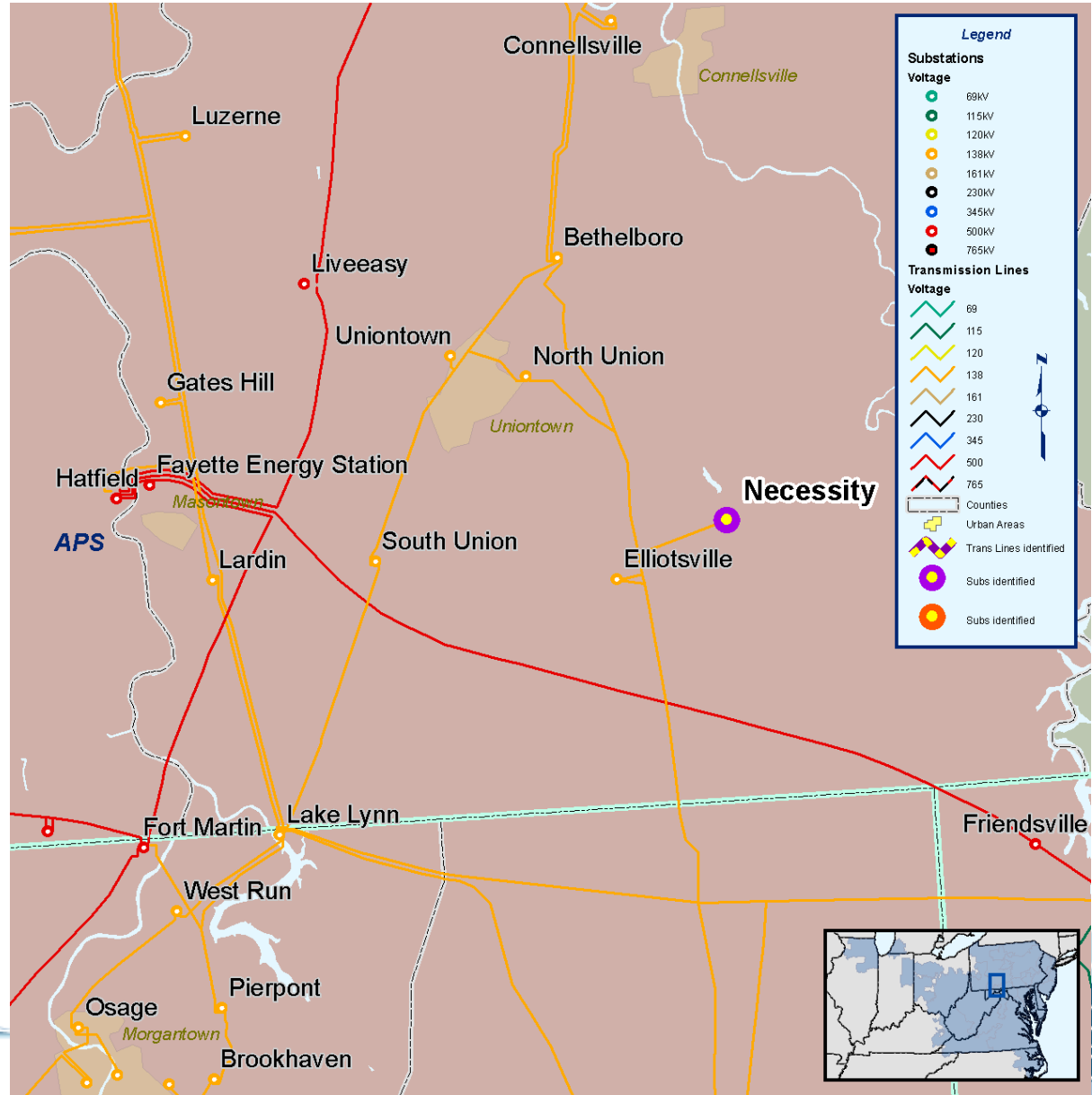
- Generator Deliverability Problem: The Albright – Loughs Lane 138 kV path is overloaded for various Category C contingencies on the 138 kV system in West Virginia
- Recommended Solution: Reconductor Albright - Mettiki - William - Parsons - Loughs Lane 138 kV with 954 ACSR
- Estimated Project Cost: \$14.7M
- IS Date: 6/1/2011



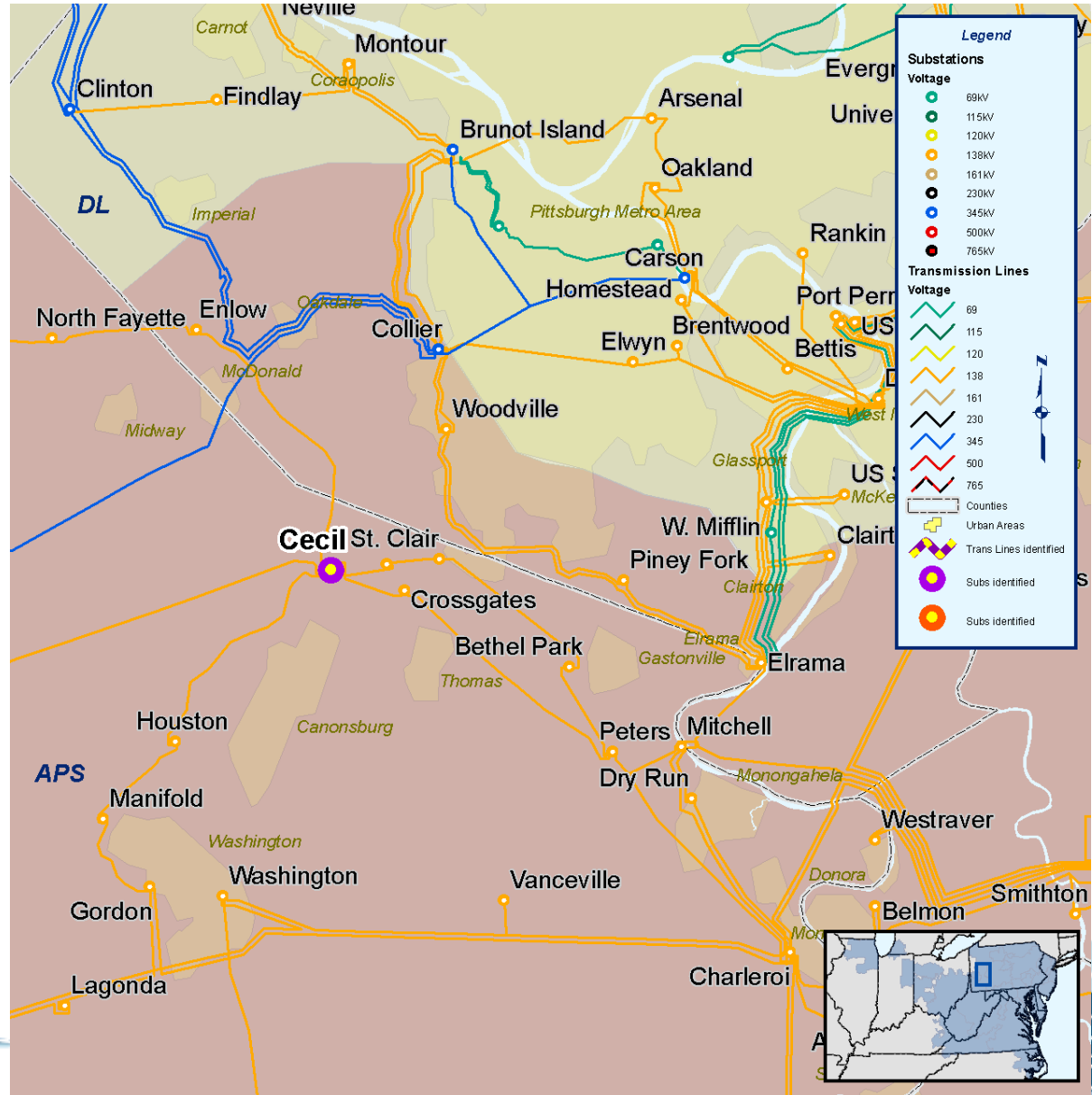
- Generator Deliverability Problem: Overload of Butler – Cabot 138 kV ckt “E” for the loss of the parallel circuit and Cabrey Junction 138 kV
- Recommended Solution: Reconfigure circuits in the Butler - Cabot 138 kV area
- Estimated Project Cost: \$ 1.18 M
- IS Date: 6/1/2012



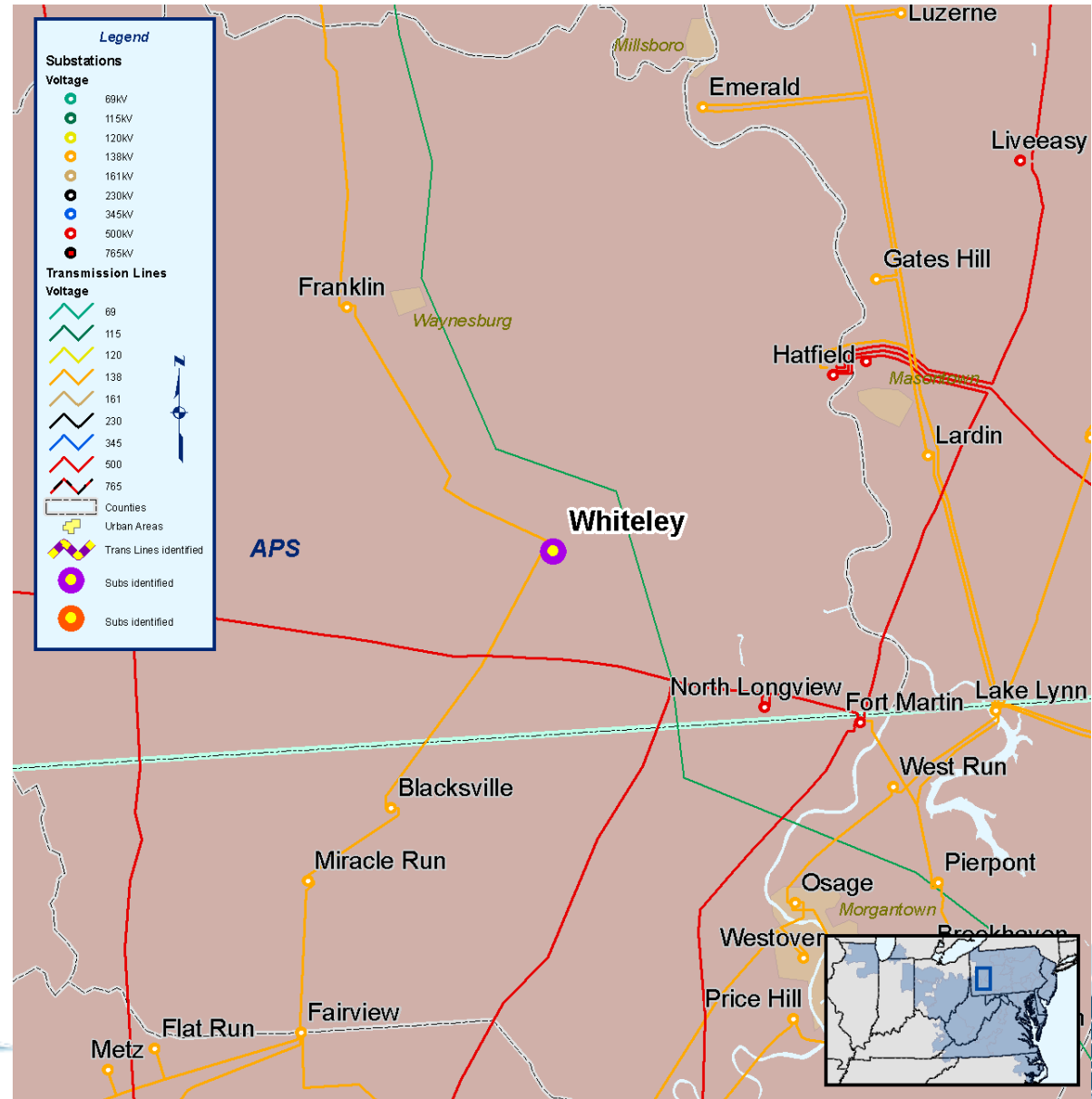
- Install 33 MVAR 138 kV Capacitor at Necessity due to Low Voltage Magnitude for the loss of Bethelboro – North Union Tap 138 kV
- Estimated Project Cost: \$ 0.77 M
- IS Date: 6/1/2009



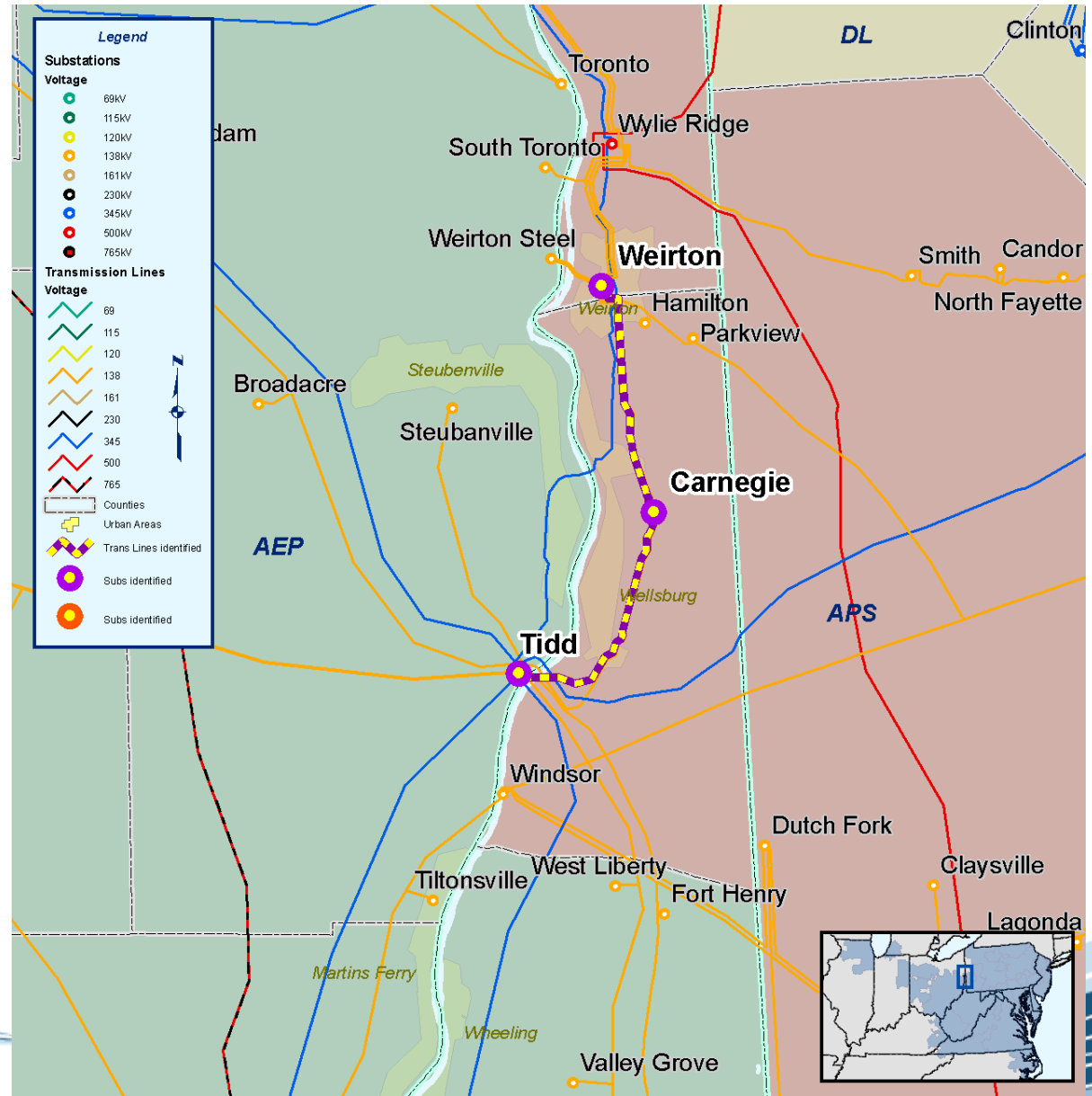
- Increase Cecil 138 kV Capacitor size to 44 MVAR due to low voltage magnitude for the loss of Wylie Ridge – Smith 138 kV
- Estimated Project Cost: \$ 0.1 M
- IS Date: 6/1/2010
- Replace five 138 kV breakers at Cecil due to increased Short Circuit fault duty as a result of the addition of the Prexy substation
- Estimated Project Cost: \$ 0.45 M
- IS Date: 6/1/2010



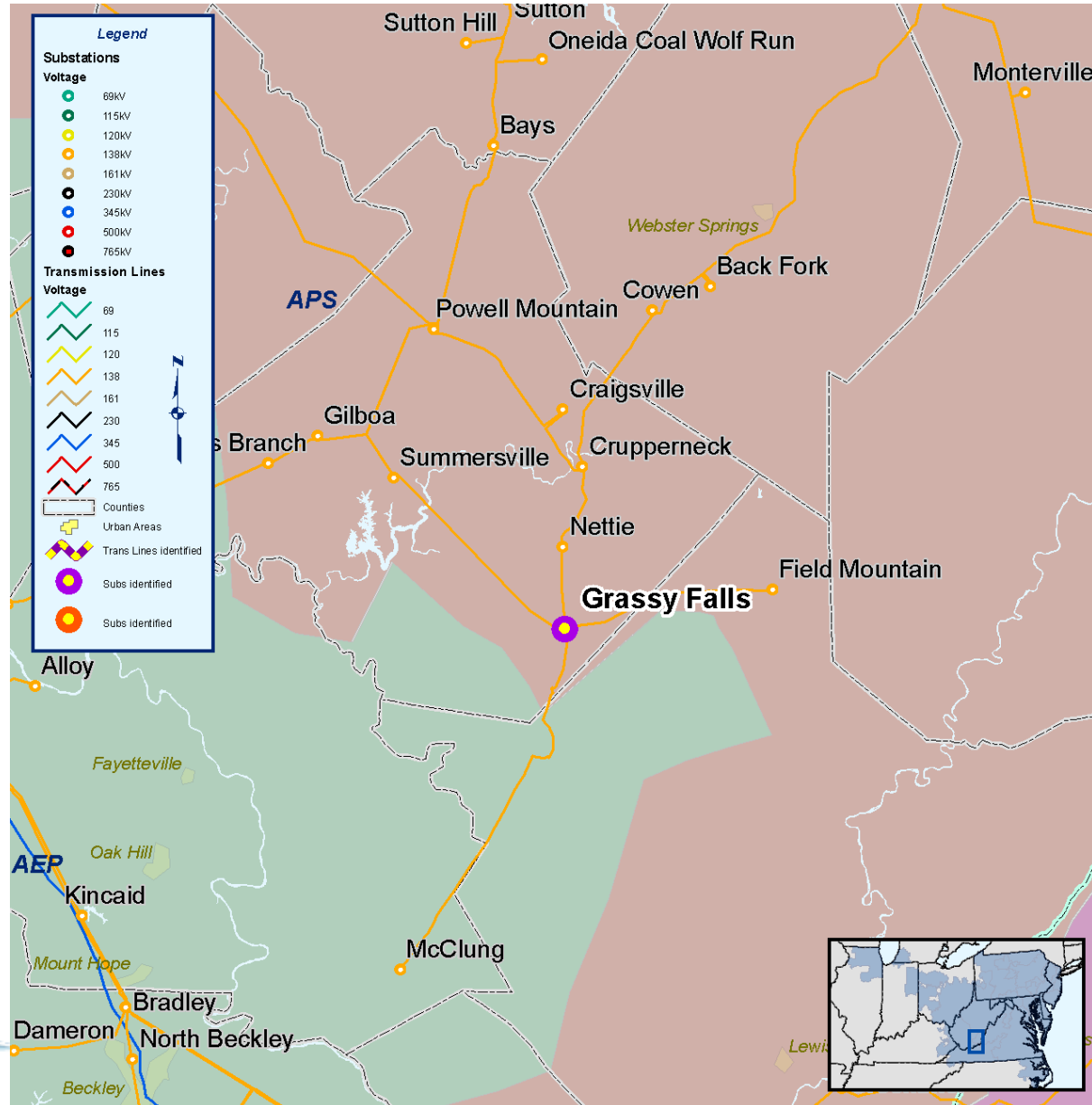
- Increase Whiteley 138 kV Capacitor size to 44 MVAR due to Low Voltage Magnitude for the loss of Fairview – Miracle Run 138 kV
- Estimated Project Cost: \$ 0.64 M
- IS Date: 6/1/2010



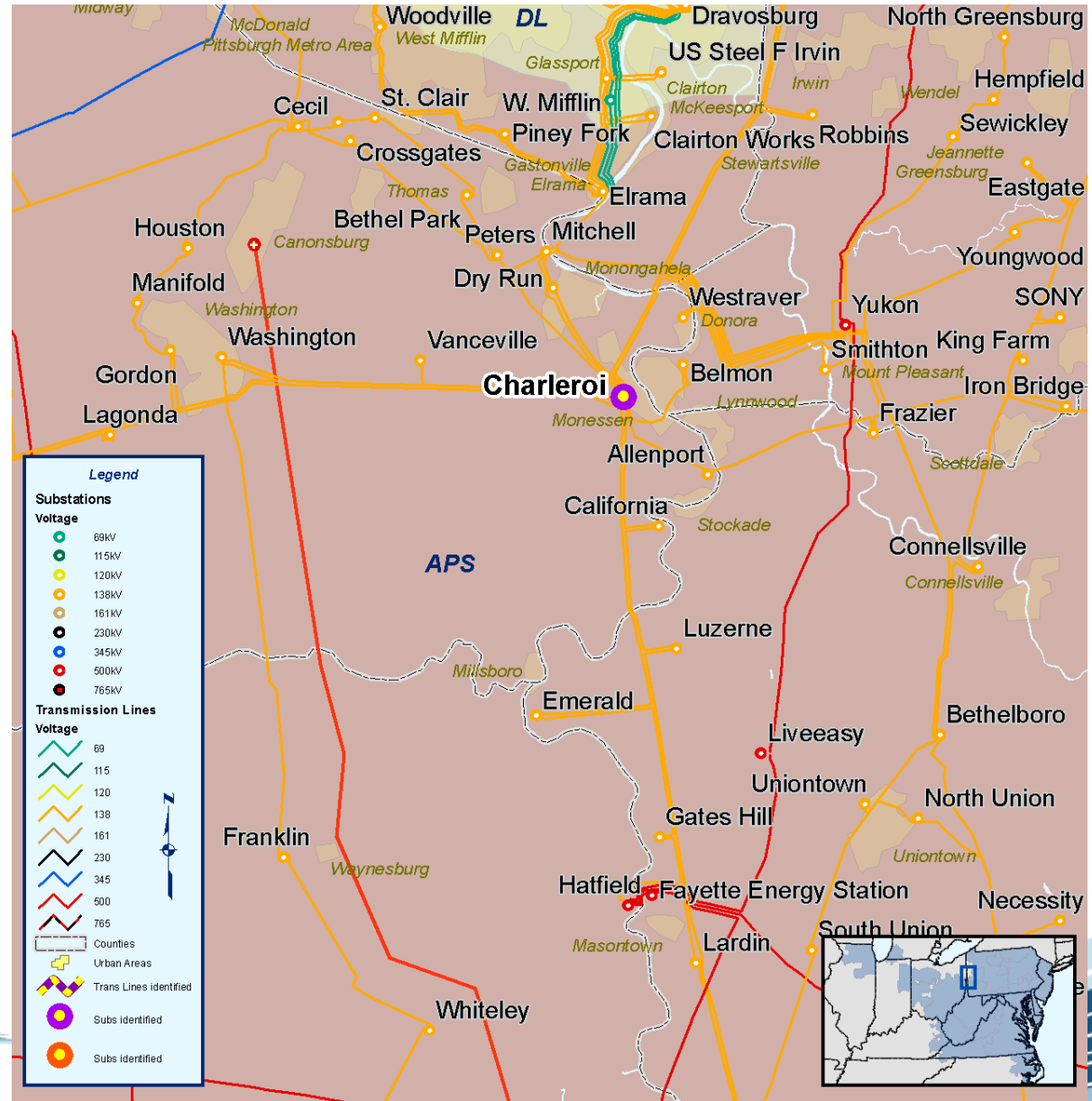
- Problem: Thermal overload of Tidd – Carnegie – Weirton 138 kV for the loss of Tidd – Mahans Lane 138 kV
- Solution: Reconductor AP portion of Tidd - Carnegie 138 kV and Carnegie - Weirton 138 kV with 954 ACSR due to Thermal Overload
- Estimated Project Cost: \$ 3.16 M
- IS Date: 6/1/2011



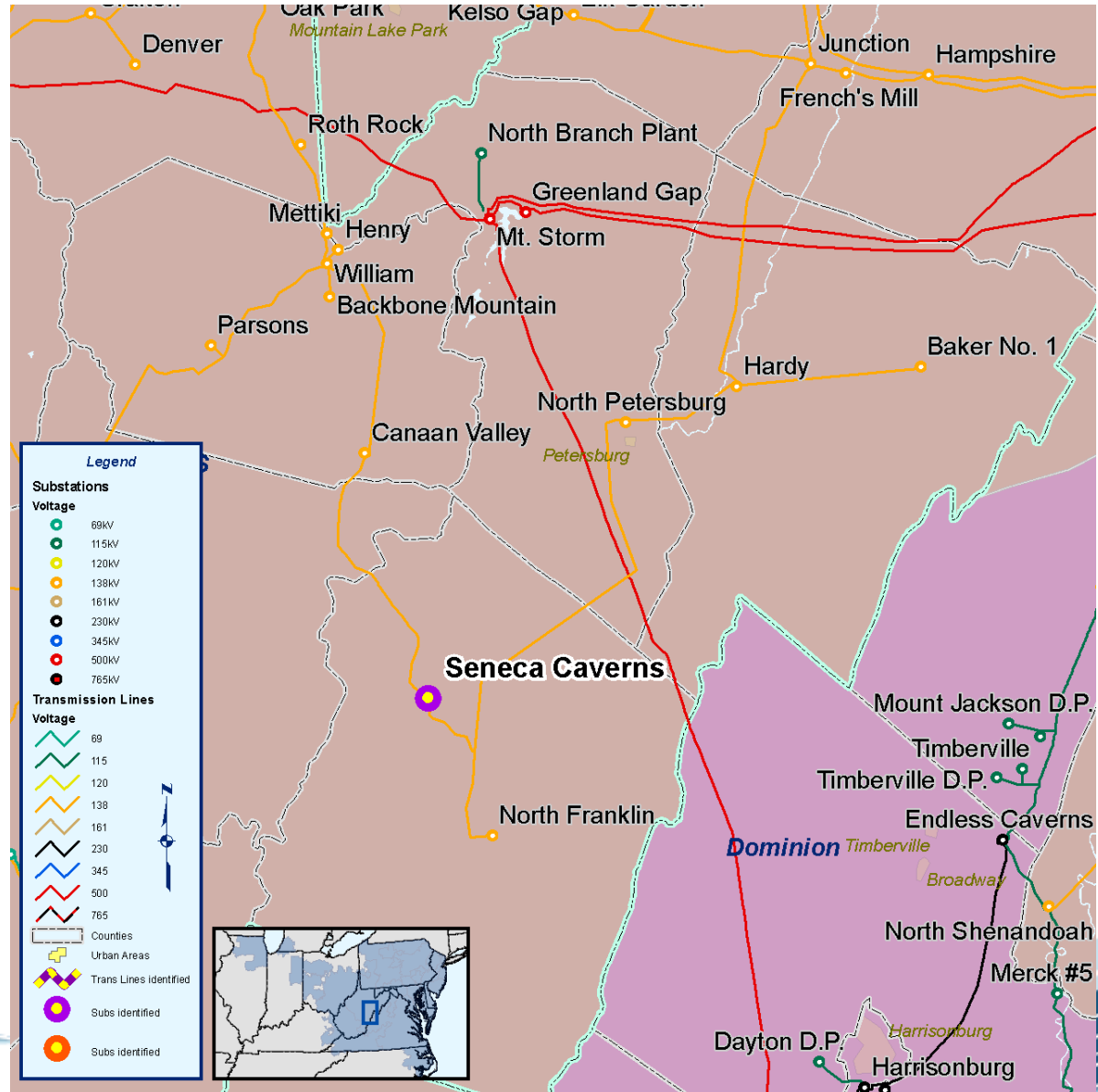
- Install 40.8 MVAR 138 kV capacitor at Grassy Falls due to Voltage Magnitude for a stuck breaker at Powell Mountain 138 kV
- Estimated Project Cost: \$ 0.5 M
- IS Date: 6/1/2010



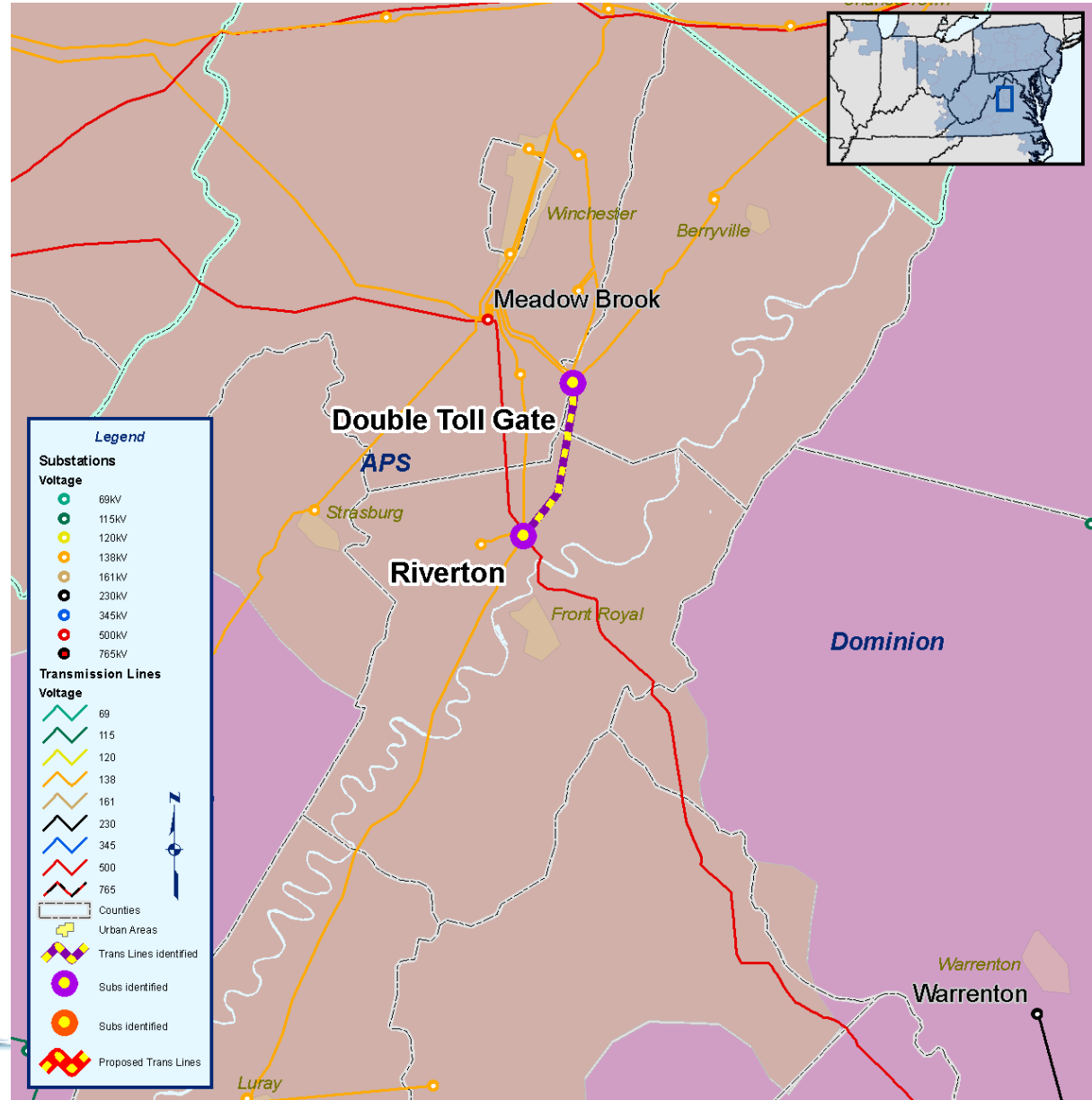
- Replace #1 and #2 138 kV breakers at Charleroi due to increased Short Circuit fault duty as a result of the addition of the Prexy substation
- Estimated Project Cost: \$ 0.45 M
- IS Date: 6/1/2009



- Install 25.2 MVAR 138 kV Capacitor at Seneca Caverns due to low voltage magnitude for the loss of Hardy - Junction 138 kV
- Estimated Project Cost: \$ 0.63 M
- IS Date: 6/1/2010



- Double Toll Gate - Riverton 138 kV is overloaded for the loss of the North Shenandoah 138 - 115 kV transformer & Meadowbrook - Klines Mill 138 kV line
- Solution: Reconductor Double Toll Gate – Riverton with 954 ACSR
- Estimated Cost: \$2.7M
- IS Date: 6/1/2013



- Thermal overload of:

- Blacks - Miracle Run 138 kV
- Bracken - Luxor 138 kV
- Eastgate - Luxor 138 kV
- Eastgate - Sony 138 kV
- Edgewater - Loyalhanna 138 kV
- Edgewater - Vanceville Jct 138 kV
- Fairview - Grant Town 138 kV
- Fairview - Miracle Run 138 kV
- King Farm - Sony 138 kV
- Luxor - Loyalhanna 138 kV
- Luxor - Stony Springs Jct 138 kV
- Social Hall- Vanceville Jct 138 kV
- Whiteley - Blacksville 138 kV
- Youngwood - Yukon 138 kV
- Yukon - Waltz Mills Tap 138 kV
- Vanceville Jct - Washington 138 kV

- Solution: Construct new 138 kV line from Osage - Whiteley

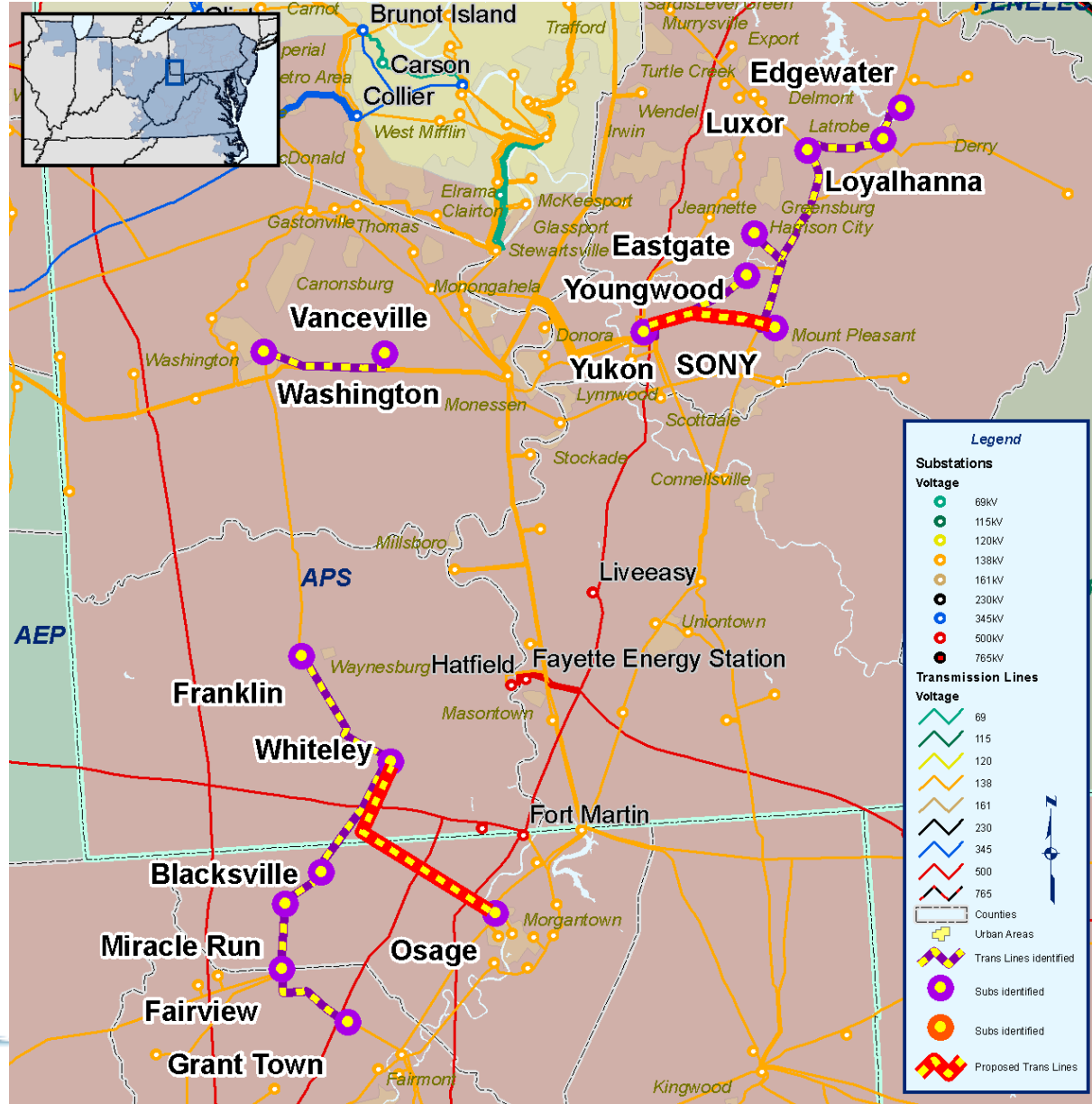
- Estimated Cost: \$13.3M

- IS Date: 6/1/2013

- Solution: Tap Yukon - Bethel Boro 138 kV line and construct new 138 kV Line to Sony

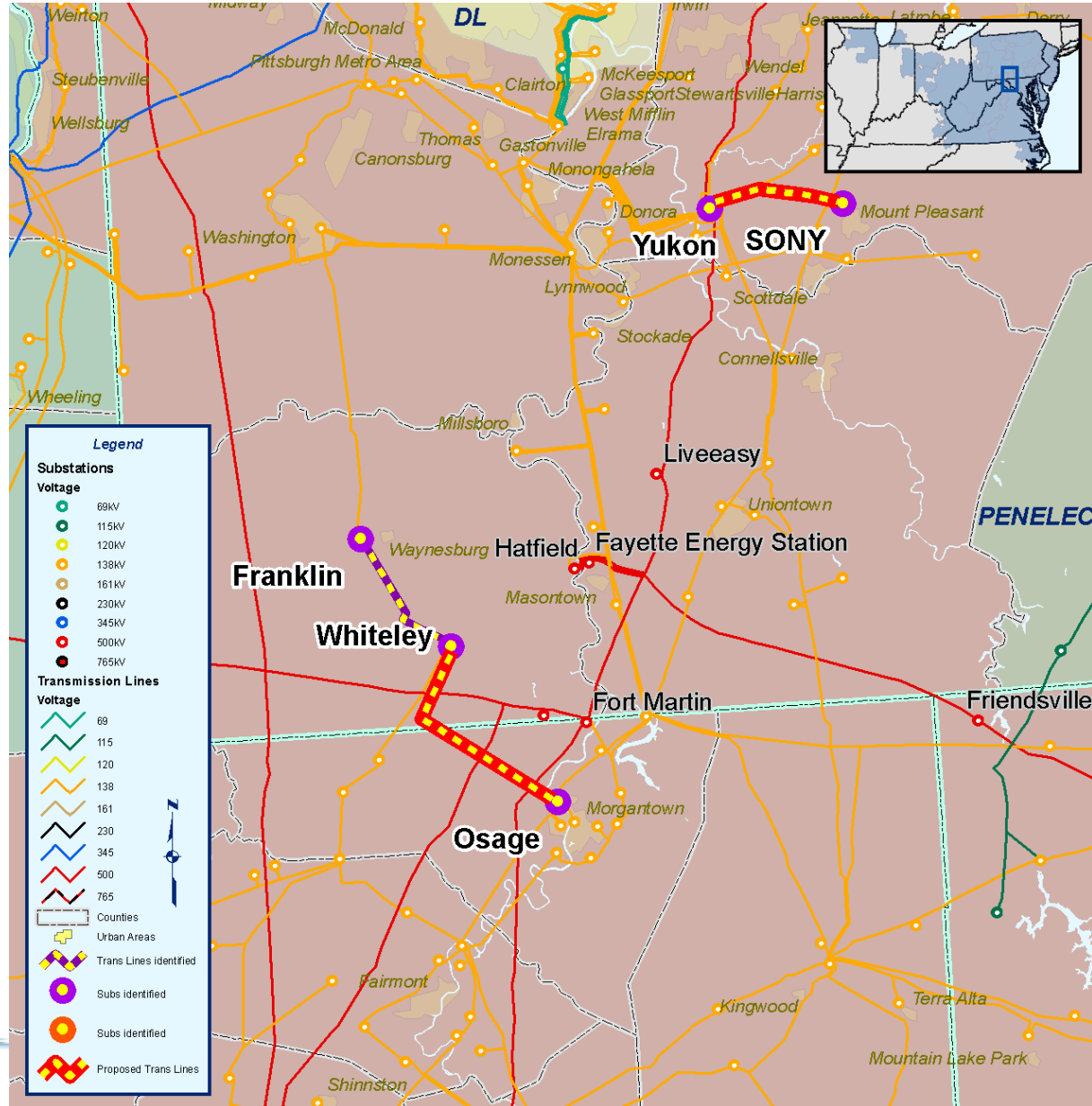
- Estimated Cost: \$10.3M

- IS Date: 6/1/2013



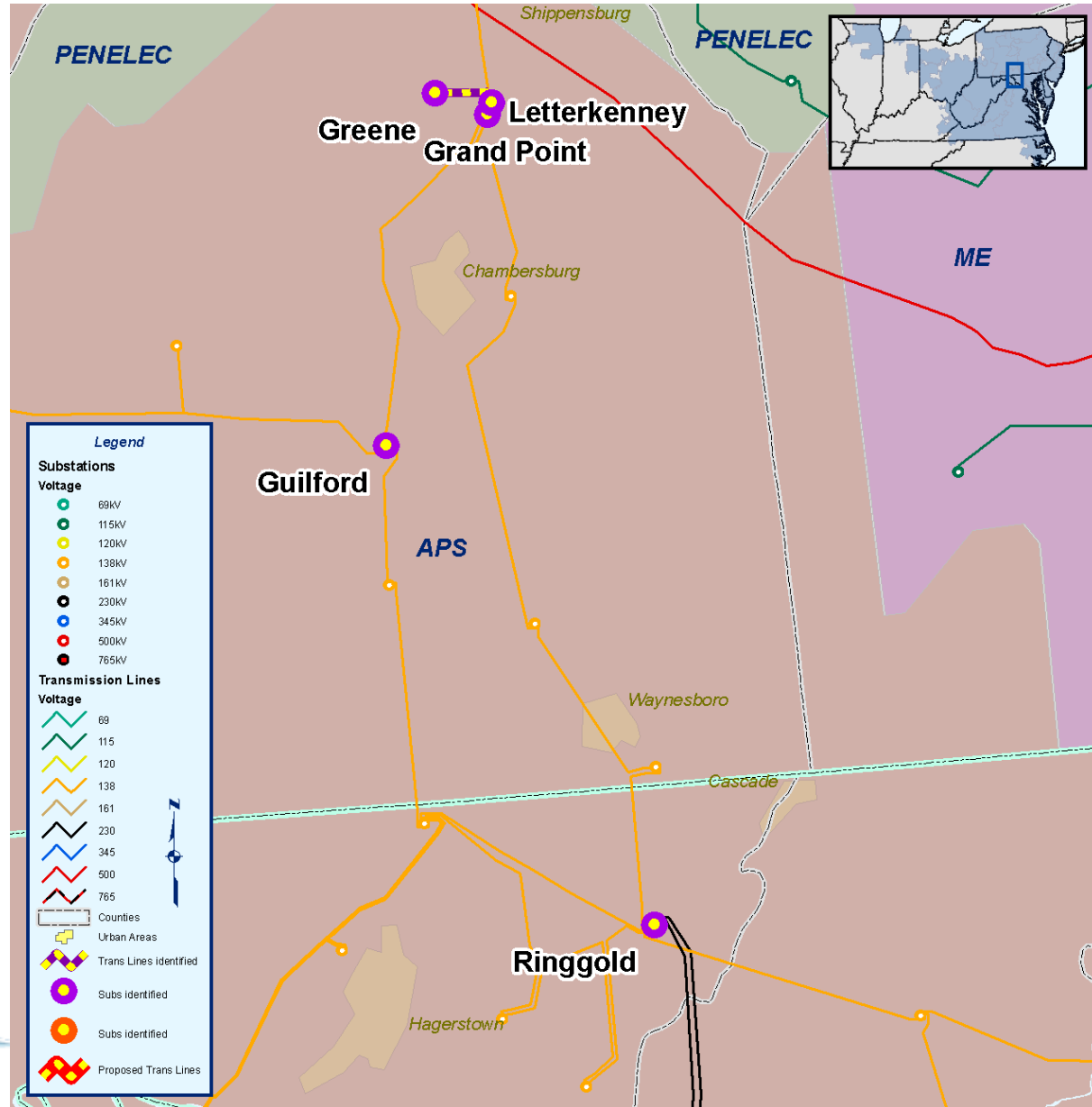
- Thermal Overload of Franklin – Pursley 138 kV I/o Vanceville Jct –Washington 138 kV line & Dutch Fork - Windsor 138 kV line
- Solution: Replace 600/5 CT's at Franklin
- Estimated Cost: \$0.01M
- IS Date: 6/1/2013

- Thermal Overload of Whiteley – Pursley 138 kV I/o Vanceville Jct –Washington 138 kV line & Dutch Fork - Windsor 138 kV line
- Solution: Replace 600/5 CT's at Whiteley
- Estimated Cost: \$0.01M
- IS Date: 6/1/2013

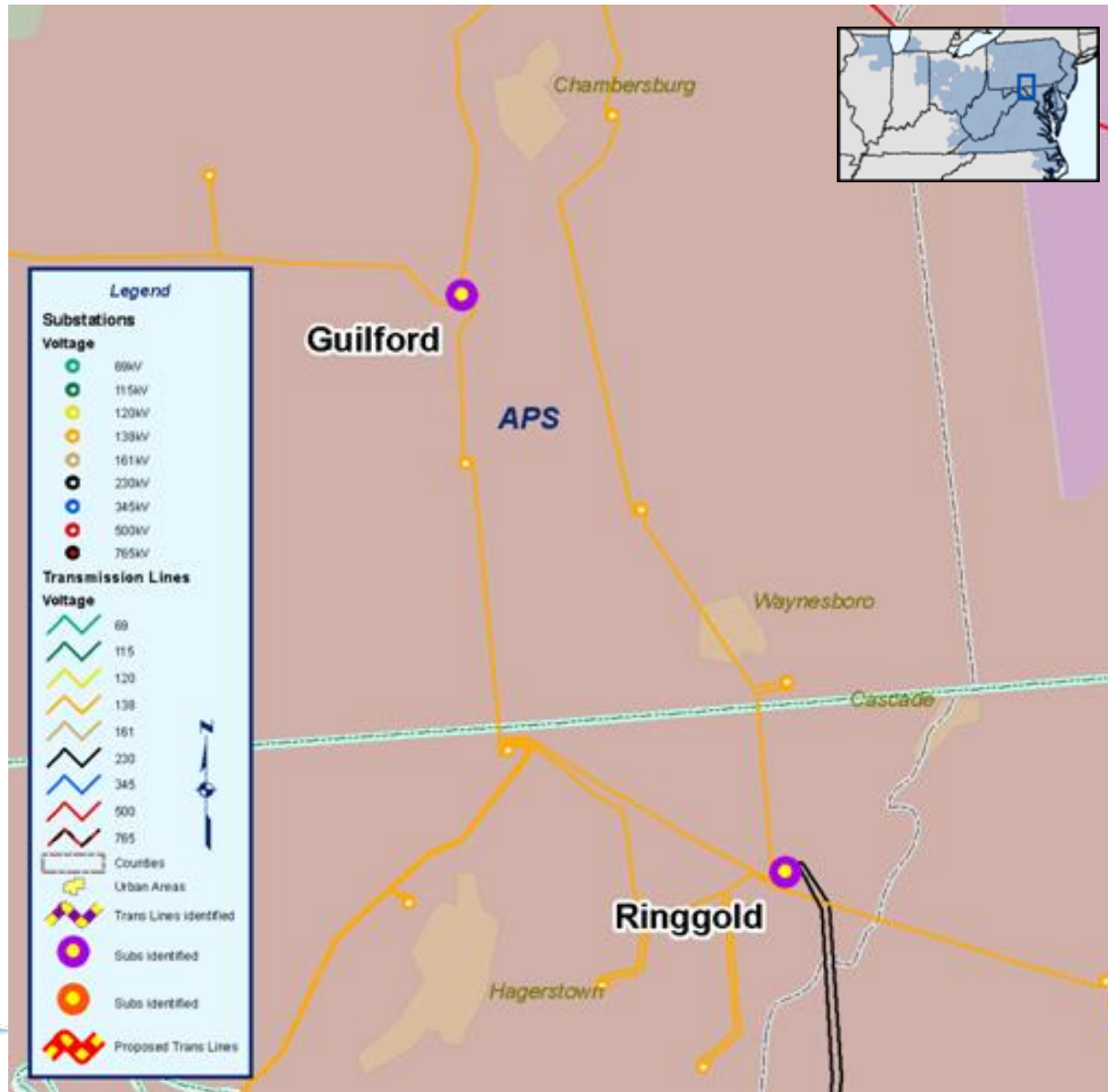


- Thermal overload of Grand Point – Letterkenney 138 kV I/o East Waynesboro – Ringgold 138 kV line & Grand Point – Guilford 138 kV line
- Reconductor Grand Point - Letterkenney with 954 ACSR
- Estimated Cost: \$2.1M
- IS Date: 6/1/2013

- Thermal overload of Greene – Letterkenney 138 kV I/o East Waynesboro – Ringgold 138 kV line & Grand Point – Guilford 138 kV line
- Reconductor Greene - Letterkenney with 954 ACSR
- Estimated Cost: \$0.56M
- IS Date: 6/1/2013



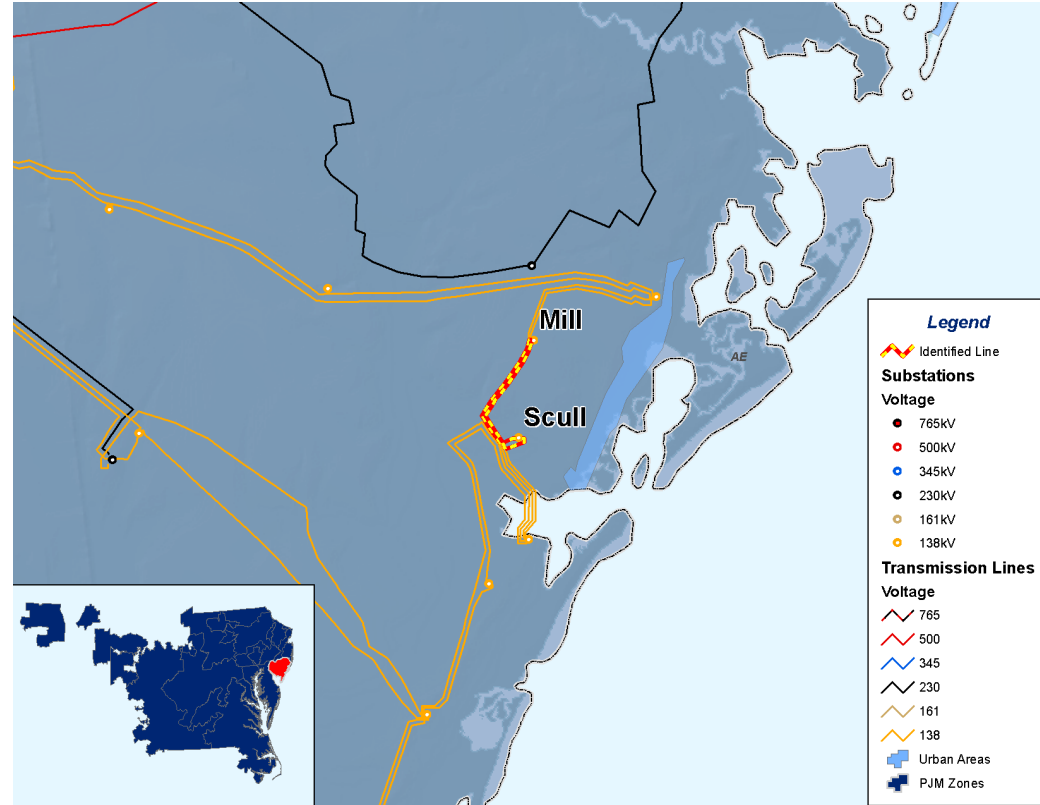
- Thermal overload of Guilford – South Chambersburg 138 kV for the loss of Ringgold – East Waynesboro 138 kV
- Generator Deliverability
- Reconductor Guilford - South Chambersburg with 954 ACSR
- Estimated Cost: \$3.2M
- IS Date: 6/1/2013



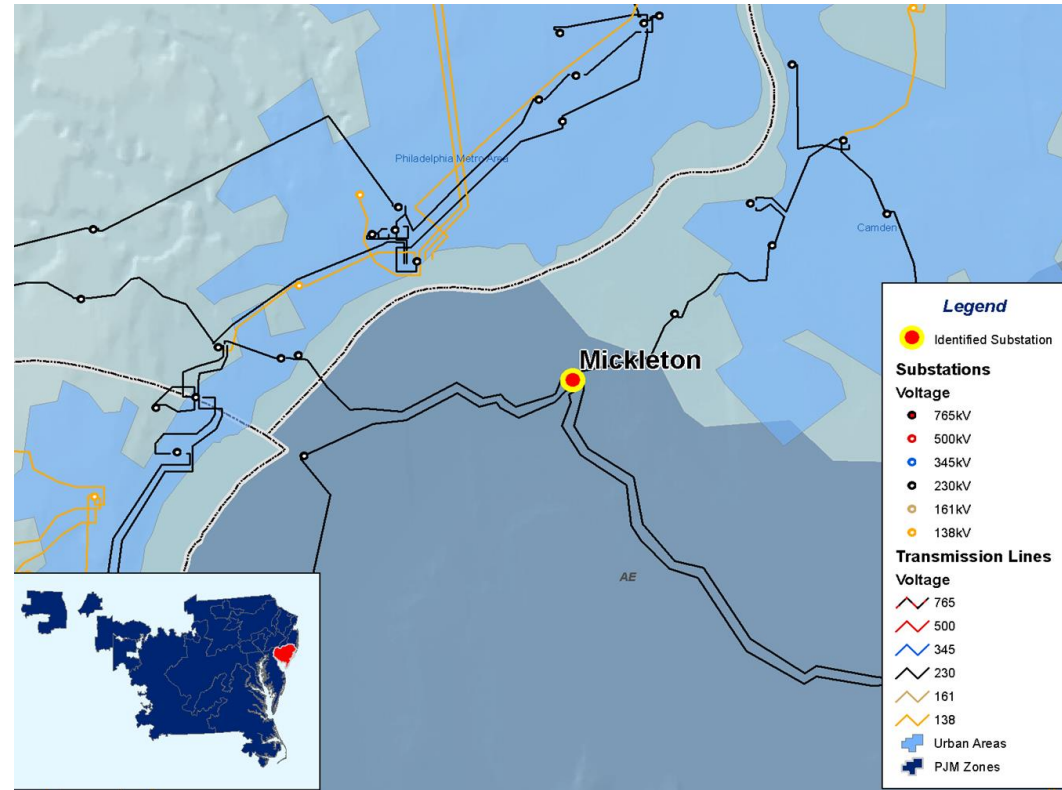


Atlantic Electric Baseline Upgrades

- Scull #2 – Mill #2 138 kV line / Loss of the other circuit (Single)
- Recommended Solution: Upgrade a strand bus at MILL
- Estimated cost: \$0.2M
- Expected in-service date: June 1, 2013



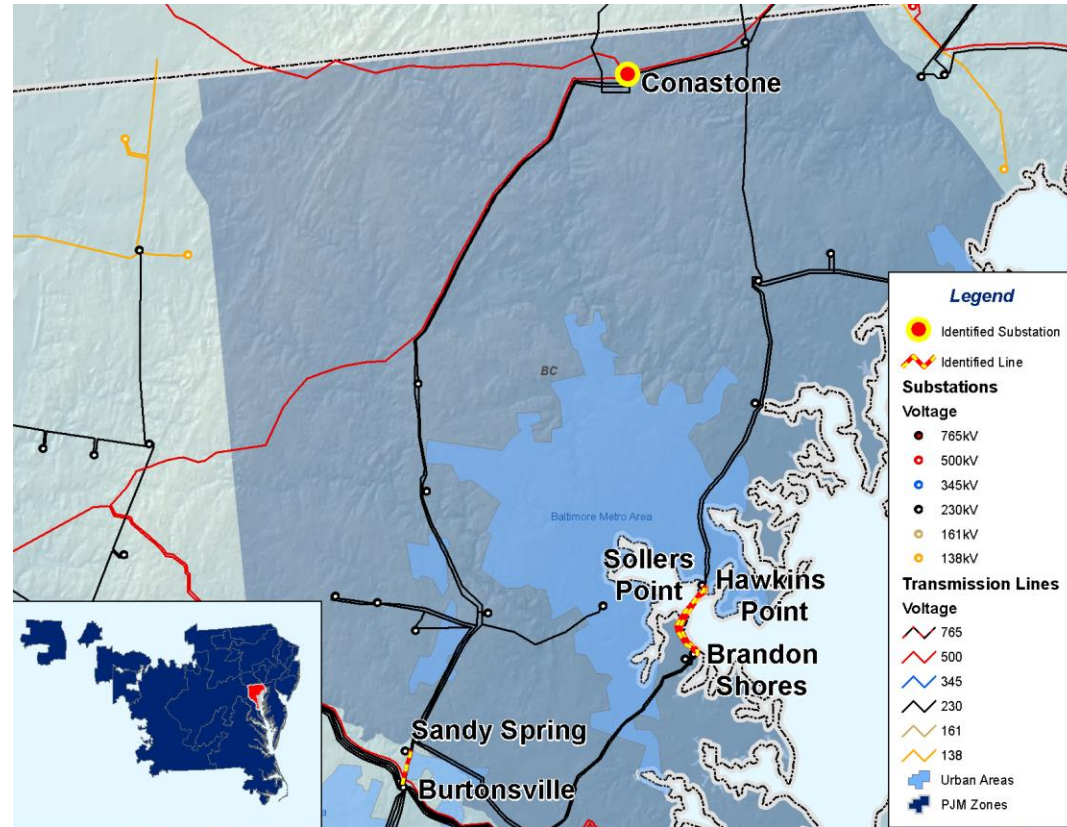
- Mickleton 230/69 kV transformer #4 / loss of the Mickleton 230/69kV transformer #1
- Recommended Solution: Move the Monroe 230/69 kV transformer to Mickleton
- Estimated cost: \$1.24 M
- Expected in-service date: June 1, 2013



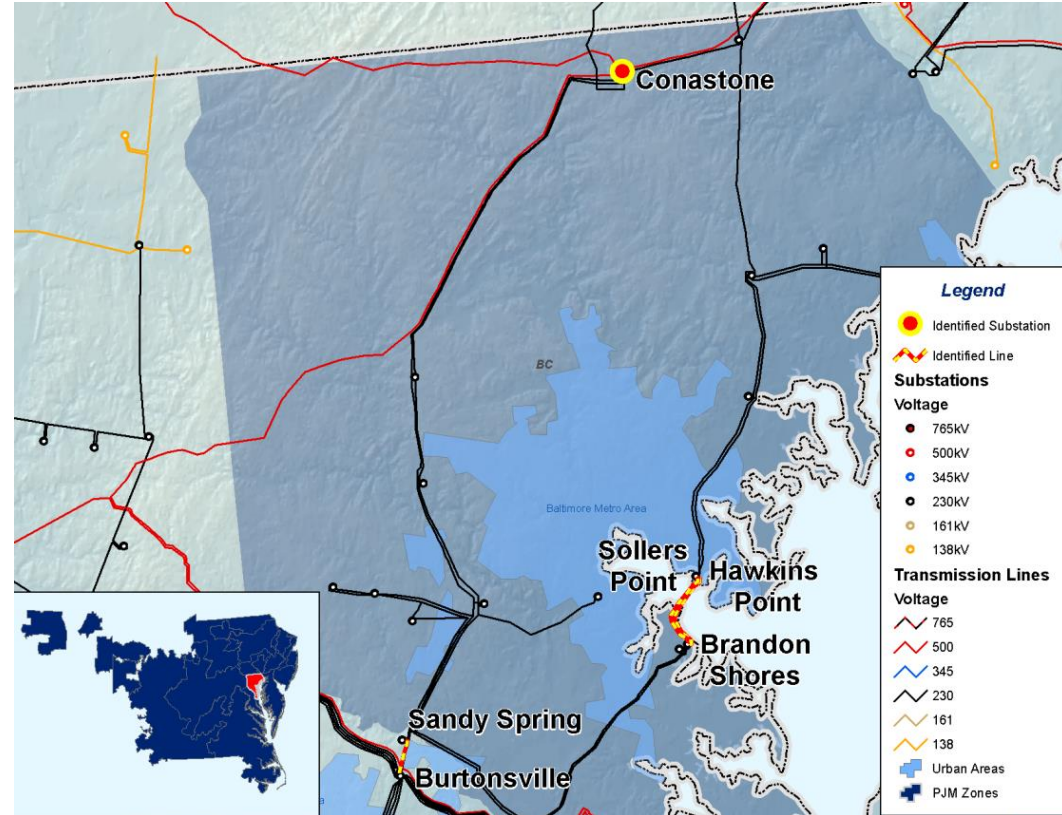


BG&E Baseline Upgrades

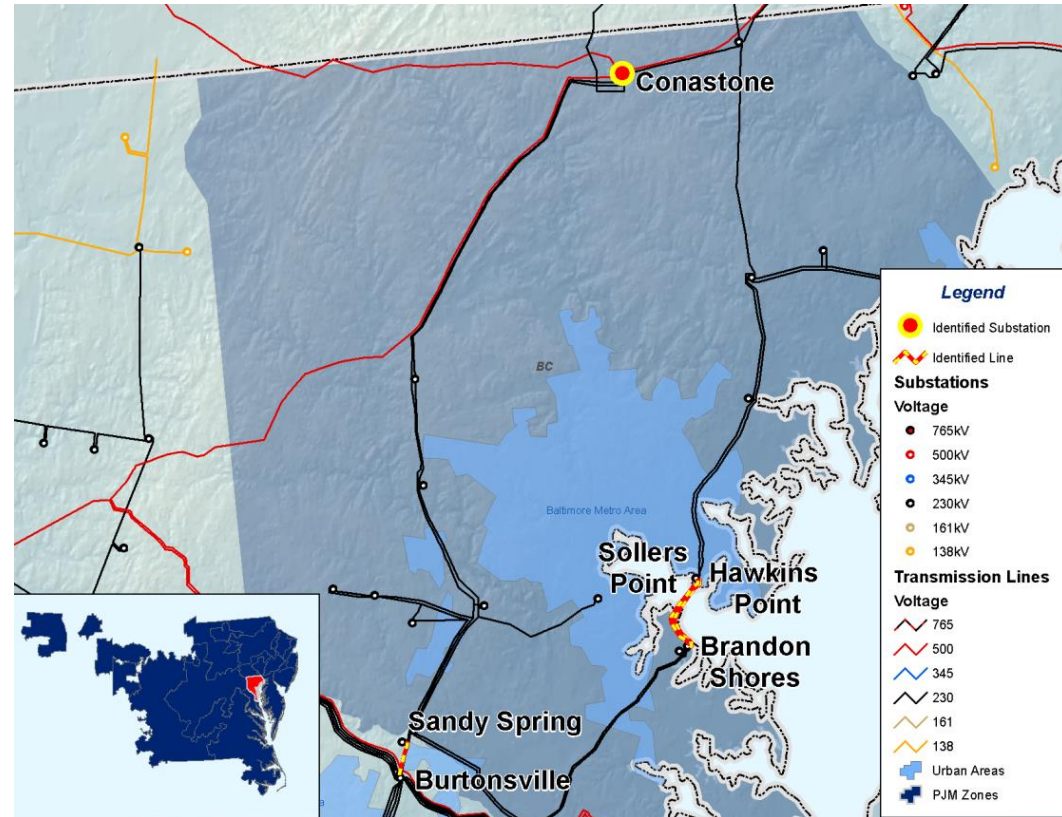
- Brandon Shores – Hawkins Point Terminal 230 kV line / Loss of Brandon Shores – Hawkins Point Terminal – Sollers Point Terminal (#2344) 230 kV line and Brandon Shores 5T Breaker failed (Line_FB)
- Sollers Point Terminal – Riverside 230 kV line CKT 2345 / Loss of Brandon Shores – Hawkins Point Terminal – Sollers Point Terminal (#2344) 230 kV line and Brandon Shores 5T Breaker failed (Line_FB)
- Recommended Solution: Replace 230 kV breaker and associated CTs at Riverside on 2345 line. Replace all dead-end structures at Brandon Shores, Hawkins Point, Sollers Point and Riverside. Install a second conductor per phase on the spans entering each station. Brandon Shores – Hawkins Point N/E = 1243/1386 MVA. Sollers Pt. – Brandon Shores N/E = 1174/1386 MVA
- Expected service date: June 1, 2013
- Estimated Cost \$1.5 M



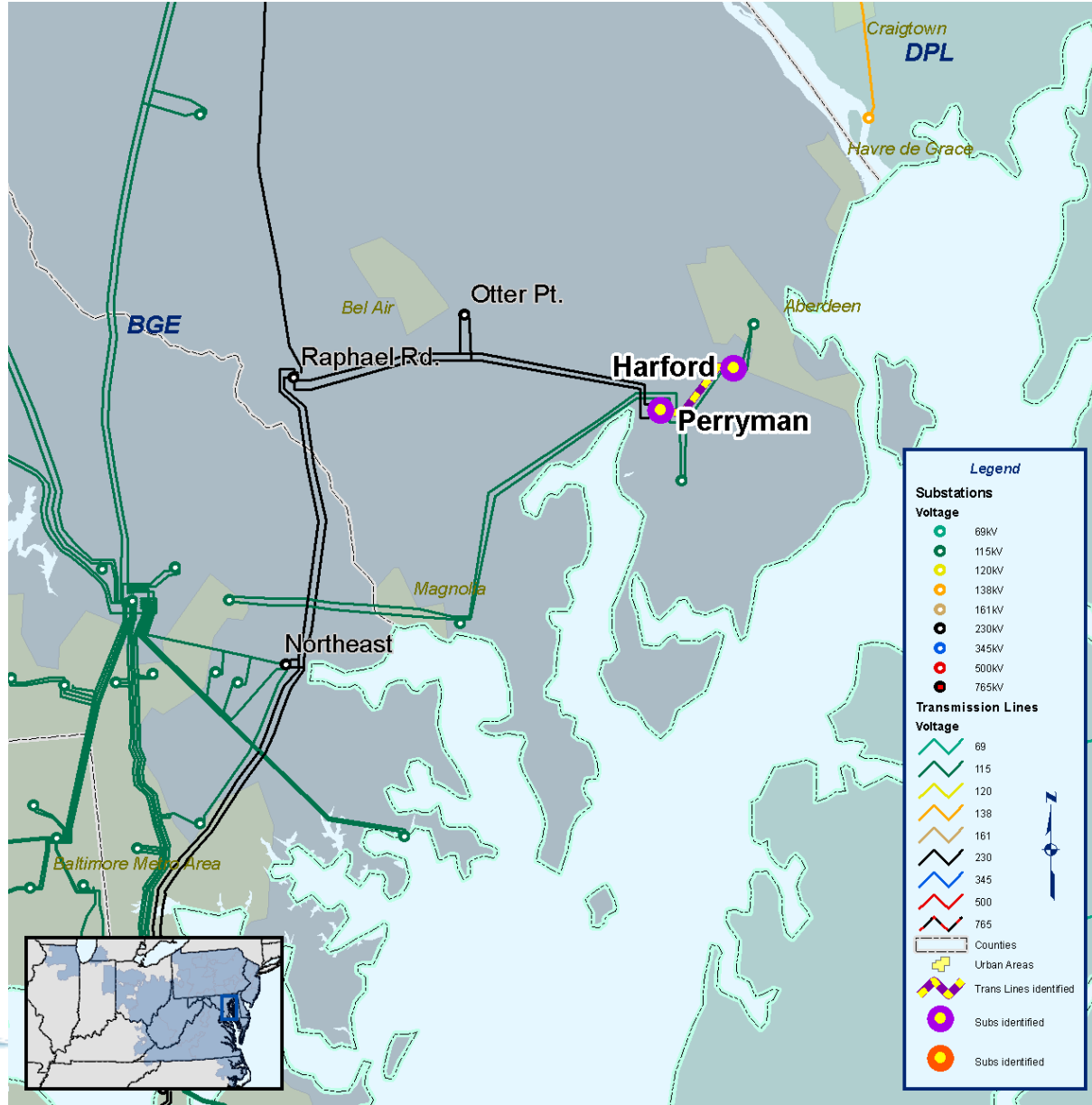
- Conastone 500/230 kV transformer CKT 1 / Loss of Conastone – Peach Bottom 500 kV line + Conastone 500/230 kV transformer CKT 2 (Line_FB)
 - The limitation on the transformer is associated bus
 - The bus will be replaced as part of the transformer replacement (B0298)



- Burtonsville – Sandy Spring 230 kV line CKT #2314 / Loss of High Ridge – Sandy Springs – Burtonsville CKT # 2334 (Single)
- Burtonsville – Sandy Spring 230 kV line CKT #2334 / Loss of High Ridge – Sandy Springs – Burtonsville CKT # 2314 (Single)
- Recommended Solution: Rebuild each line (0.2 miles each) to increase the normal rating to 968 MVA and the emergency rating to 1227 MVA
- Expected in-service: June 1, 2013
- Estimated cost: \$0.27 M per line



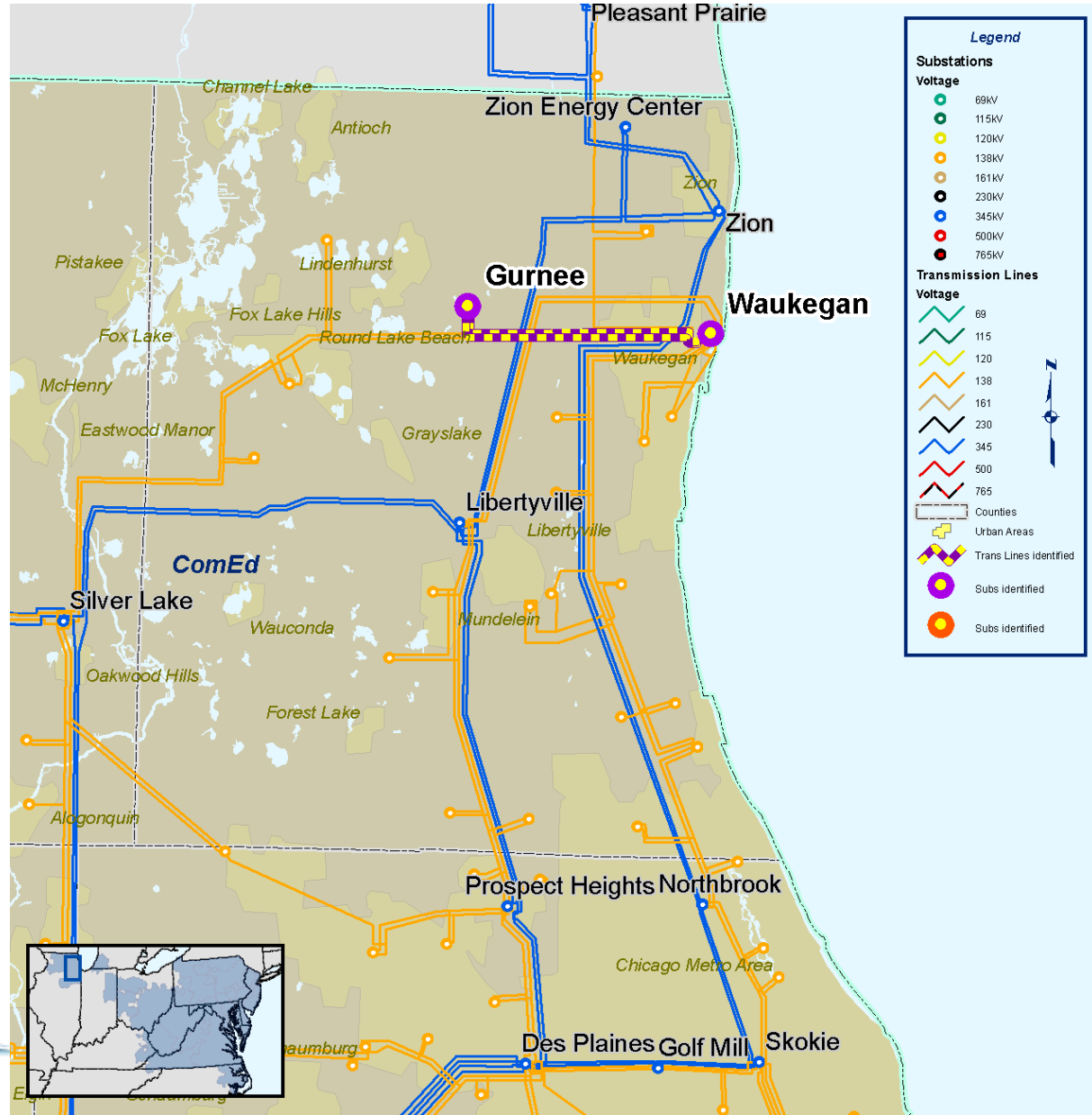
- Harford - Perryman 110615-A 115 kV line / loss of Harford
- Perryman 110616-A 115 kV line
- Harford - Perryman 110616-A 115 kV line / loss of Harford
- Perryman 110615-A 115 kV line
- Rebuild both Harford - Perryman 115 kV lines 110615-A & 110616-A
- Estimated Project Cost: \$8.0 M
- Expected IS Date: 6/01/2013





ComEd Baseline Upgrades

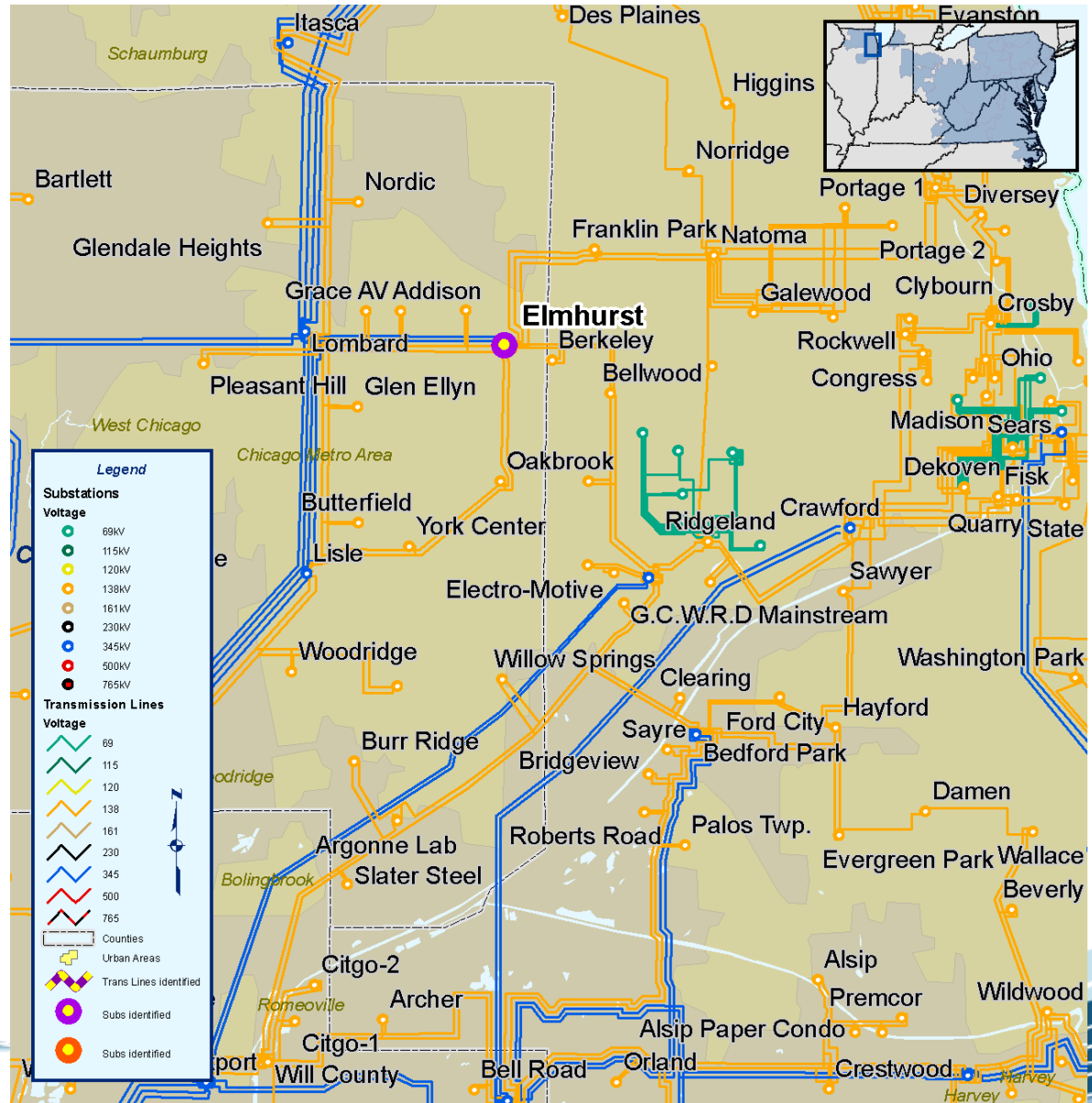
- Thermal overload of Waukegan – Gurnee 138 kV “Red”
 - Bus fault at Silver Lake 138 kV “Red”
- Thermal overload of Waukegan – Gurnee 138 kV “Blue”
 - Tower Outage of Round Lake – Wilson 138 kV “Blue” and “Red” circuits
- Generator Deliverability
- Reconductor 138 kV lines 1603 and 1607 from Waukegan to Gurnee
- Estimated Cost: \$11.6M
- IS Date: 6/1/2013



Dynamic Voltage Criteria & Voltage Stability Criteria

- Solution: Add a 300 MVAR SVC at Elmhurst 138 kV “Red”
- IS Date: 6/1/2013
- Cost: \$32.5M

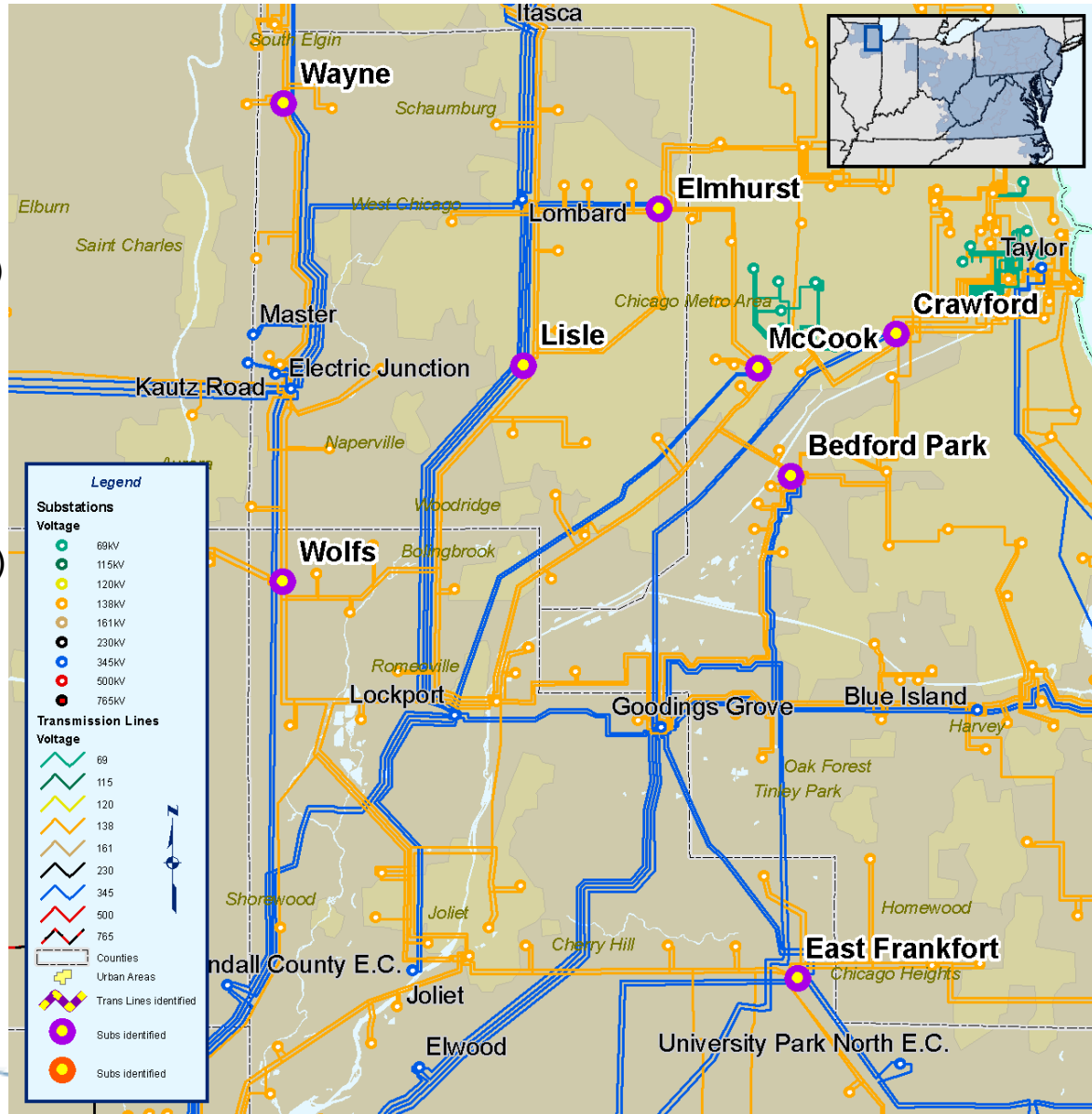
- Solution: Add a 300 MVAR SVC at Elmhurst 138 kV “Blue”
- IS Date: 6/1/2013
- Cost: \$32.5M



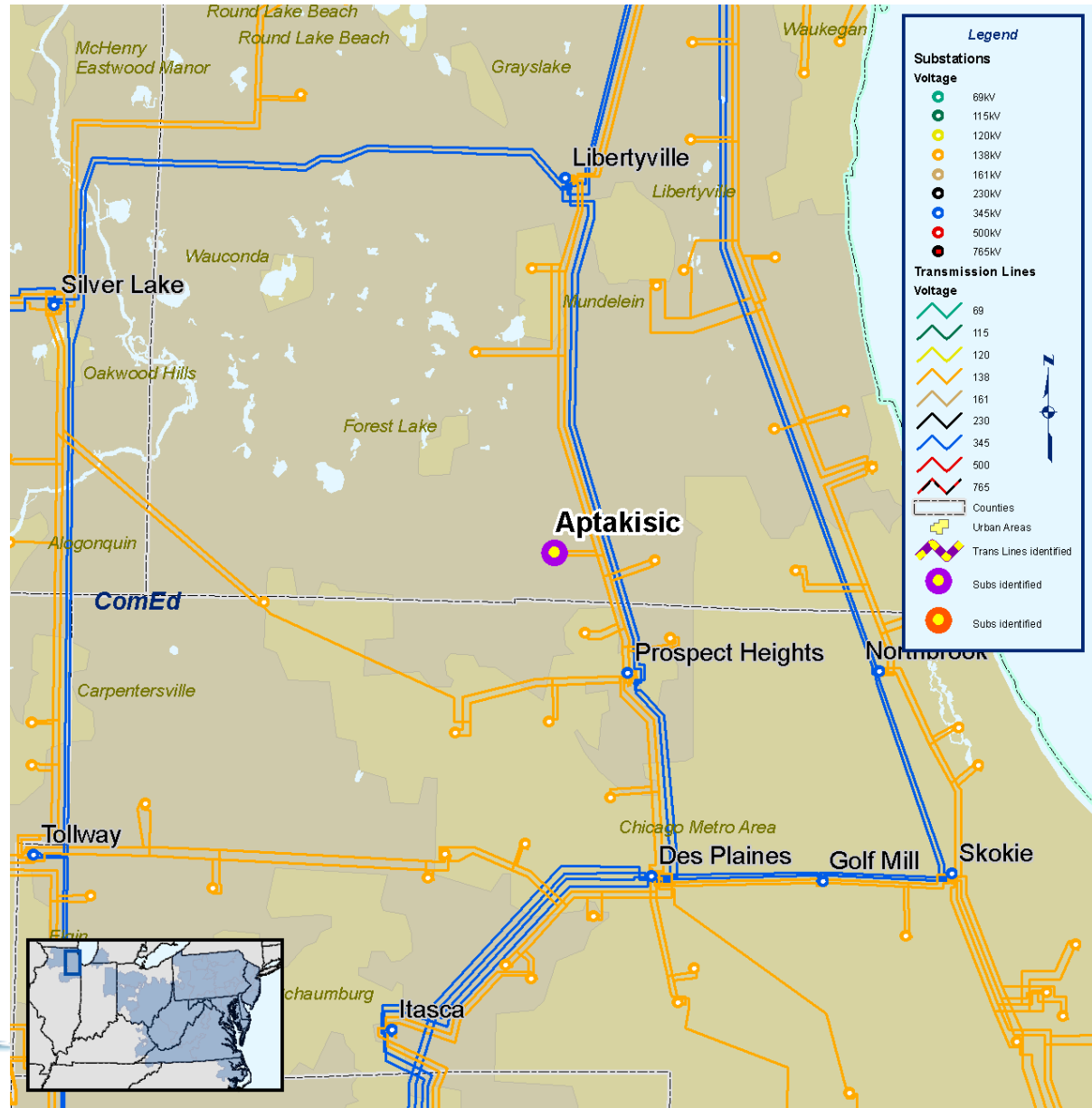
Voltage Stability

• Solution: Install 115.2 MVAR switched capacitors at the following locations by 6/1/2013:

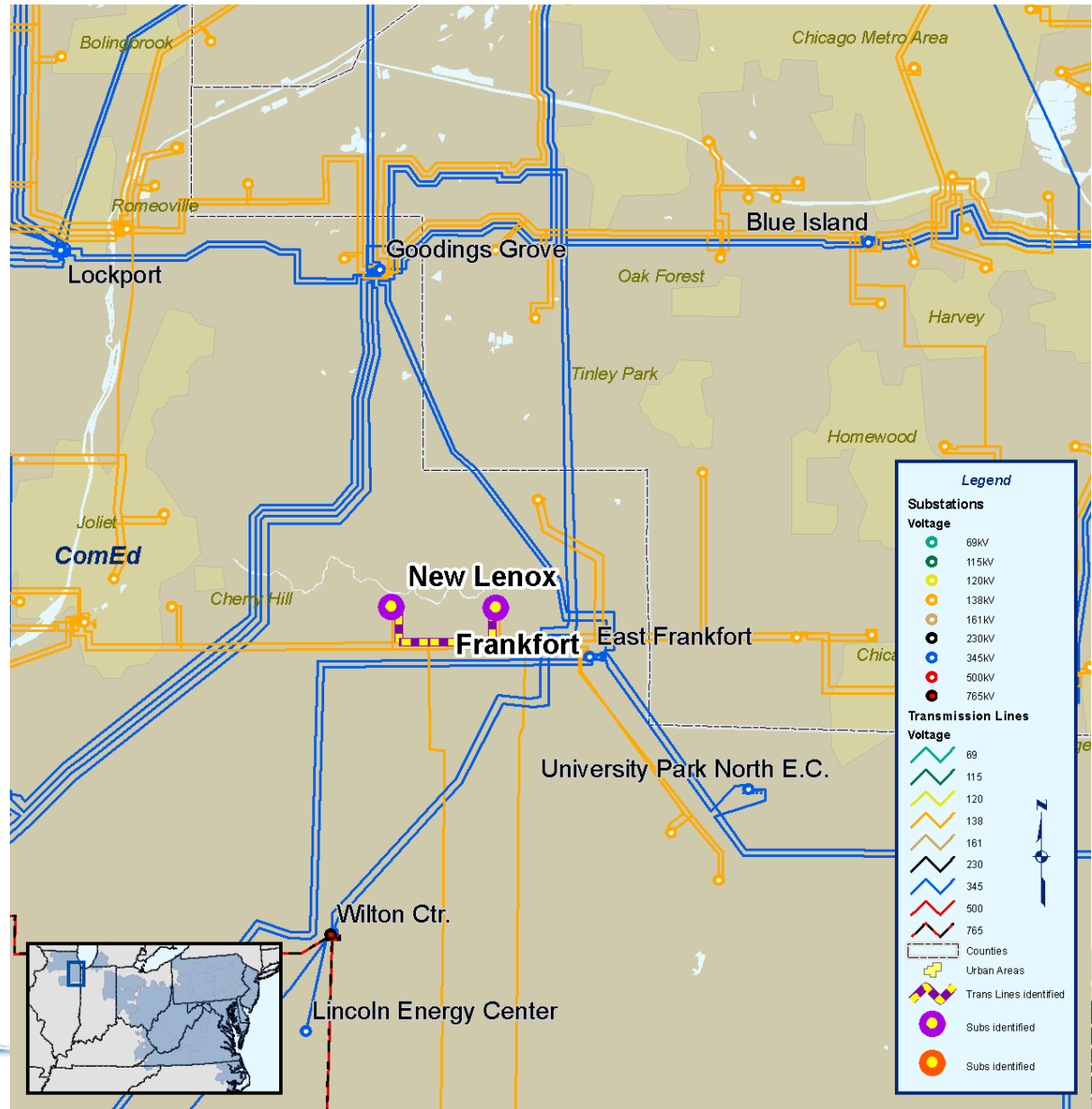
- East Frankfort 138 kV (\$2.9M)
- Plano 138 kV Red (\$2.3M)
- Plano 138 kV Blue (\$2.3M)
- McCook 138 kV Red (\$2.3M)
- McCook 138 kV Blue (\$2.3M)
- Wayne 138 kV Blue (\$2.9M)
- Wayne 138 kV Red (\$2.9M)
- Crawford 138 kV Blue (\$2.3M)
- Crawford 138 kV Red (\$2.3M)
- Bedford Park 138 kV Blue (\$2.9M)
- Bedford Park 138 kV Red (\$2.9M)
- Wolfs 138 kV (57.6 MVAR) (\$1.5M)



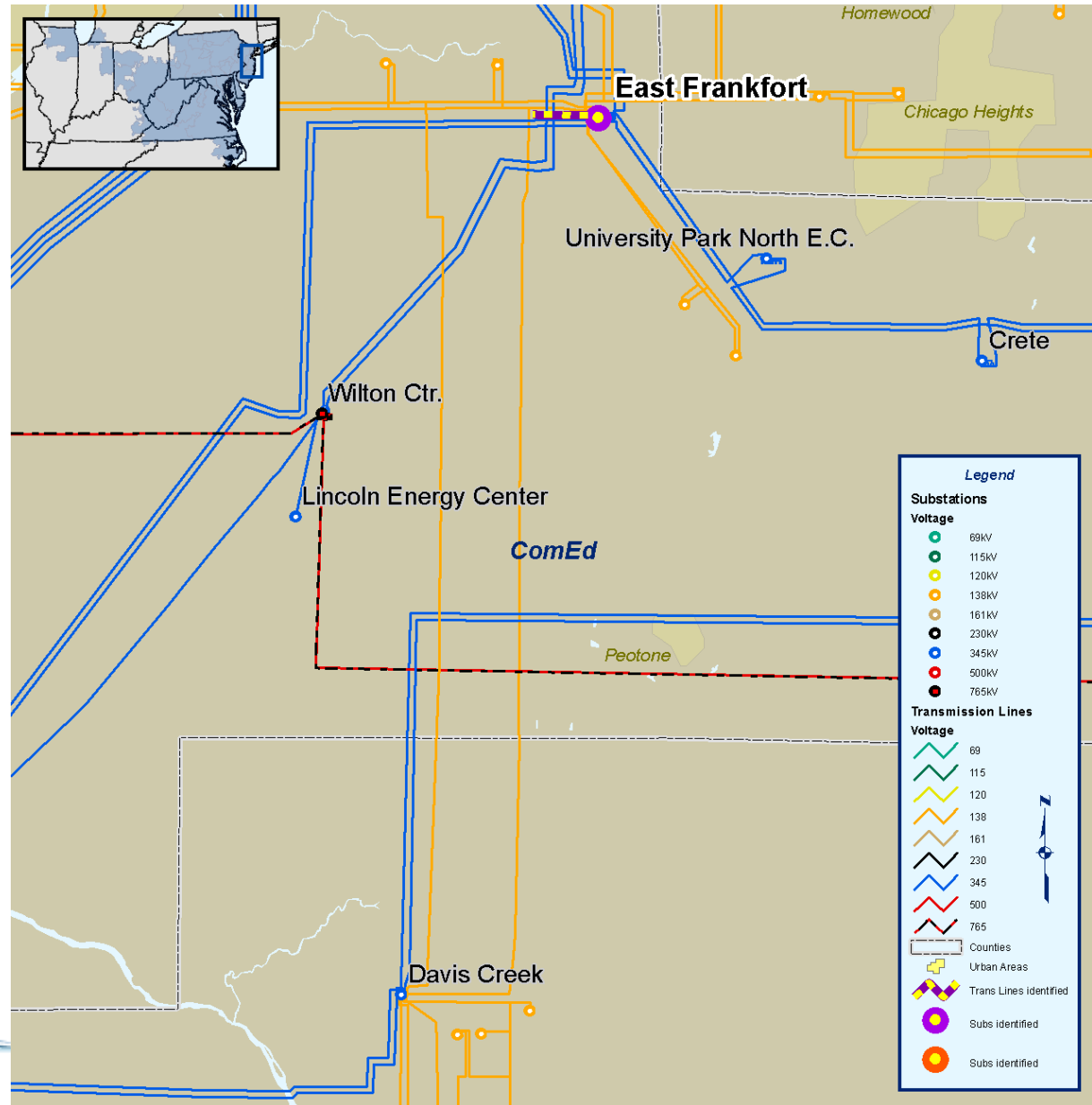
- Thermal overload of Prospect Heights 345/138 kV “Red” transformer for the loss of Prospect Heights – Leithton 138 kV line 11708
- Solution: Add a breaker at Aptakisic 138 kV to split the line in two for the 11708 contingency
- ComEd criteria & PJM Load Deliverability
- Expected IS Date: 6/1/2013
- Cost estimate: \$4M



- Thermal overload of 0902 Frankfort – New Lenox 138 kV for the loss of Dresden – Shorewood 138 kV
- Solution: Reconductor line 0902 Frankfort - New Lenox 138 kV
- Generator Deliverability
- Expected IS Date: 6/1/2013
- Cost Estimate: \$2M



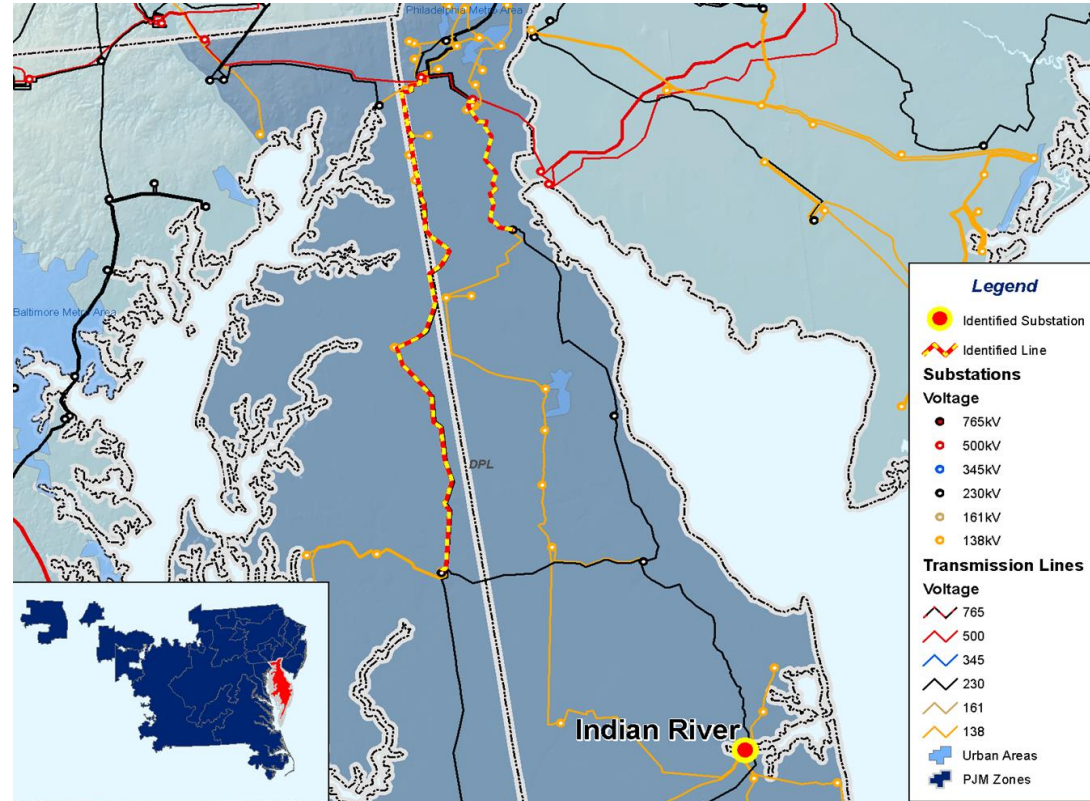
- Thermal overload of 138 kV line 0902 between E. Frankfort TSS 66 and Davis Creek TSS 86 tap for the loss of East Frankfort – Matteson 138 kV
- Solution: Increase capacity of 138 kV line 0902 between E. Frankfort TSS 66 and Davis Creek TSS 86 tap ~ 1.5 miles
- Generator Deliverability
- Expected IS Date: 6/1/2013
- Cost Estimate: \$1.5M



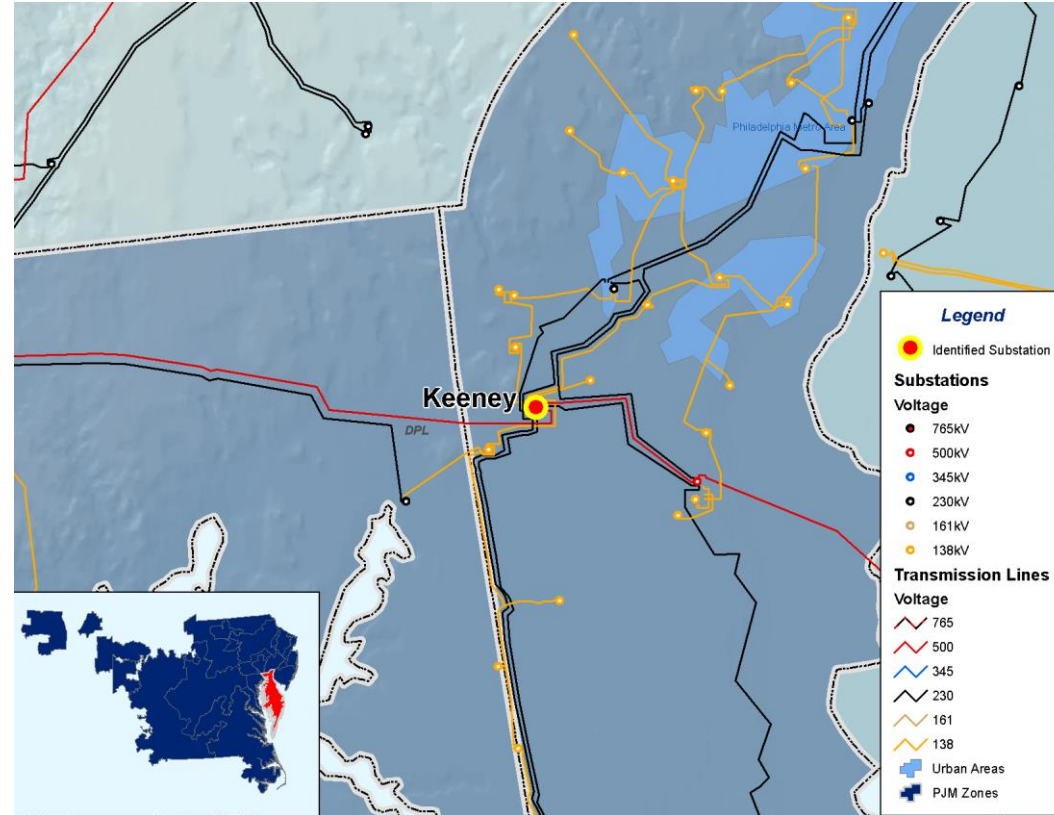


Delmarva Baseline Upgrades

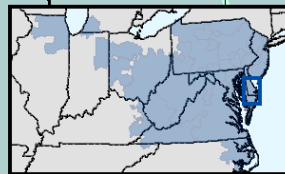
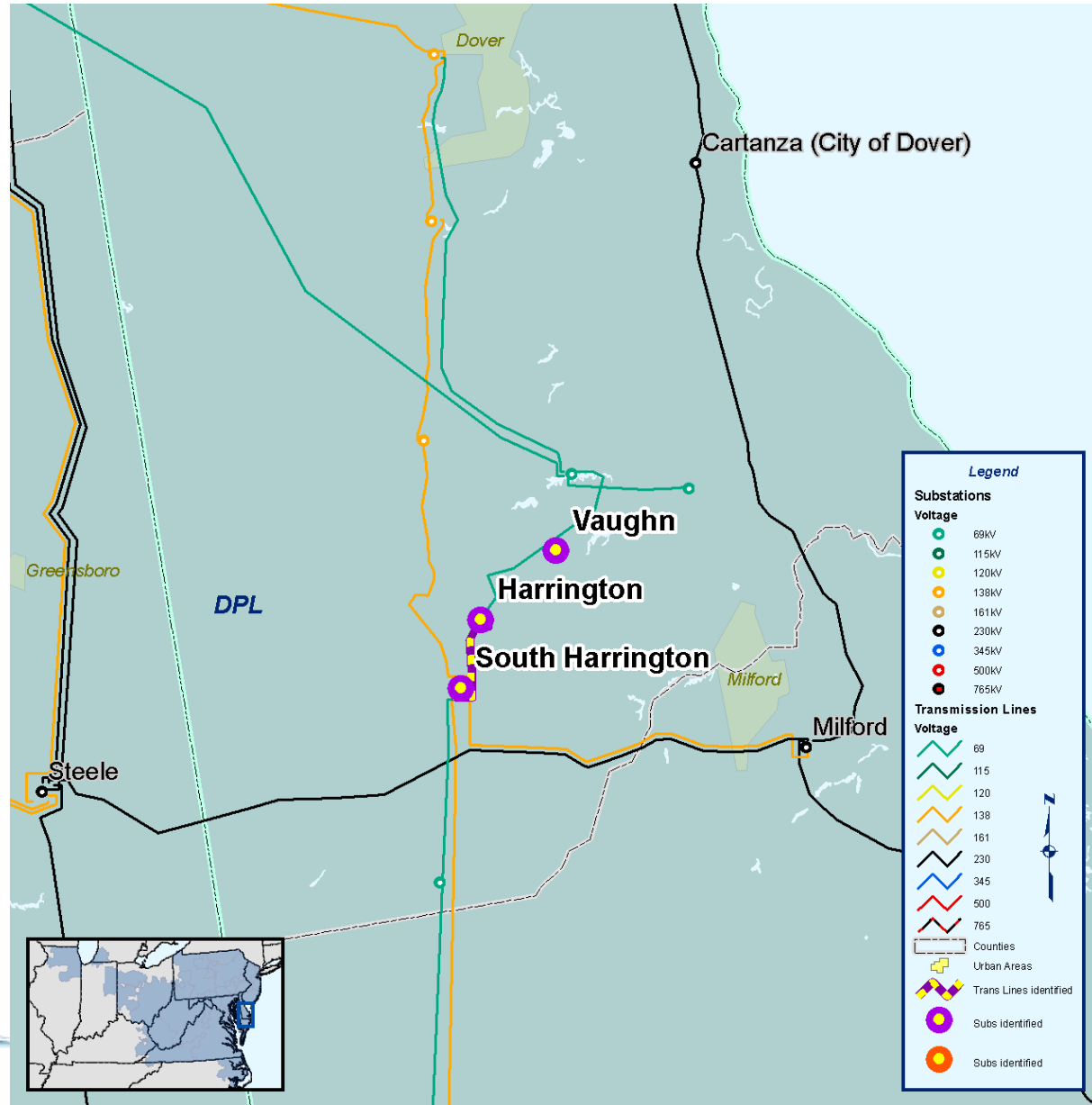
- Voltage collapse / loss of Indian River unit 3
- Voltage collapse / loss of Cedar Creek - Red Lion 230 kV line
- Voltage collapse / loss of Keeney - Steele 230 kV line
- Recommended Solution (for all three issues): Convert the 138 kV network path from Vienna to Loretto to Piney Grove to 230 kV and add 230/138 kV transformer at Loretto 230 kV station
- Estimated cost: \$40M
- Expected in-service date: June 1, 2013



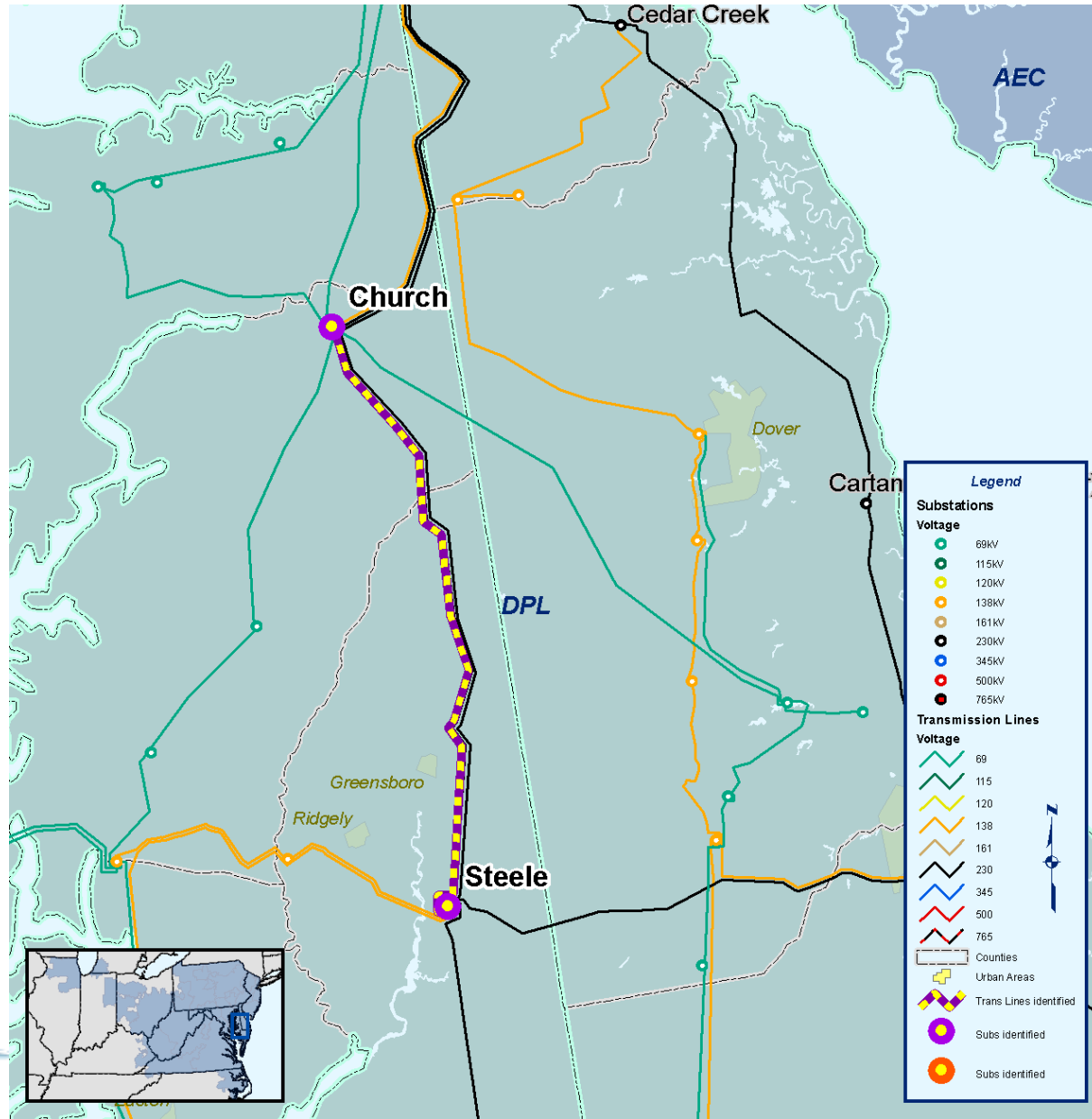
- Keeney 500/230 kV transformer CKT 1 / Loss of Keeney – Red Lion + Keeney 500/230 kV transformer CKT 2 (Line_FB)
- Keeney 500/230 kV transformer CKT 2 / Loss of Keeney – Red Lion + Keeney 500/230 kV transformer CKT1 (Line_FB)
- Recommended Solution: Add two additional breakers at Keeney 500 kV
- Estimated cost: \$4.5M
- Expected in-service date: June 1, 2013



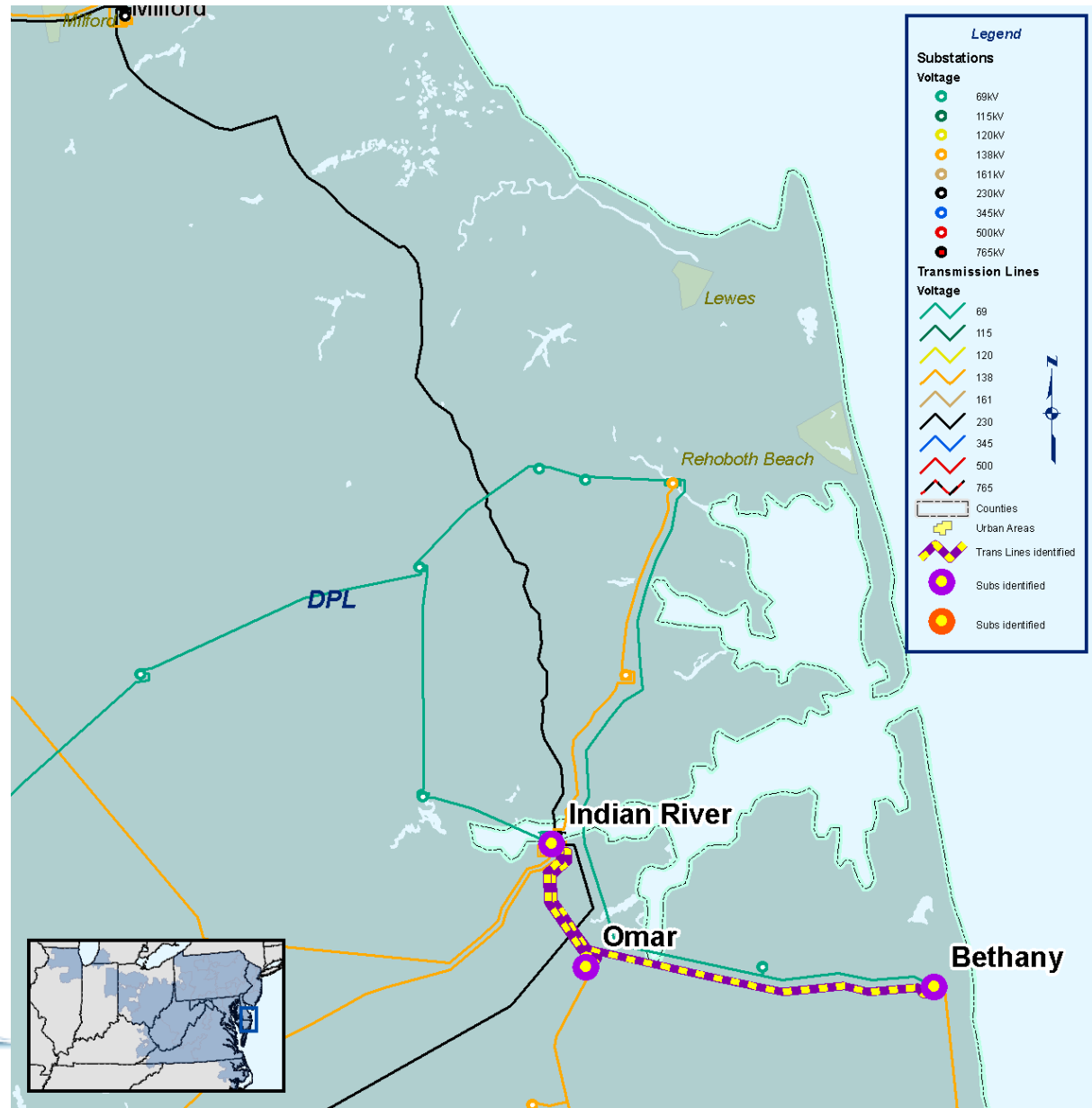
- Vaughn – Wells
69 kV line / loss
of Harrington –
South Harrington
69 kV line
- Rebuild Vaughn –
Wells 69 kV line
- Estimated
Project Cost:
\$1.6 M
- Expected IS
Date: 6/01/2013



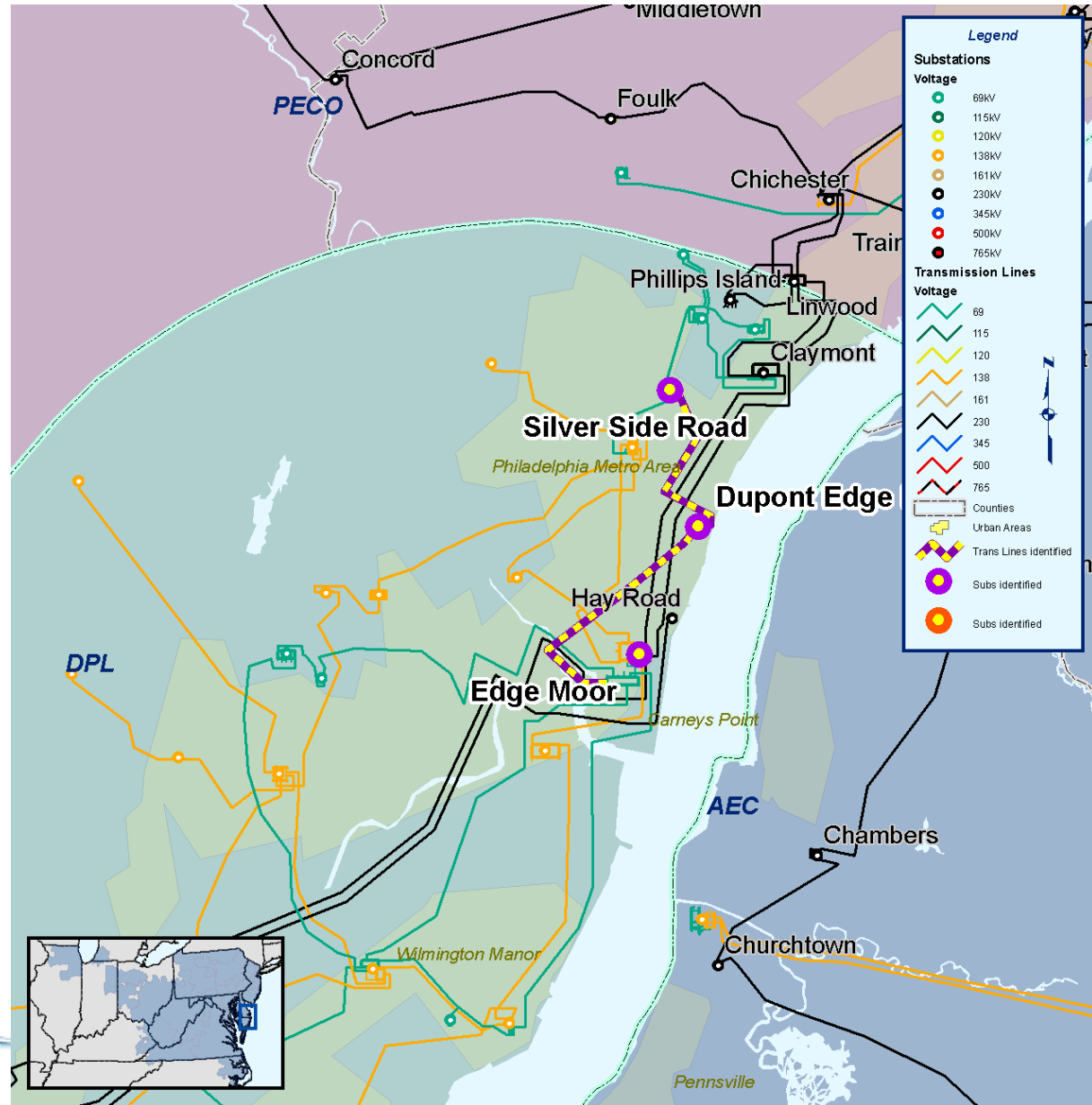
- Oil City – Steele 138 kV line / loss of Glasgow – Mount Pleasant 138 kV line + loss of Lums - Reybold 138 kV line
- Oil City – Church 138 kV line / loss of Glasgow – Mount Pleasant 138 kV line + loss of Lums - Reybold 138 kV line
- Recommended Solution: Rebuild Church – Steele 138 kV line
- Estimated Project Cost: \$20 M
- Expected IS Date: 6/01/2013



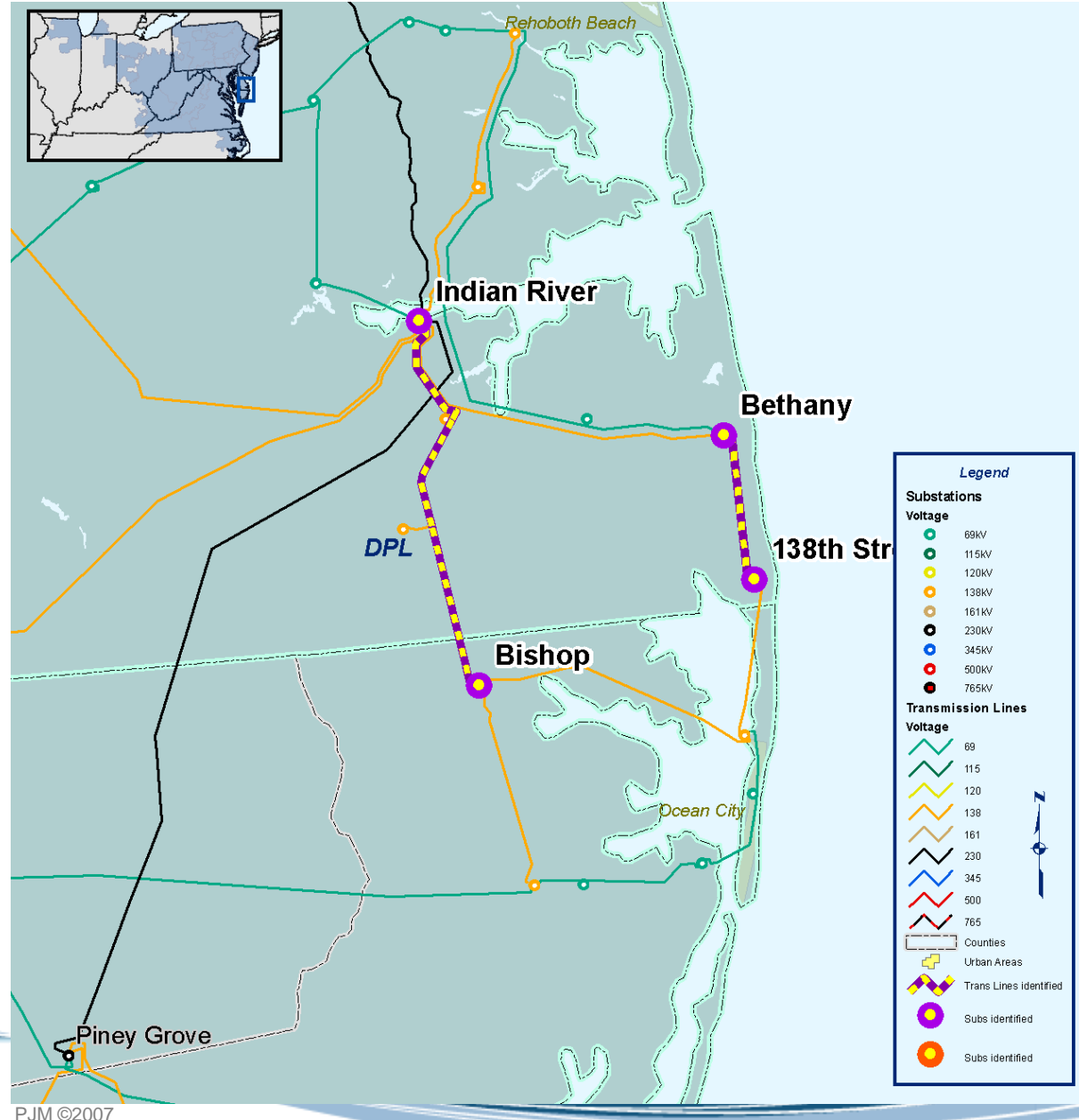
- Indian River - Omar 138 kV line / loss of Frankford- Bishop 138 kV line + loss of Indian River – Robinson 138 kV line
- Bethany - Omar 138 kV line / loss of Frankford- Bishop 138 kV line + loss of Indian River – Robinson 138 kV line
- Recommended Solution: Rebuild Indian River – Omar - Bethany 138 kV line
- Estimated Project Cost: \$9.6 M
- Expected IS Date: 6/01/2013



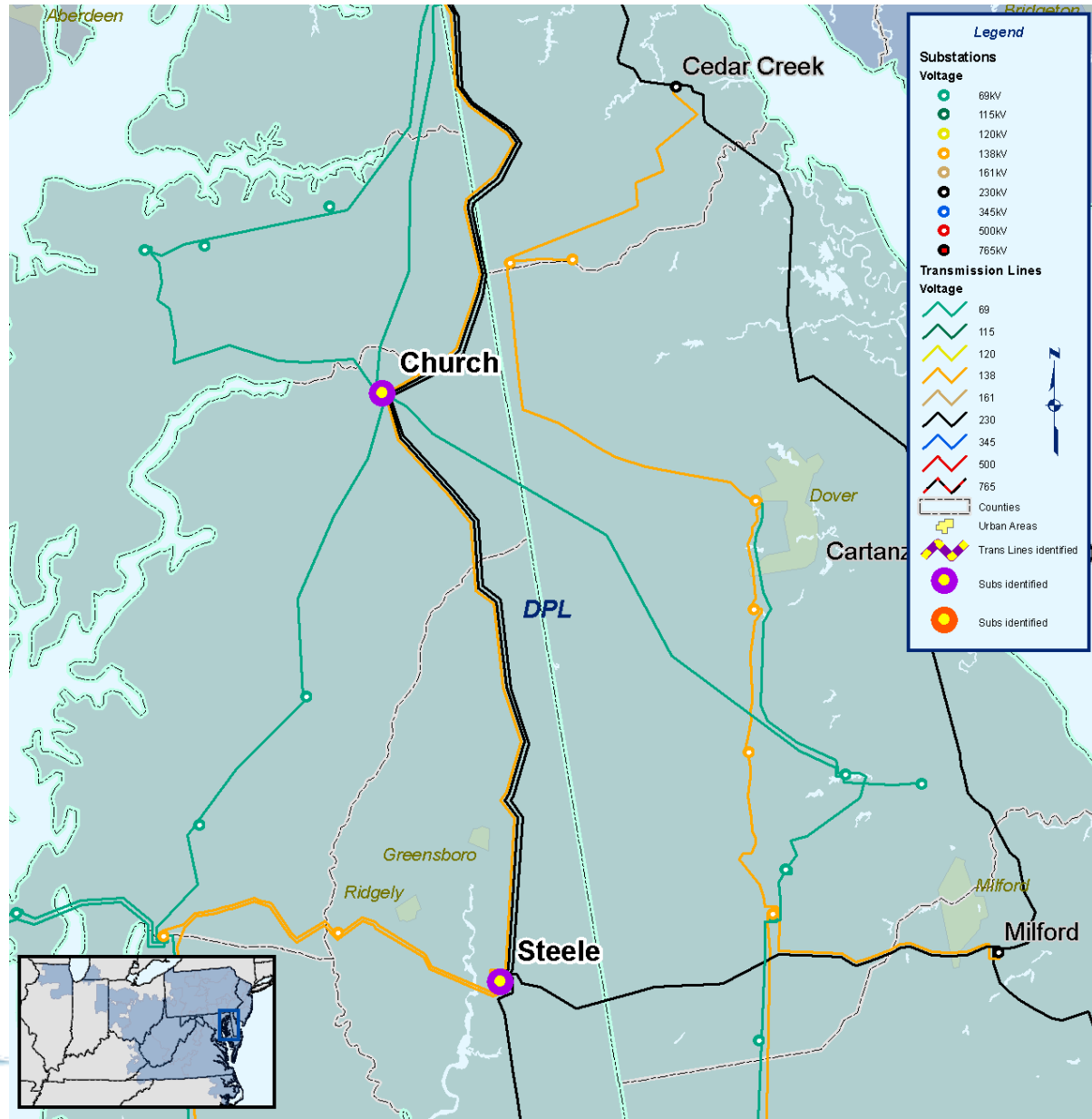
- Dumpont Edgemoor - Edgemoor 69 kV line / loss of Kiamensi - Silverbrook 138 kV line + loss of Carrcroft - Edgemoor 138 kV line
- Dumpont Edgemoor - Silverside 69 kV line / loss of Kiamensi - Silverbrook 138 kV line + loss of Carrcroft - Edgemoor 138 kV line
- Recommended Solution: Rebuild Dupont Edgemoor – Edgemoor – Silverside 69 kV line
- Estimated Project Cost: \$5.0 M
- Expected IS Date: 6/01/2013



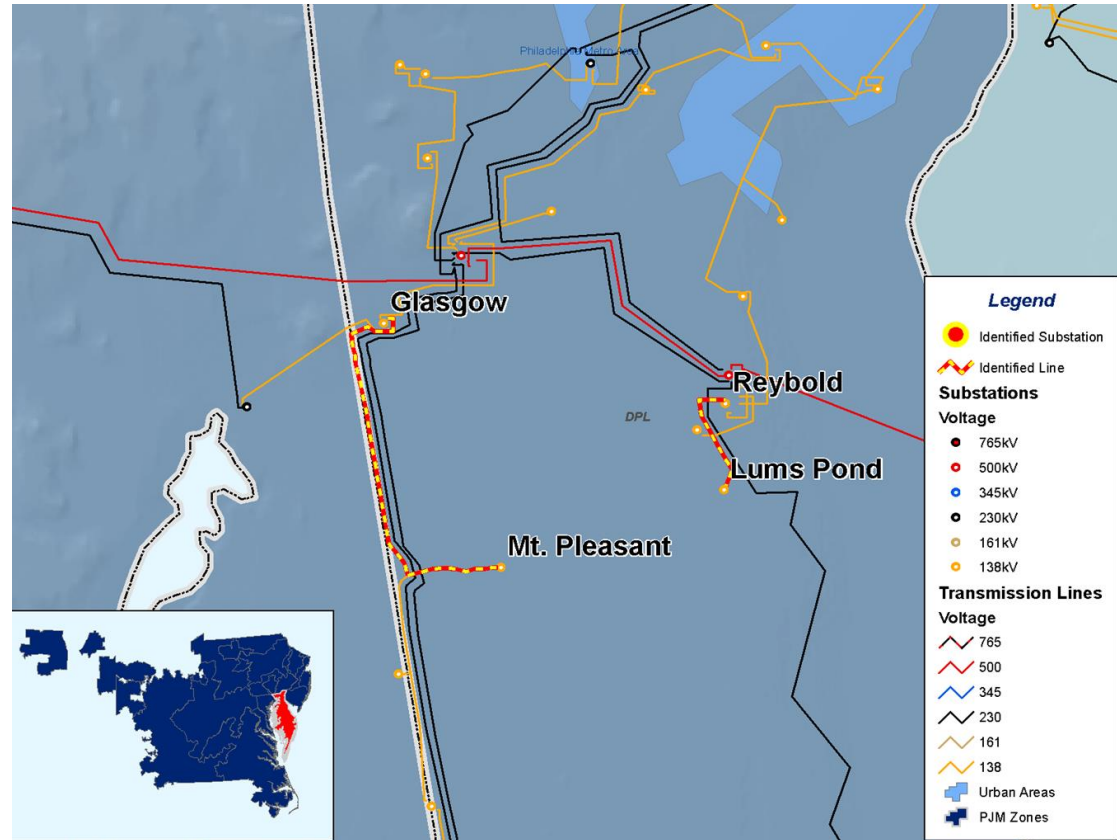
- Numerous 69 kV overloads involving 2 sets of contingencies related by the loss of Bethany – 138th Street 138 kV line + loss of either one of the two 138 kV lines out of Bishop
- Recommended Solution: Build a new Indian River – Bishop 138 kV line
- Estimated Project Cost: \$18 M
- Expected IS Date: 6/01/2013



- Steele 230/138 kV transformer AT21 / loss of Steele 230/138 kV transformer AT20 + loss of Mount Pleasant – Townsend 138 kV line
- Steele 230/138 kV transformer AT20 / loss of Steele 230/138 kV transformer AT21 + loss of Mount Pleasant – Townsend 138 kV line
- Townsend – Church 138 kV line / loss of Steele 230/138 kV transformer AT20 + loss of Steele 230/138 kV transformer AT21
- Recommended Solution: Add a 3rd Steele 230/138 kV transformer
- Estimated Project Cost: \$8 M
- Expected IS Date: 6/1/2013



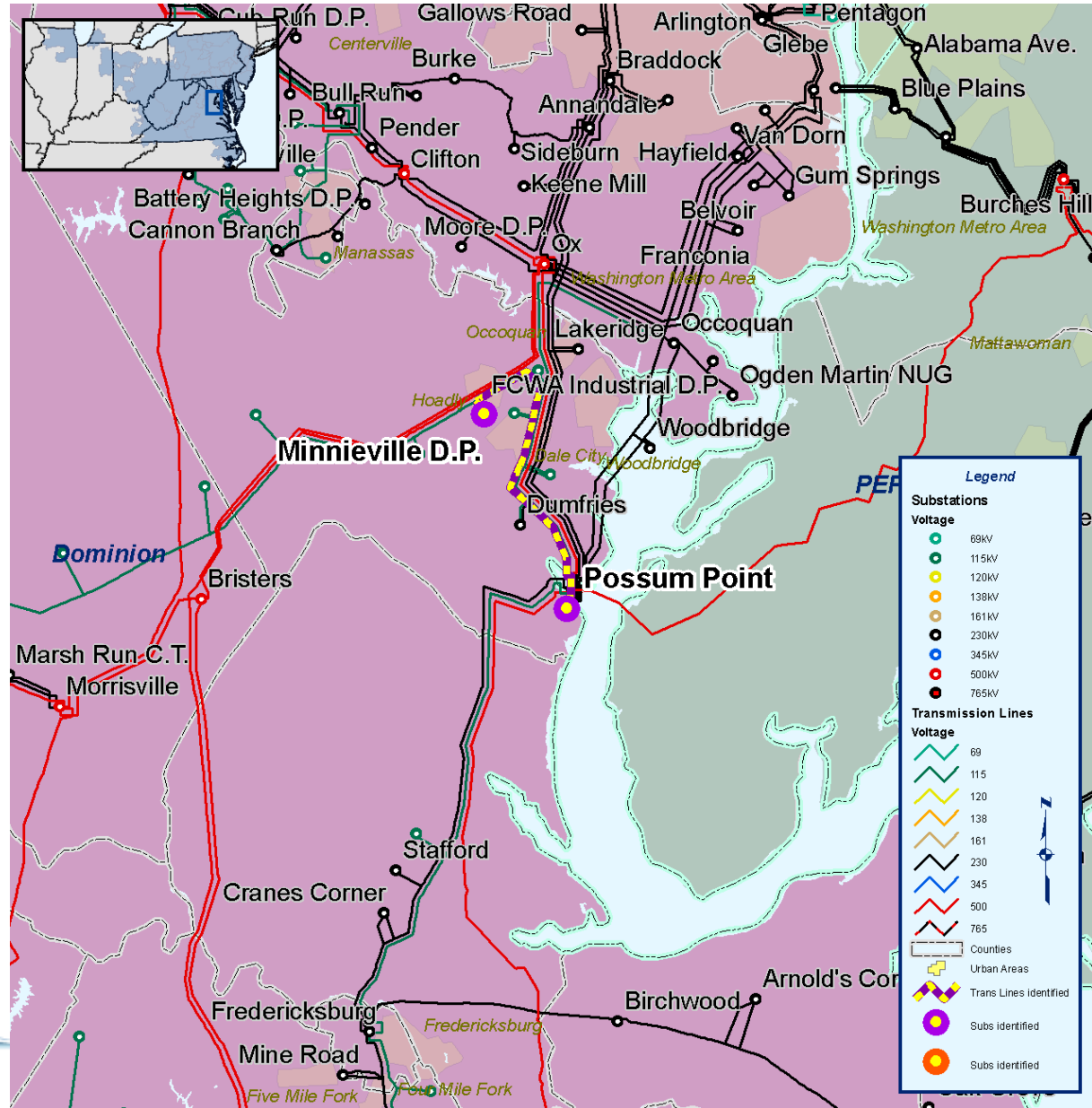
- Reybold – Lums Pond 138 kV line for the loss of Glasgow – Keeney 138 kV line
- Recommended Solution: Replace two circuit breakers to bring the emergency rating up to 348 MVA
- Estimated cost: \$1.0M
- Expected in-service: June 1, 2013
- Glasgow – Mt. Pleasant 138 kV line for the loss of Lums Pond – Reybold 138 kV line
- Recommended Solution: Rebuild 10 miles of Glasgow to Mt. Pleasant 138 kV line to bring the normal rating to 298 MVA and the emergency rating to 333 MVA
- Estimated cost: \$5.7 M
- Expected in-service: June 1, 2013



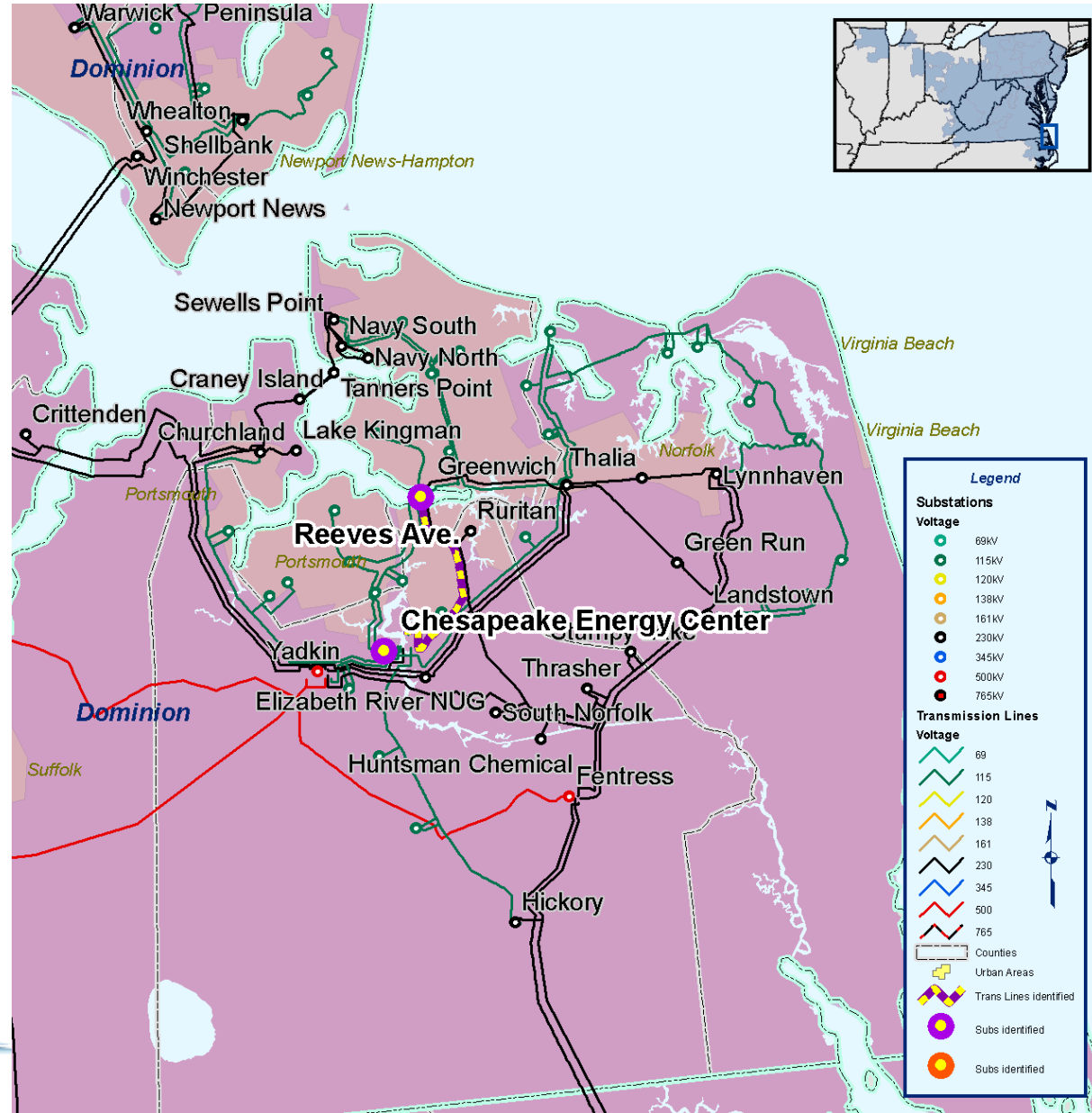


Dominion Baseline Upgrades

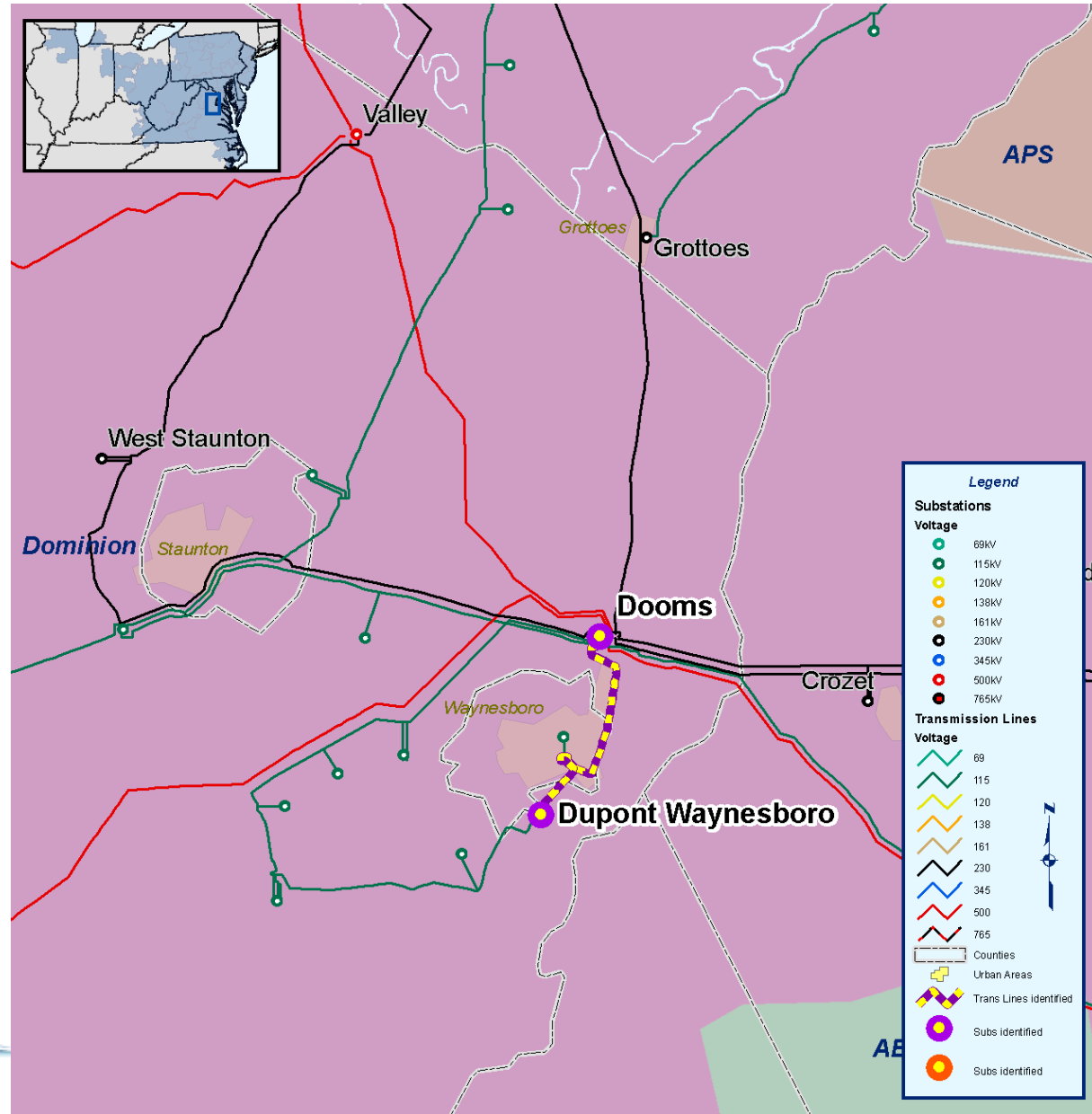
- With Possum Pt #3 off the outage of Possum Pt 230-115 Tx overloads for the outage of the parallel Tx.
- Loading on line#183 Bristers-Independent Hill 115 kV line and # 145 exceeds their 100 MVA line loading limits for Dominion Criteria for radial line loading.
- Recommended Solution: Close switch 145T183 to network the lines. Rebuild the section of Line #145 between Possum Point – Minnieville DP 115kV (15 miles),
- Expected service date: May 2013
- Est. Cost: \$9.0 M



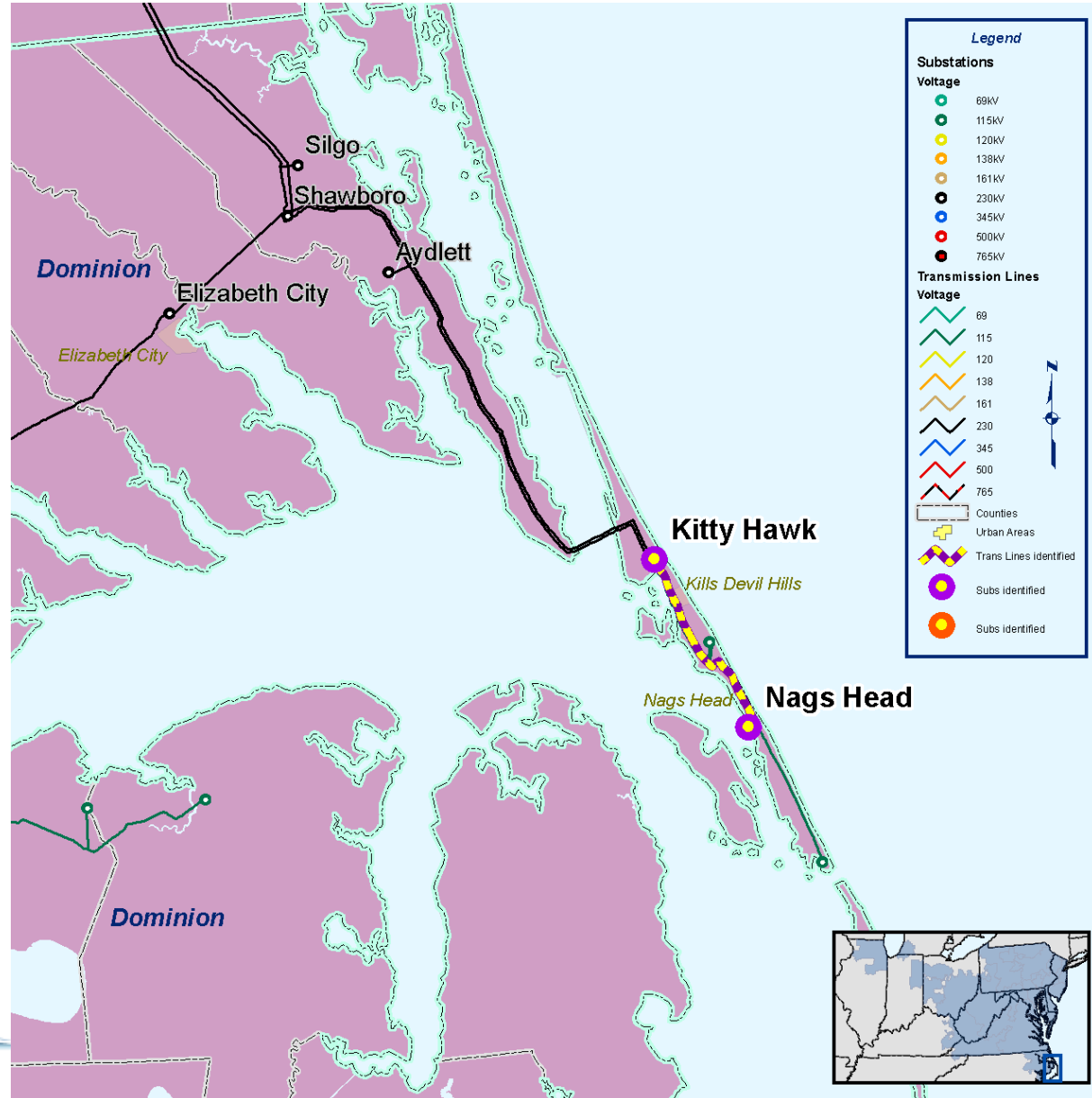
- Chesapeake to Reeves Avenue 115 kV is overloaded for the loss of Chesapeake to Craddock 115 kV
- Recommended Solution: Reconductor one mile of Chesapeake to Reeves Avenue 115 kV line
- Expected service date: May 2013
- Est. Cost: \$1.0 M



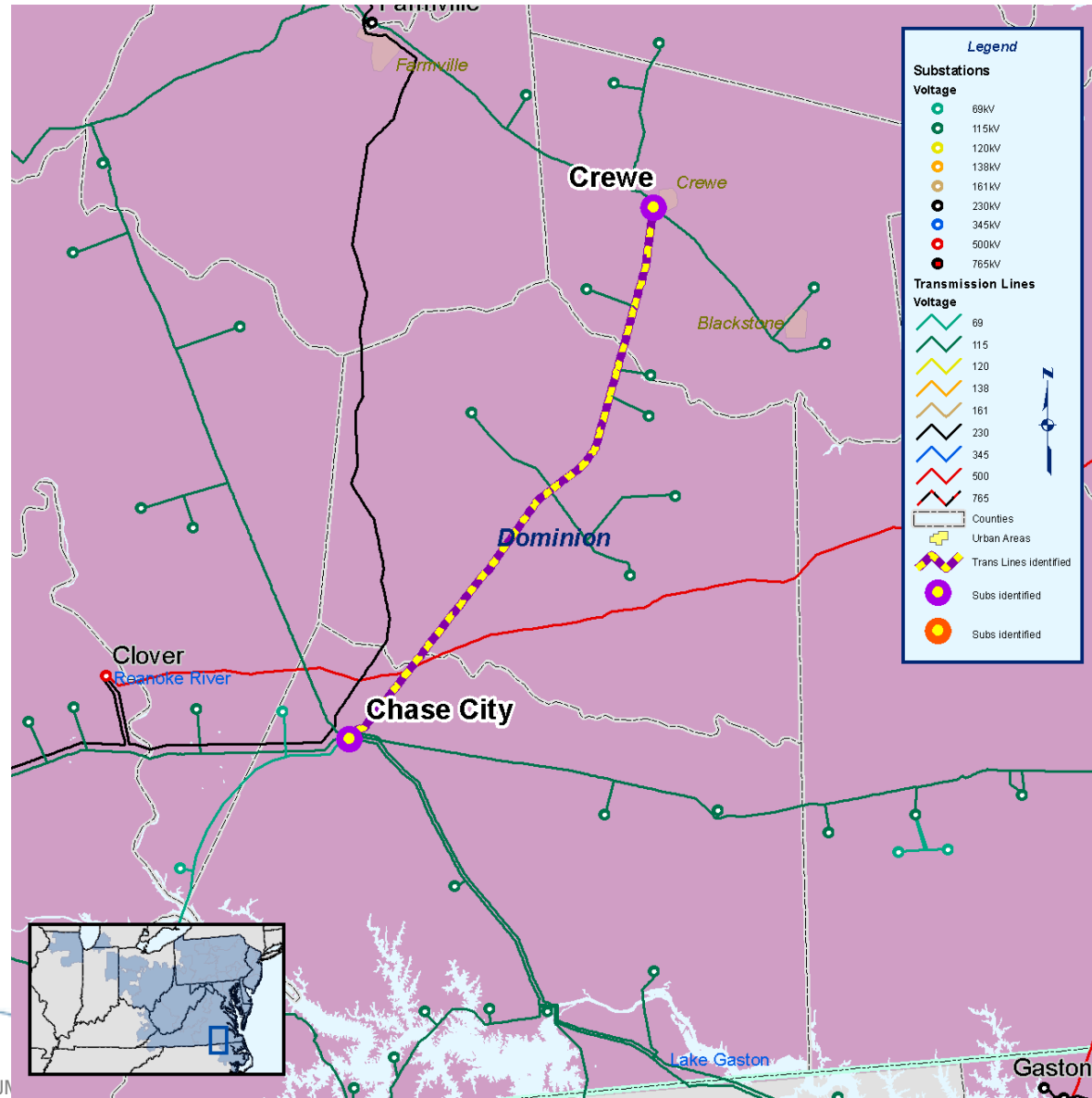
- An outage of Line #160 Doods-Dupont-Waynesboro 115 kV causes area voltage violations
- Solution: Build 2nd Doods - Dupont-Waynesboro 115 kV line
- Expected service date: May 2013
- Est. Cost: \$6.0 M



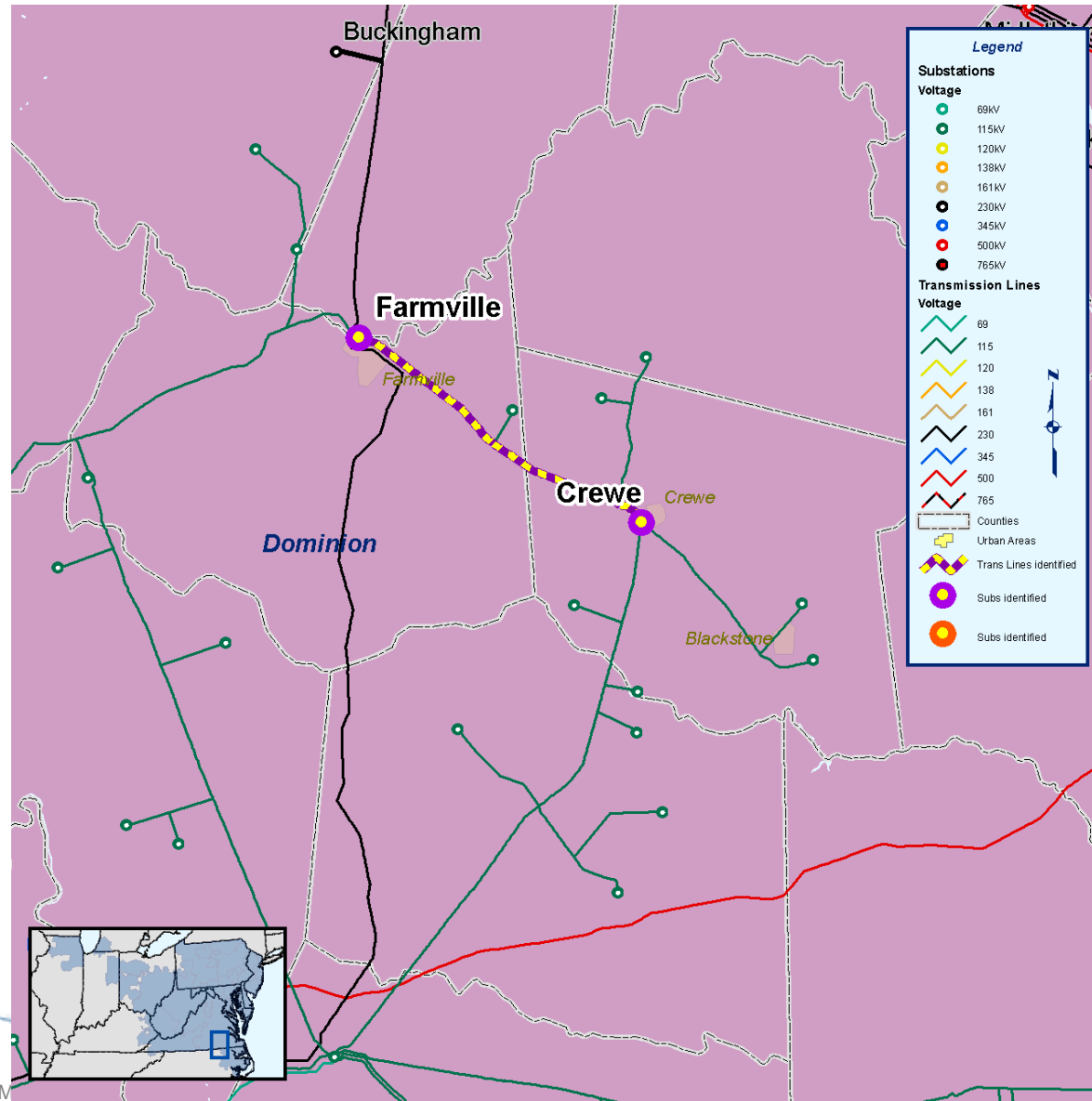
- The loading on Kitty Hawk to Nag's Head exceed 100 MW
- Solution: Build 115 kV line from Kitty Hawk to Colington 115 kV.
 - Colington on the existing line and Nag's Head and Light House DP on new line.
- Service Date: May 2009
- Est. Cost: \$9.0 M



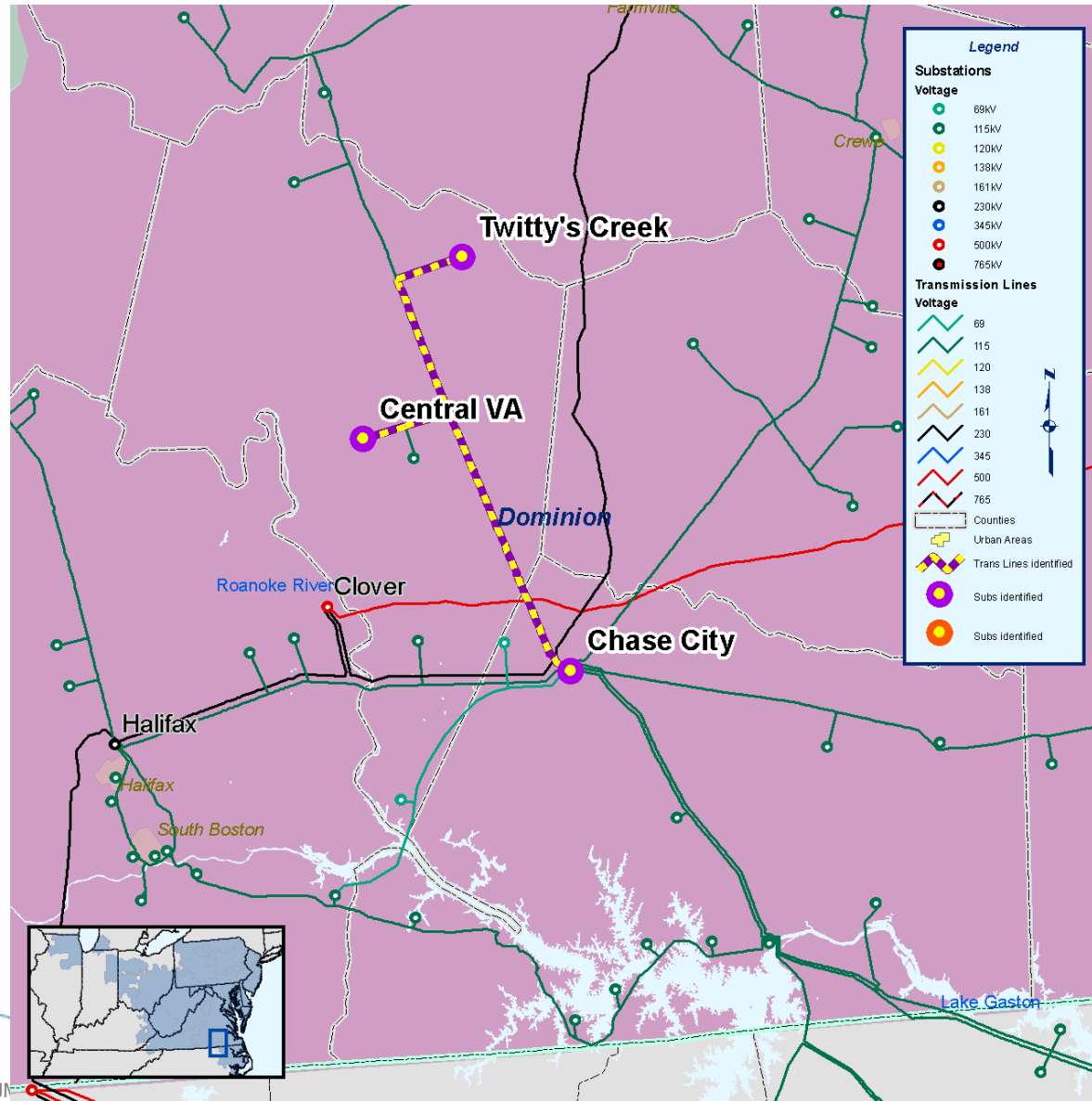
- The Chase City - Crewe 115 kV line overloads when the Crewe to Farmville line is fed from Chase City
- Rebuild the Chase City - Crewe 115 kV line
- In-service: Spring 2011
- Est. Cost: \$11.0 M



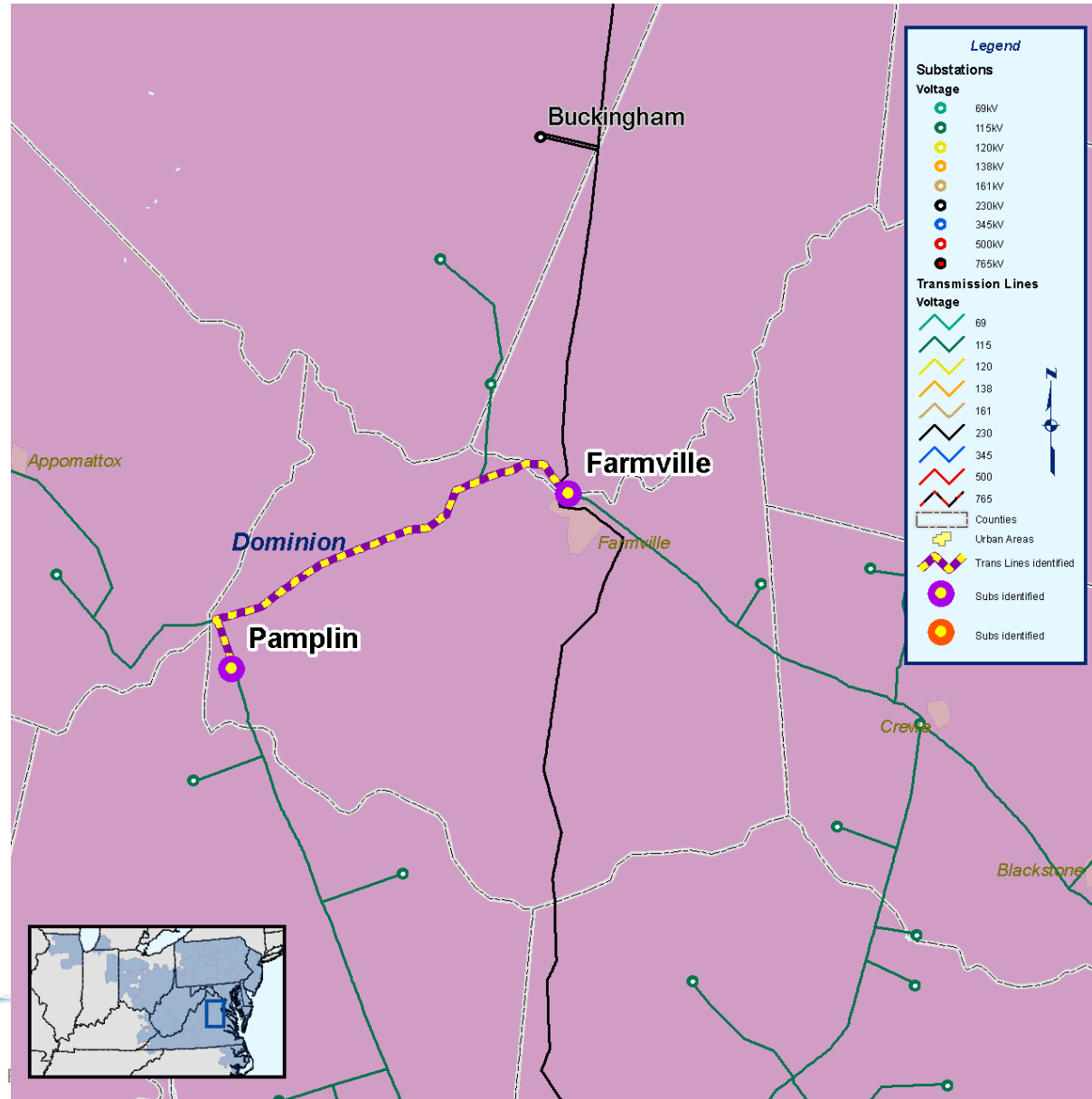
- The Farmville - Crewe line is overloaded for various line segment conditions
- Reconductor the Moran DP - Crewe 115 kV segment
- In-service: June 2011
- Est. Cost: \$5.0 M



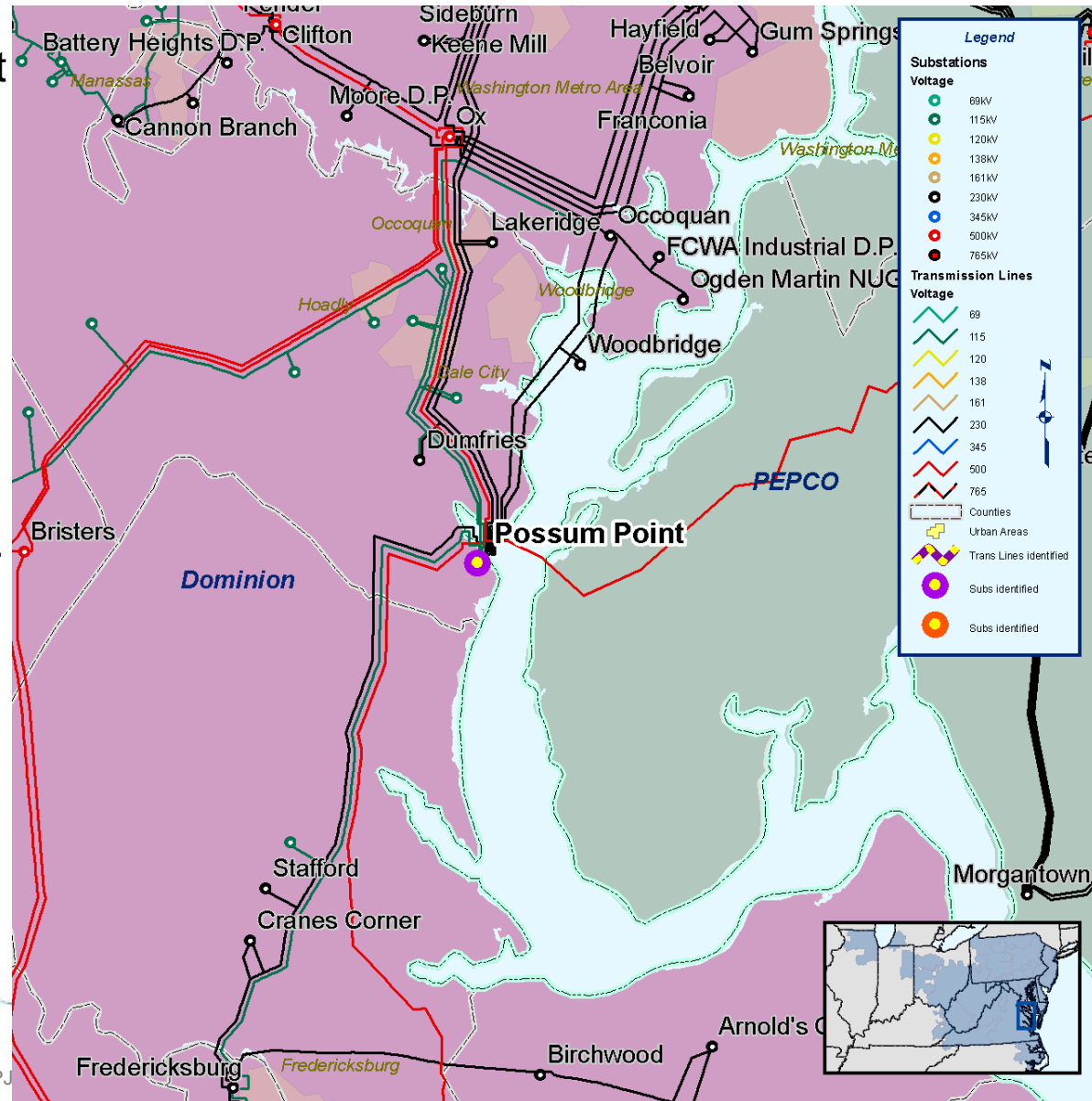
- The Chase City - Pamplin 115 kV line is overloaded when the Pamplin to Farmville line is fed from Pamplin
- Upgrade the Chase City - Twitty's Creek 115 kV segment
- In-service: June 2011
- Est. Cost: \$7.0 M



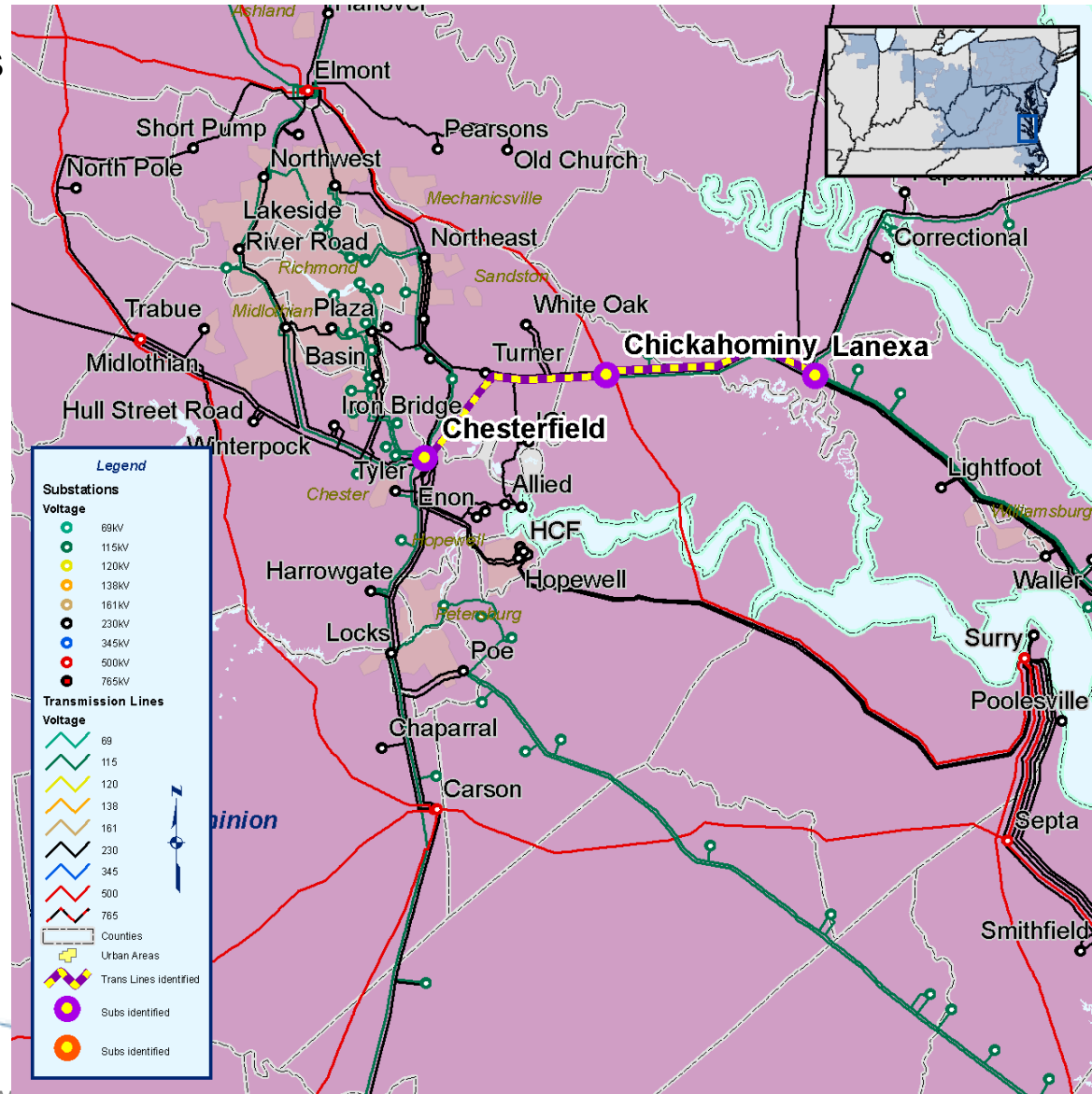
- The Chase City - Pamplin - Farmville 115 kV line overloads when the entire line is fed from the Farmville end
- Reconductor the line from Farmville – Pamplin 115 kV
- Expected service date: June 2011
- Est. Cost: \$9.0 M



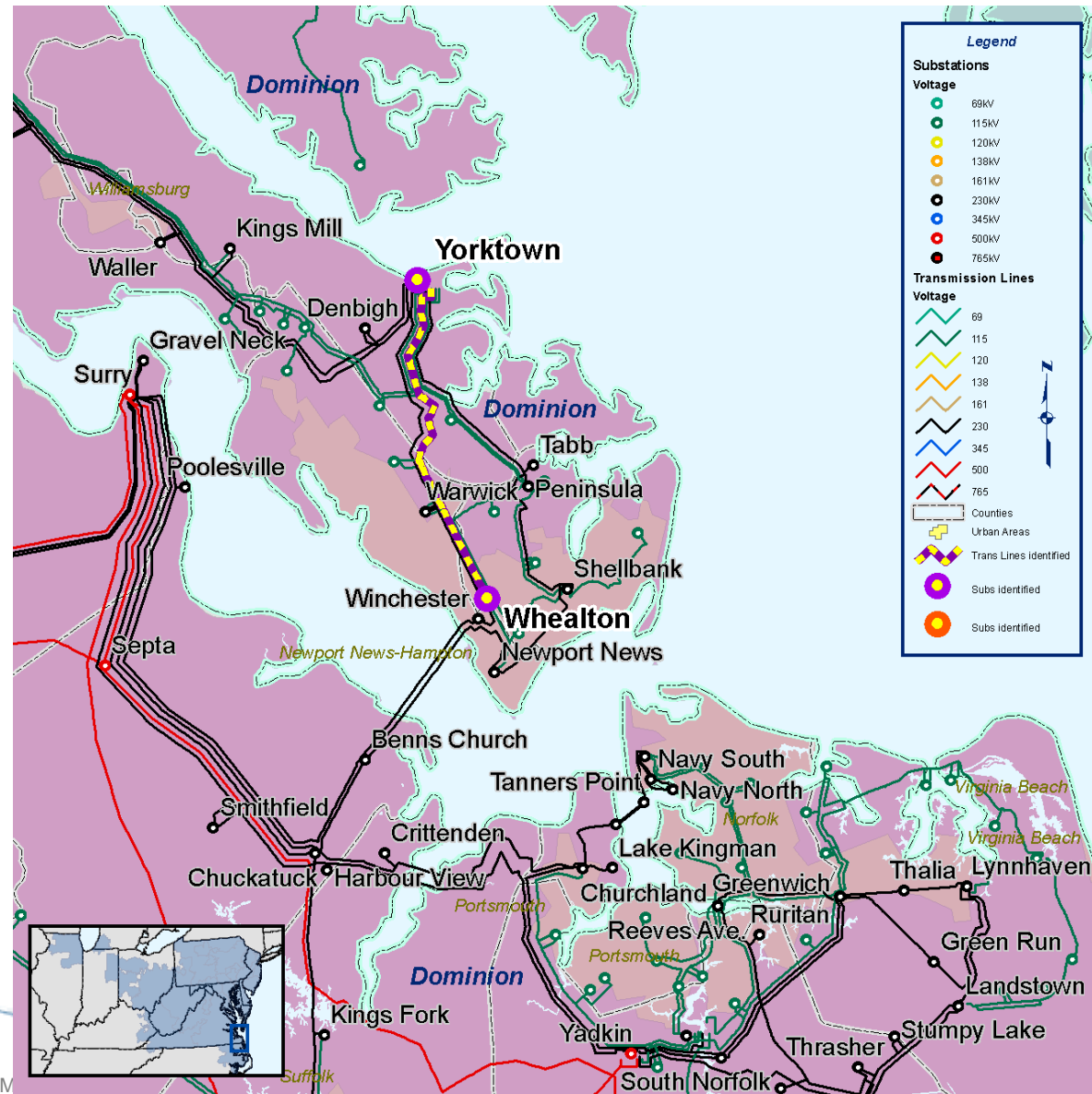
- When the Possum Point #3 Unit is out and the outage of the Fredricksburg 230-115 kV Tx or the outage of the Fredricksburg to Possum Pt 115 kV line occurs the Possum Point 230-115 kV Tx overloads.
- Solution: Install 2nd 230-115 kV TX at Possum Point
- Expected service date: May 2009
- Est. Cost: \$3.5 M



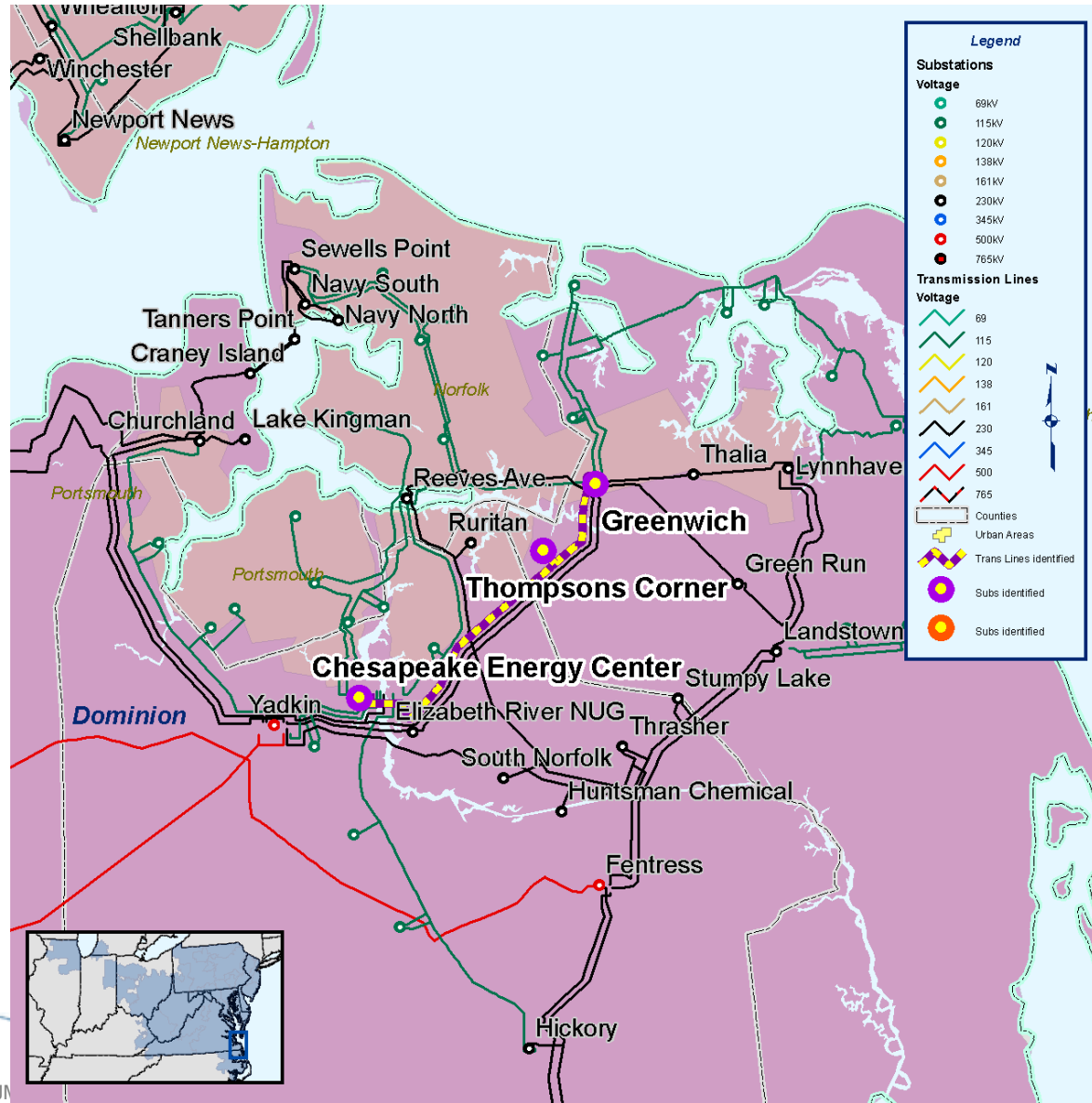
- Lanexa to Chesterfield is overloaded for the loss of Chickahominy to Lanexa
- Chickahominy to Lanexa is overloaded for the loss of Birchwood to Northern Neck
- Solution: Build new Elko station and transfer load from Turner and Providence Forge stations
- Expected service date: May 2009
- Est. Cost: \$2.2 M



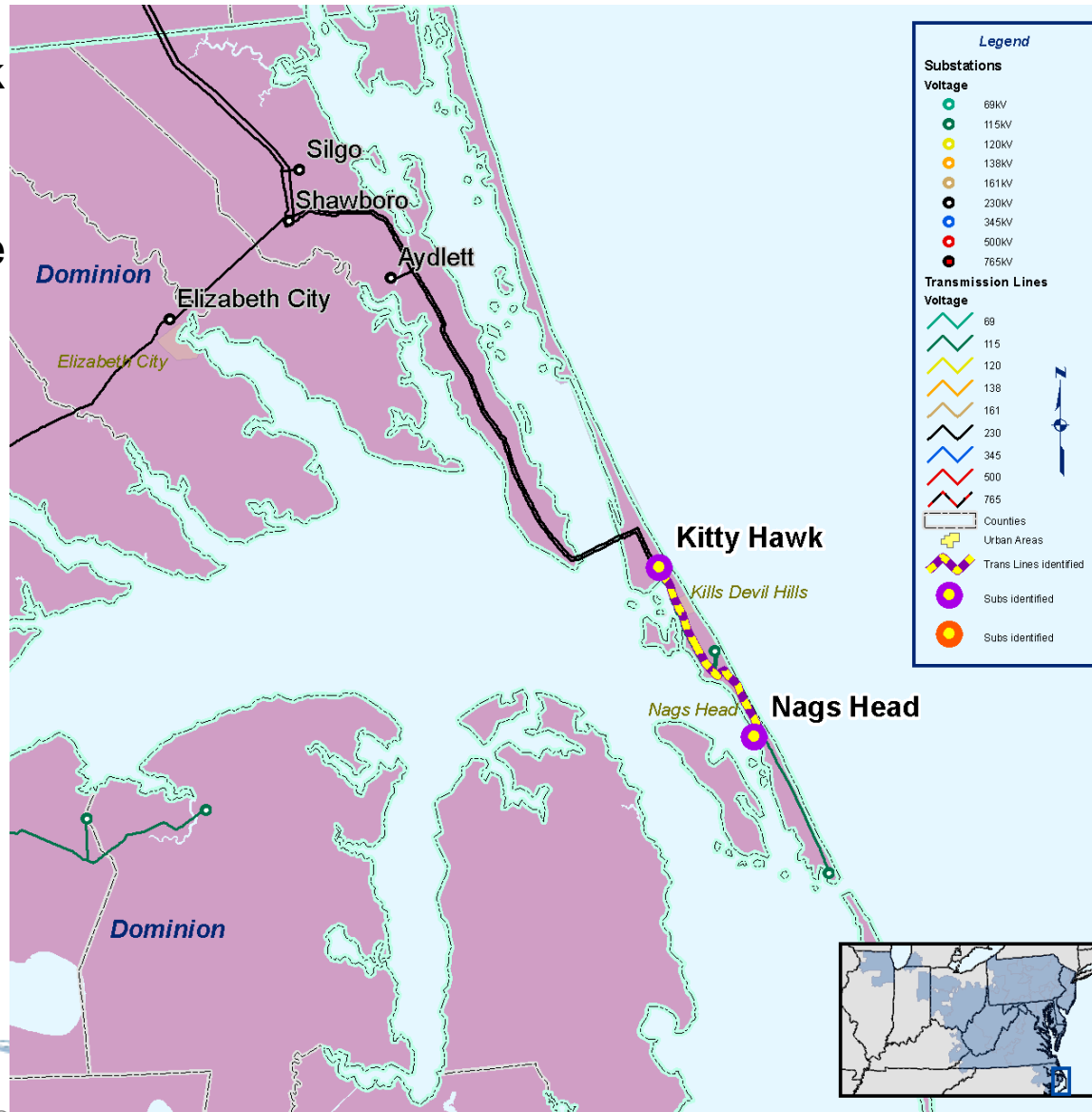
- The Yorktown to Whealton 115 kV line overloads for an outage of the remote end of the line
- Solution: Rebuild 17.5 miles of the line for a new summer rating of 262 MVA
- Expected service date: May 2009
- Est. Cost: \$18.0 M



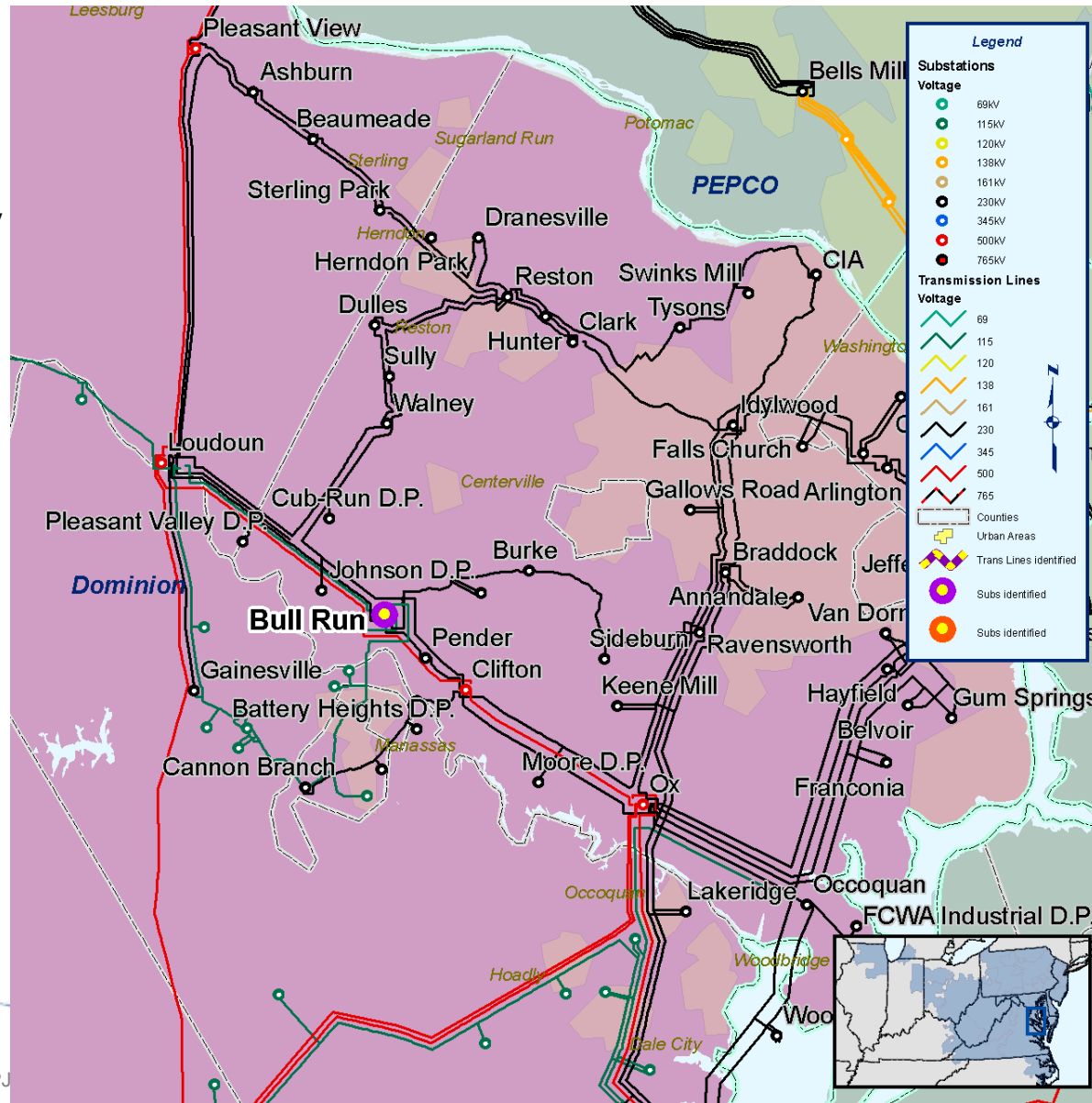
- For an outage of the Chesapeake Energy Center end of the Greenwich – Chesapeake Energy Center 115 kV line, the Greenwich end of the line overloads
- Solution: Increase the rating on 2.56 miles of the line between Greenwich and Thompsons Corner 115 kV
- Expected service Date: May 2009
- Est. Cost: \$4.0 M



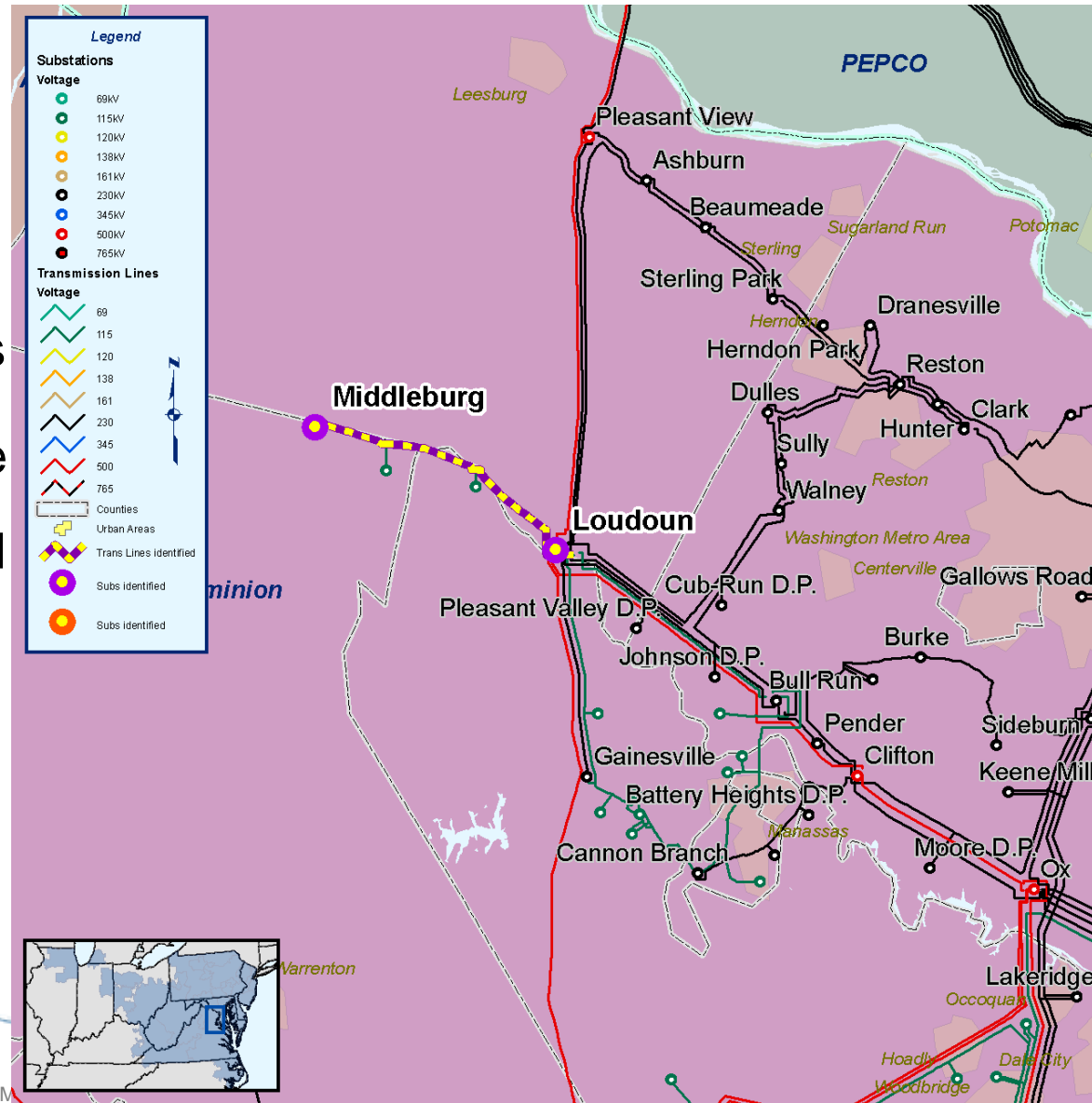
- The loading on Kitty Hawk to Nag's Head exceed 100 MW
- Solution: Build 115 kV line from Kitty Hawk to Colington 115 kV.
 - Colington on the existing line and Nag's Head and Light House DP on new line.
- Service Date: May 2009



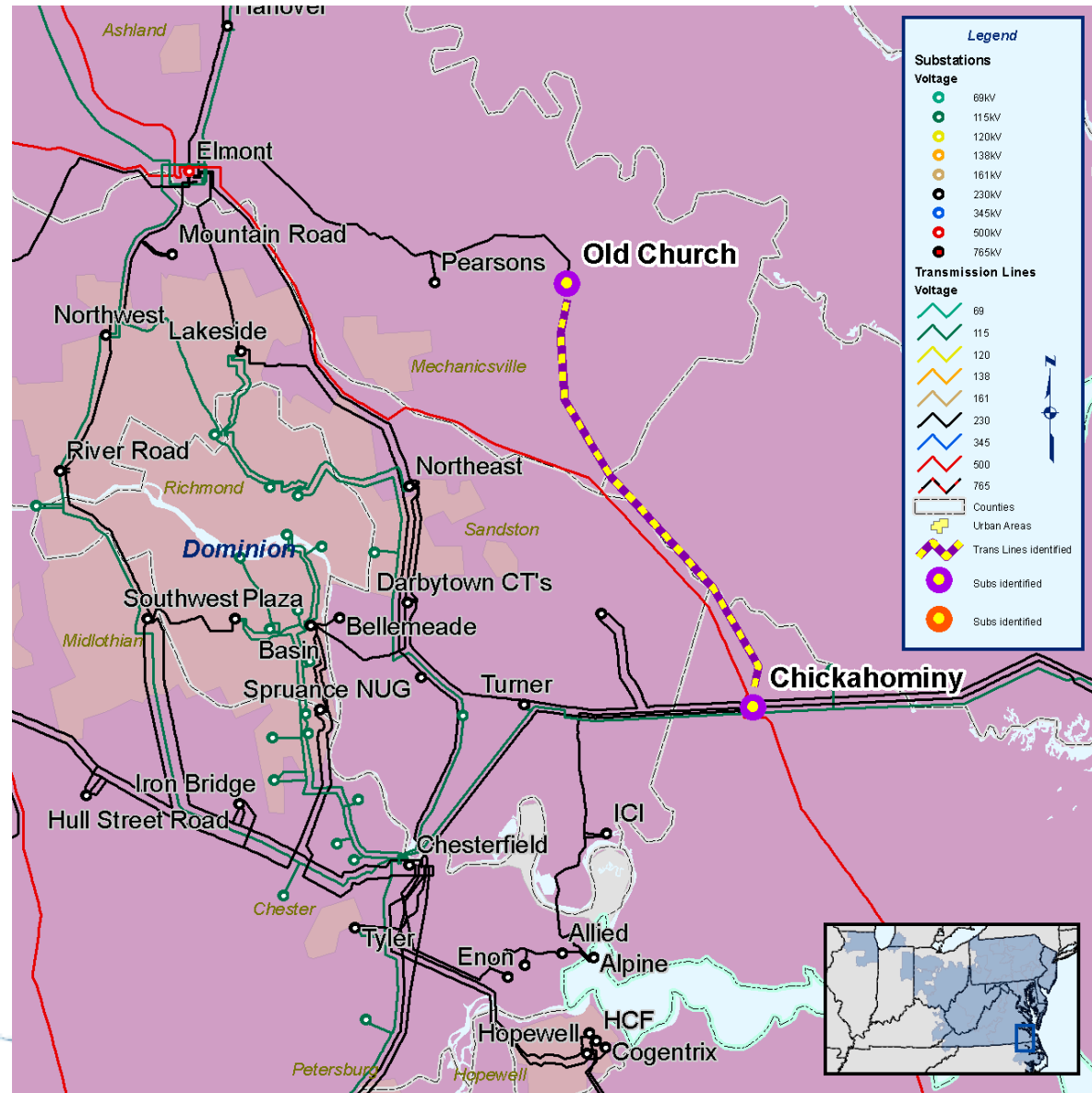
- For N-2 events involving the loss of any combination of Bull Run #3 230-115 kV, Loudoun #3 230-115 kV or Loudoun #4 230-115 kV, the remaining autotransformer exceeds it's emergency rating
- Solution: Add a second Bull Run 230-115 kV autotransformer
- Expected service date: May 2009
- Est. Cost: \$3.0 M



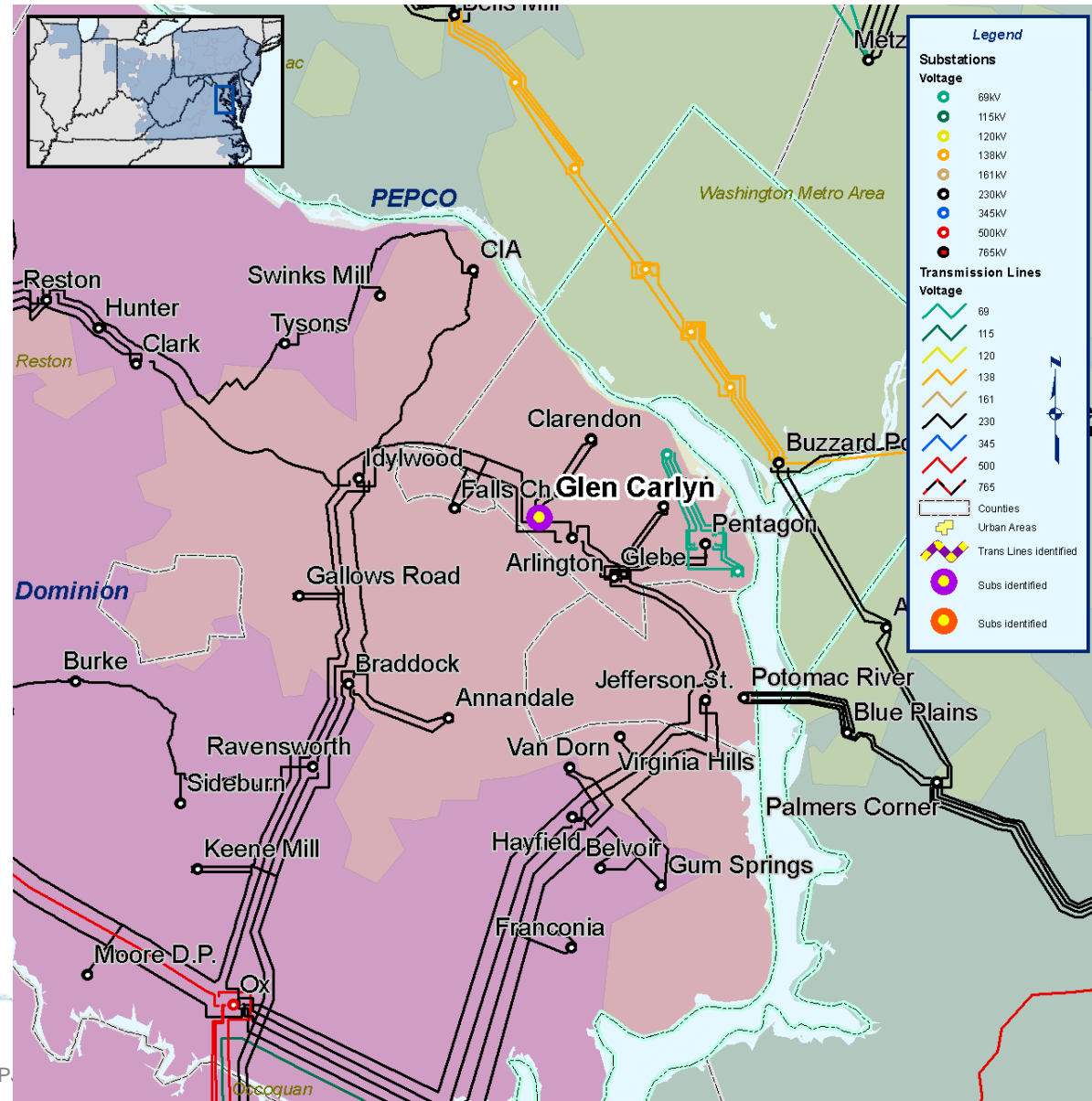
- A section of the radial Loudoun to Middleburg 115 kV line is expected to be overloaded due to increased load at various delivery points on the line
- Solution: Increase the rating of the line between Loudoun and Cedar Grove 115 kV to a minimum of 150 MVA
- Expected service date: May 2009
- Est. Cost: \$0.2 M



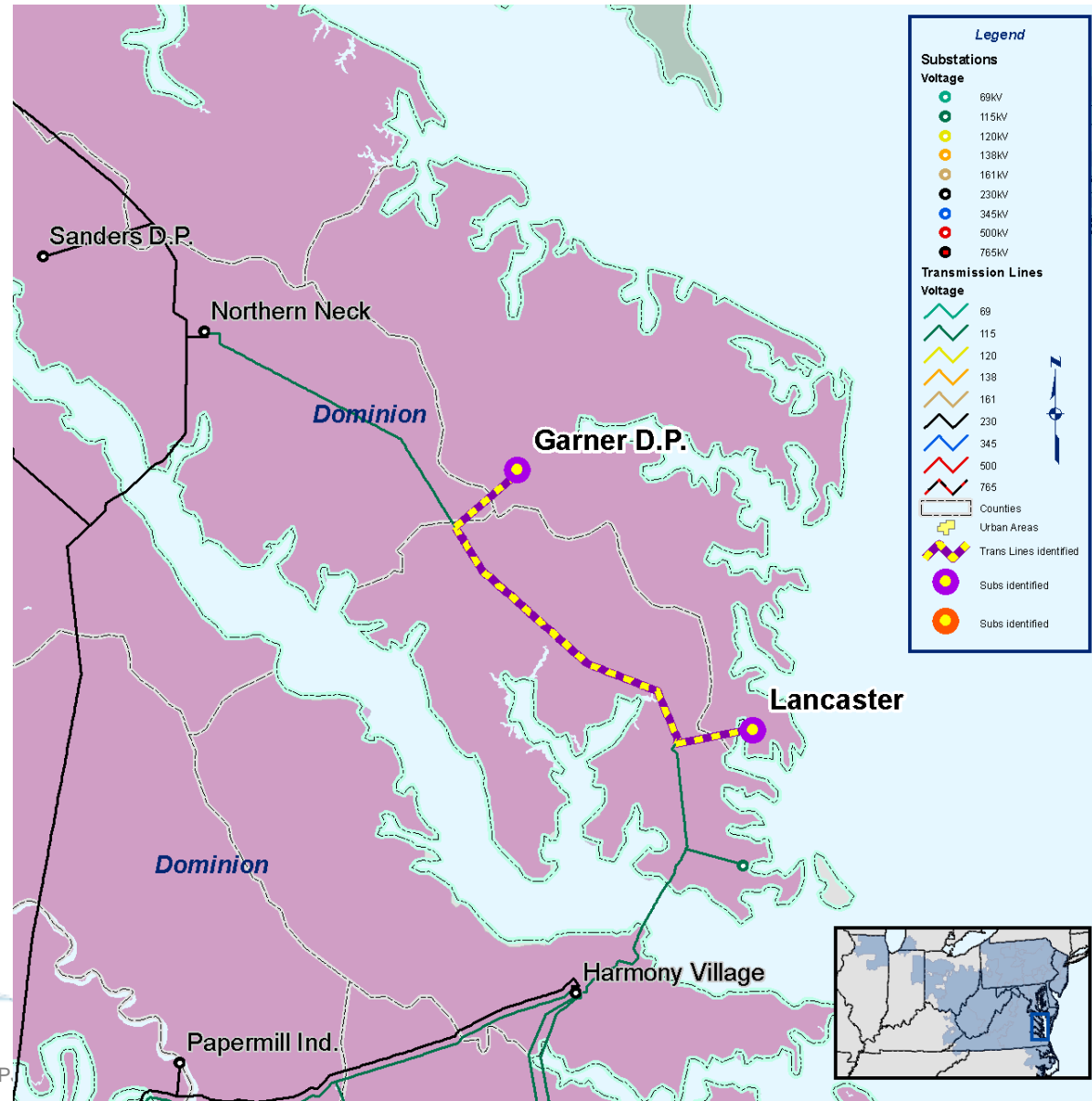
- Line loading at Pearsons and Old Church Subs. exceeds 100 MVA
- Solution: Extend the line from Old Church to Chickahominy 230 kV
- Expected Service Date: November 2009
- Est. Cost \$17.0 M



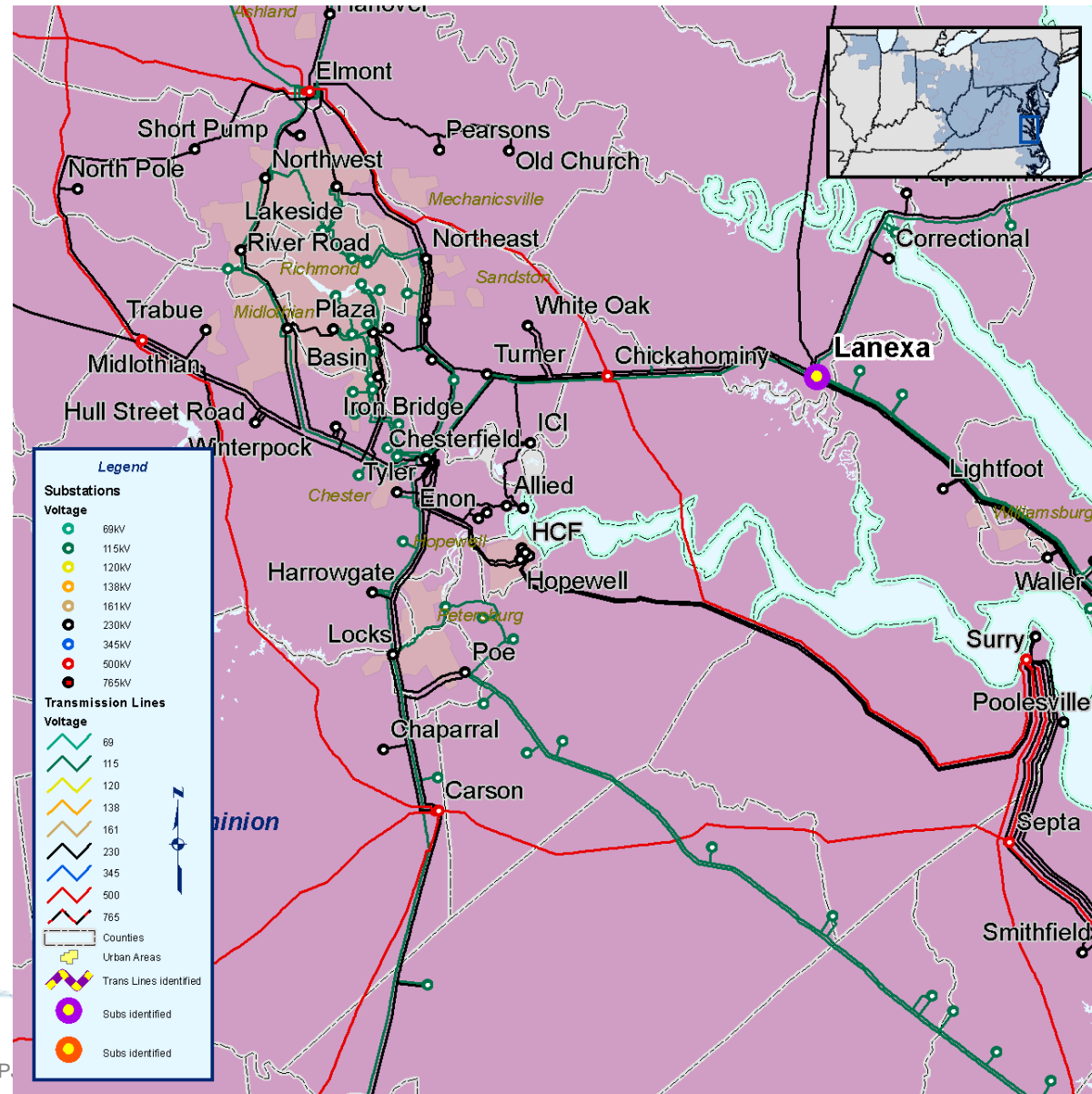
- For the loss of line #266 and line #273 into Glen Carlyn, Tx. #1 and #3 along with line #277 and line #278 will be out of service.
- Solution: Loop line #251 Idylwood to Arlington into the GIS sub.
- Service Date: May 2010
- Est. Cost: \$25.0 M



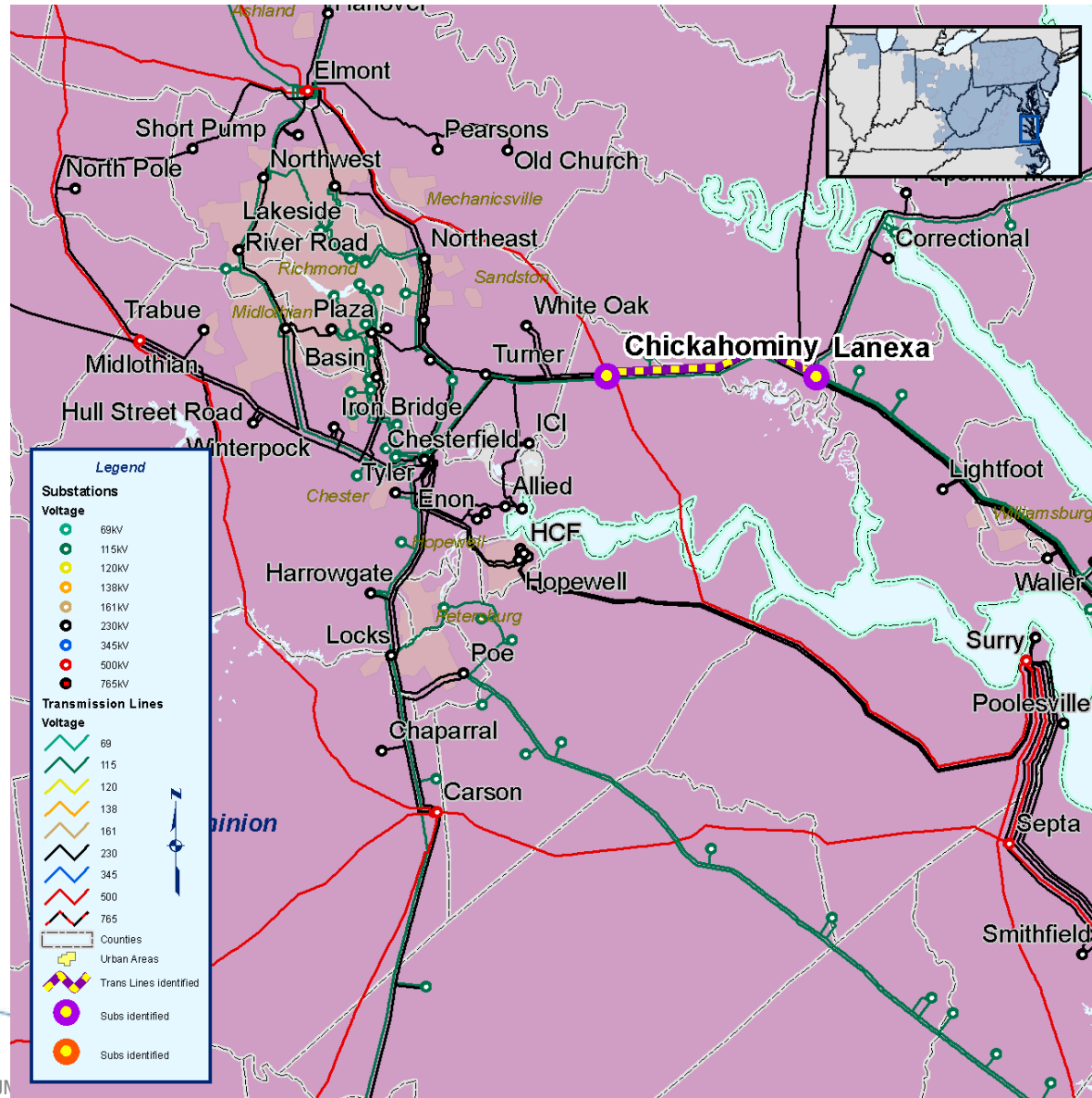
- The Garner to Lancaster portion of Northern Neck to Harmony Village 115 kV line overloads for the loss of Lanexa to Harmony Village 230 kV
- Solution: Re-tension 15 miles of the line for a new summer rating of 216 MVA
- Expected service date: May 2010
- Est. Cost: \$5.5 M



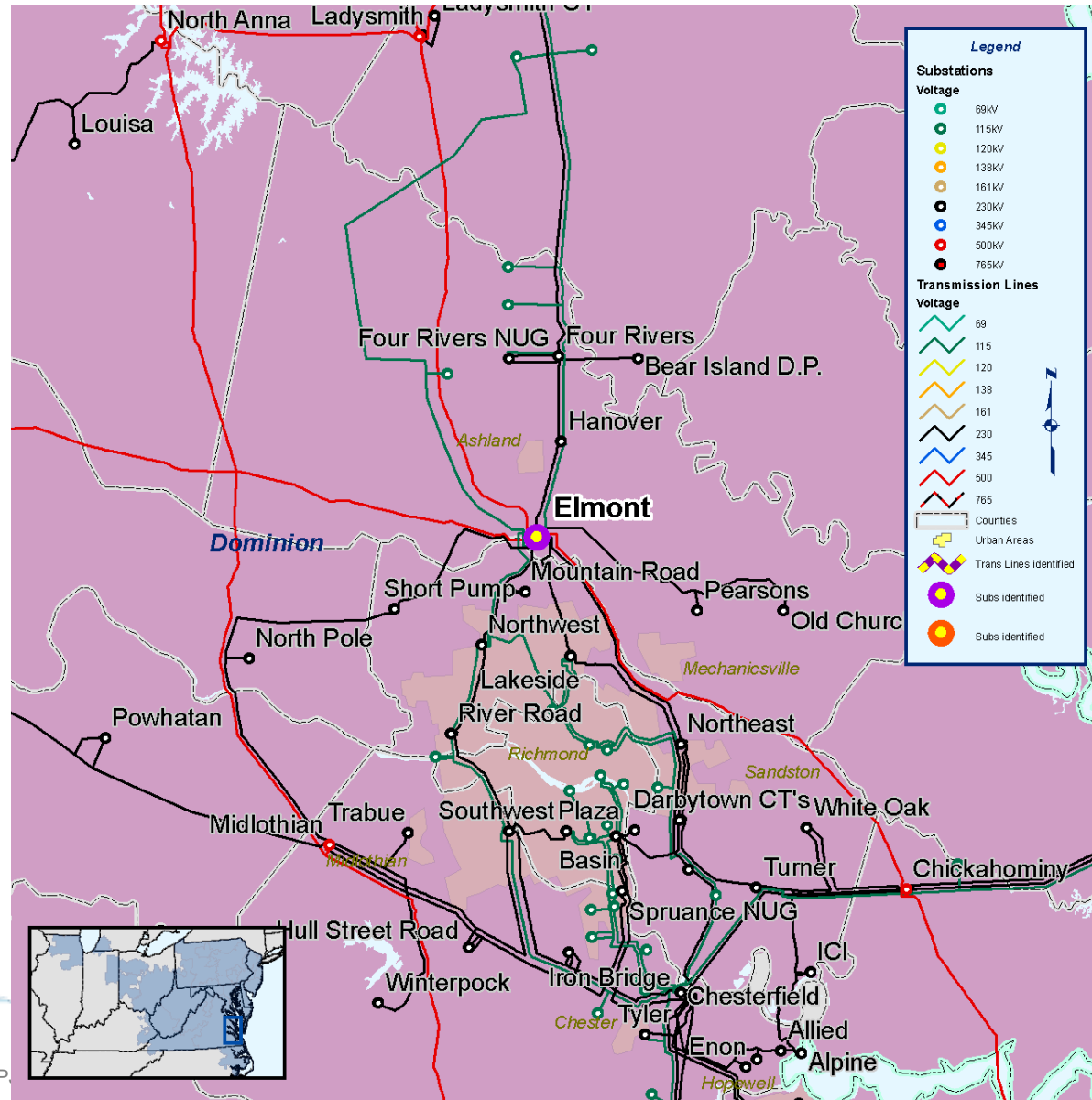
- Loss of the Lanexa to Correctional segment of Lanexa to Harmony Village overloads the Lanexa 230-115 kV autotransformer
- Solution: Add a second 230-115 kV autotransformer at Lanexa
- Expected service date: May 2010
- Est. Cost: \$3.2 M



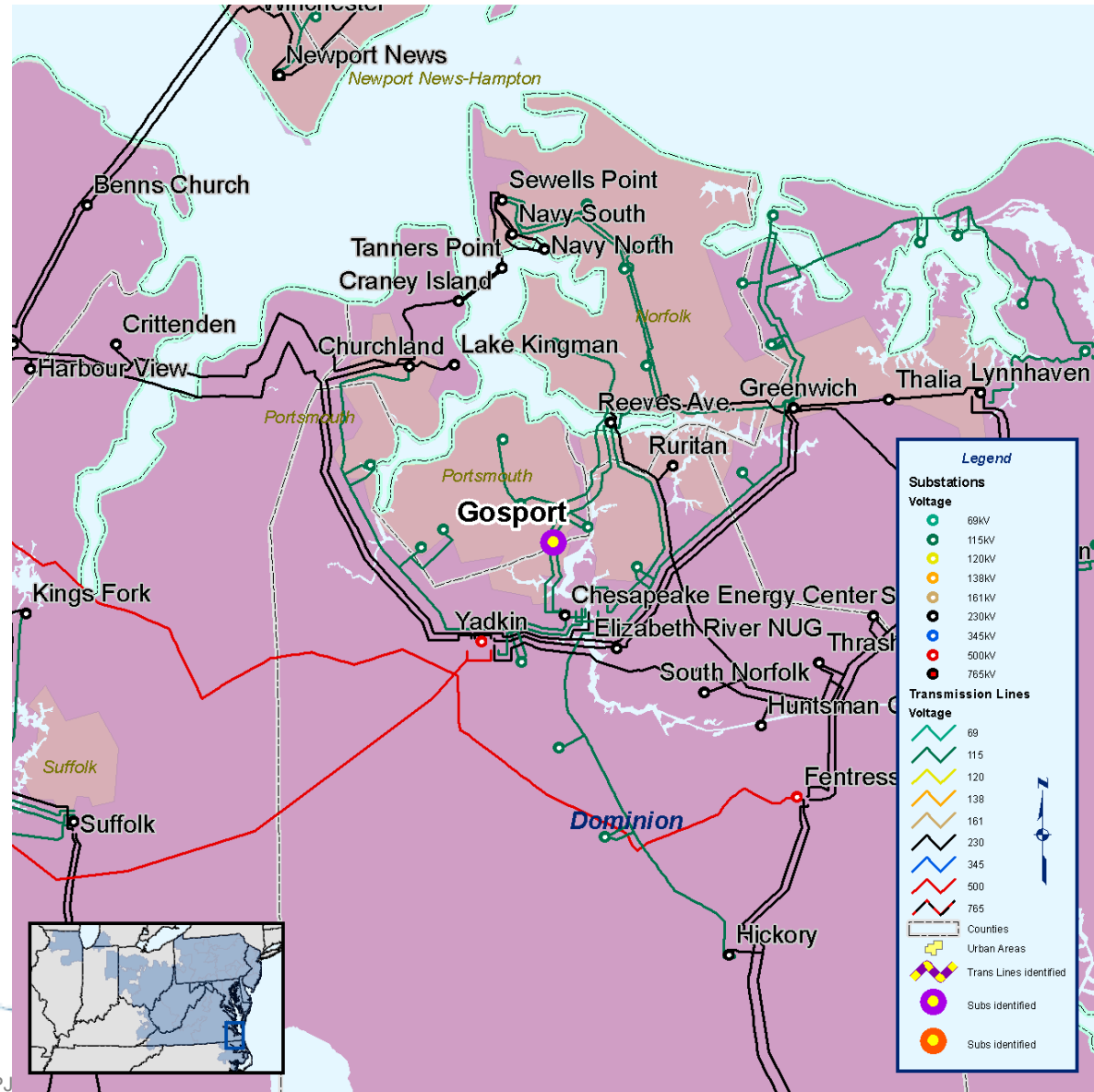
- In 2010 James River crossing is overloaded for the loss of Chickahominy to Yortown or the loss of Lanexa to Chickahominy
- In 2012 a portion of the Chesterfield to Lanexa line between Chesterfield and Turner overloads for the loss of Chickahominy to Lanexa
- Chickahominy to Lanexa overloads for the loss of Birchwood to Northern Neck
- Chickahominy to Lanexa overloads for the loss of Chickahominy to Harmony Village
- Solution: Build a parallel Chickahominy to Lanexa 230 kV line
- In-service date: May 2010
- Est. Cost: \$3.5 M



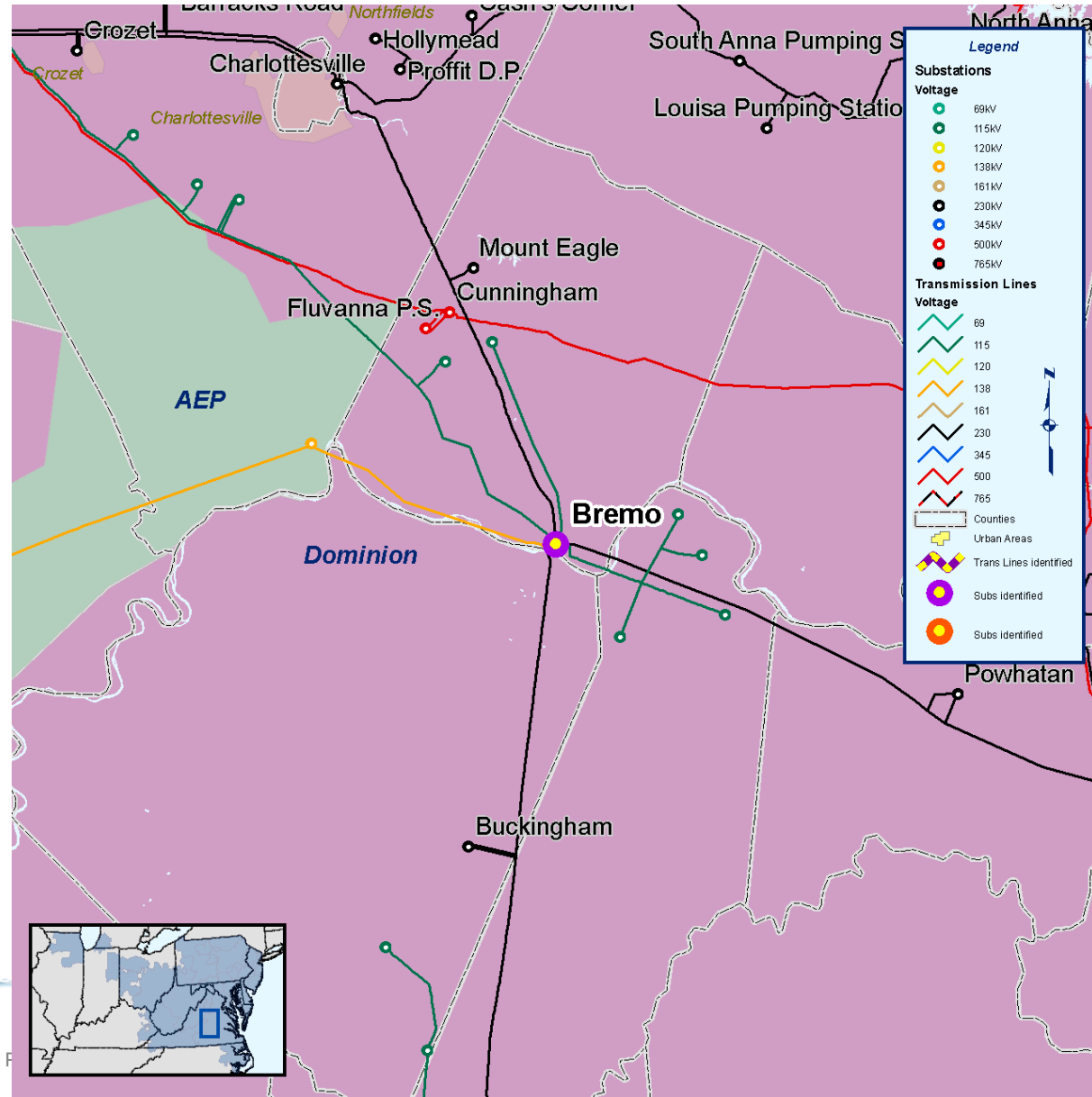
- The Northwest 230-115 kV autotransformer overloads for the loss of Elmont to Northwest 230 kV line
- Solution: Install a second Elmont 230-115 kV autotransformer
- In-service date: May 2010
- Est. Cost: \$4.5 M



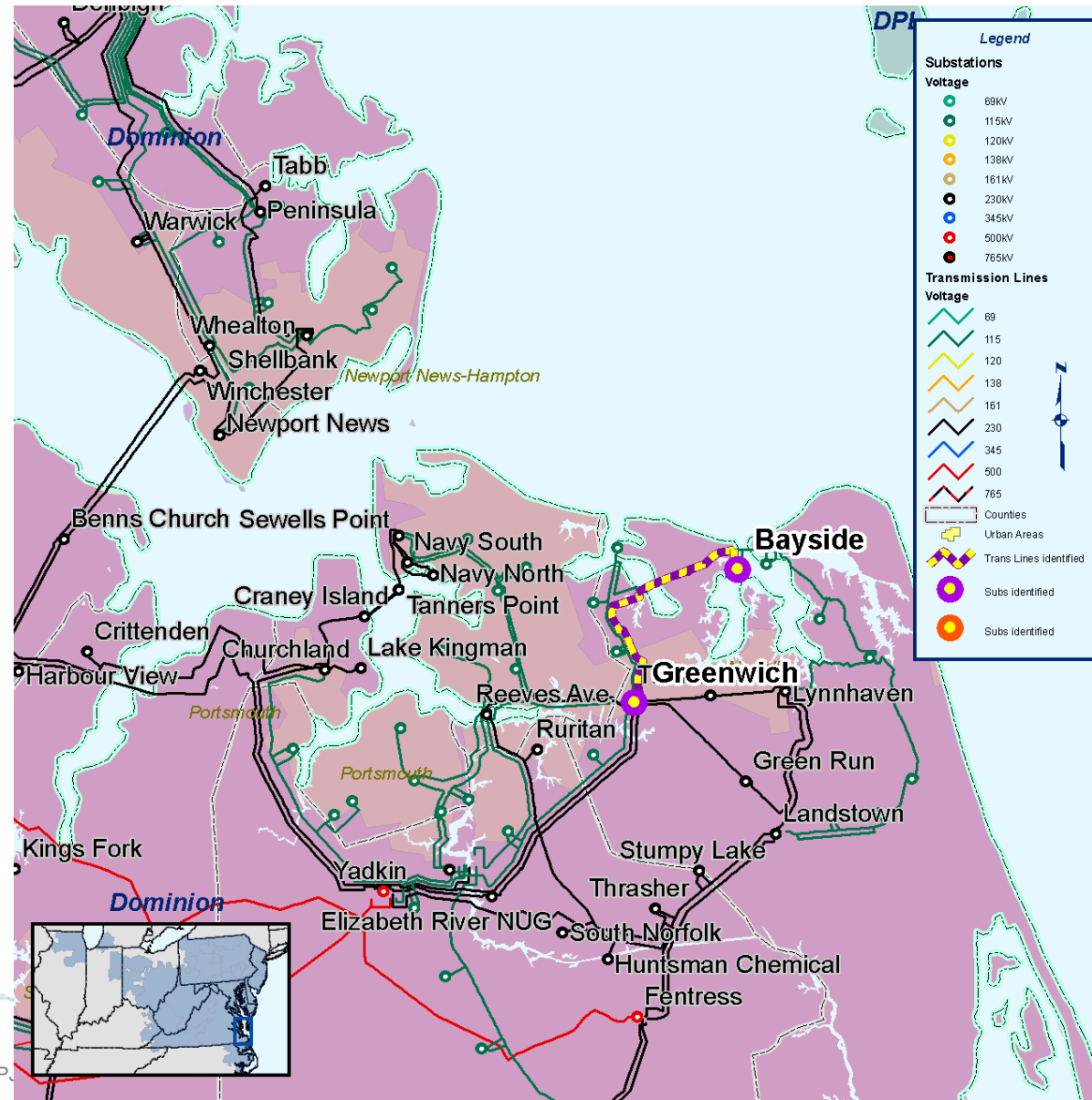
- Stability concerns exist at Gosport 115 kV for double line to ground faults.
- Solution: Install dual primary protection schemes on lines #62 and #51 at remote terminals
- Expected service date: May 2010
- Est. Cost: \$0.46 M



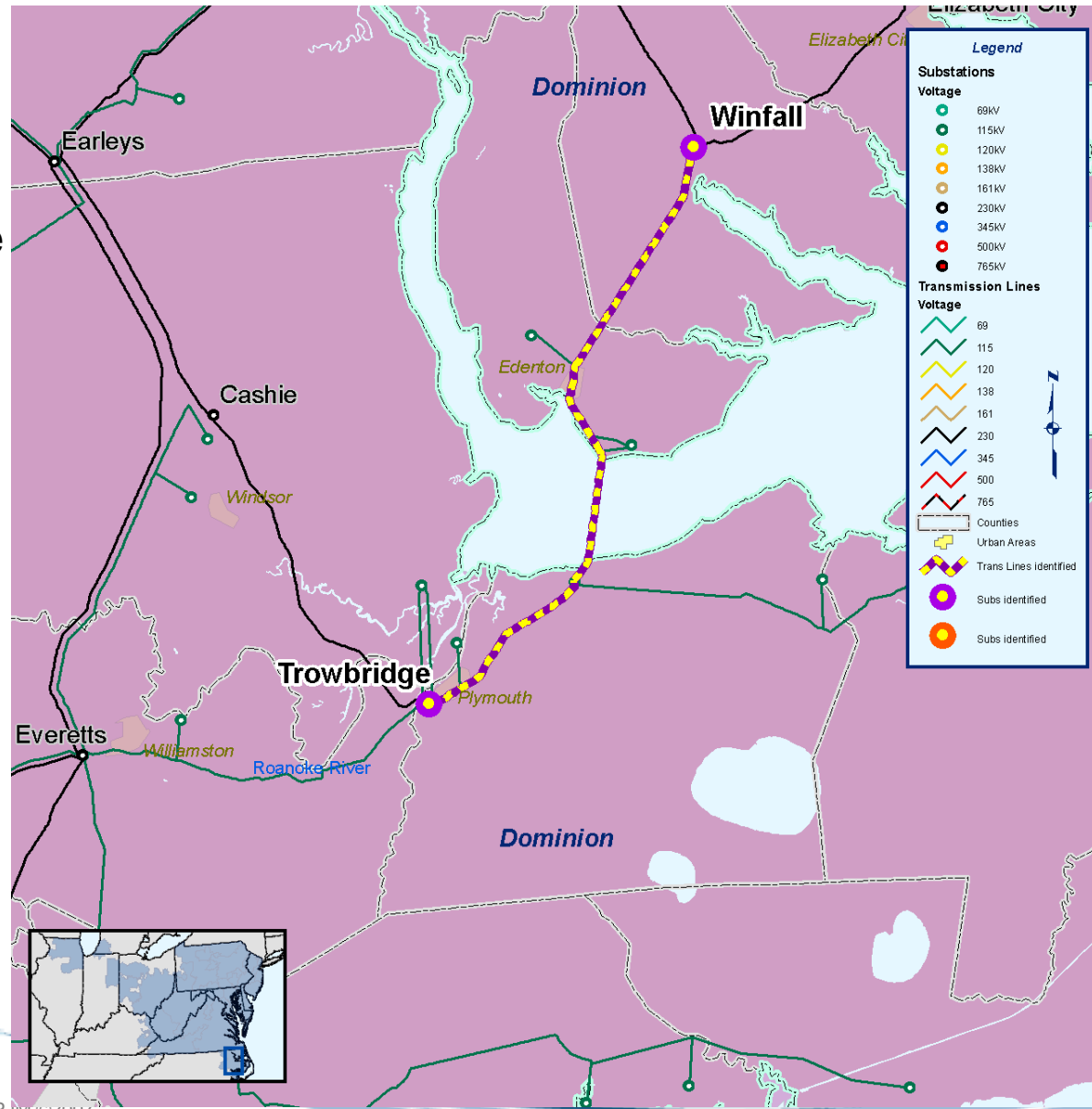
- Loss of the Bremo 230-115 kV autotransformer is causing low voltage on the 115 kV system at Bremo
- Solution: Install a 33 MVAR capacitor on the Bremo 115 kV
- In-service: May 2011
- Est. Cost: \$0.5 M



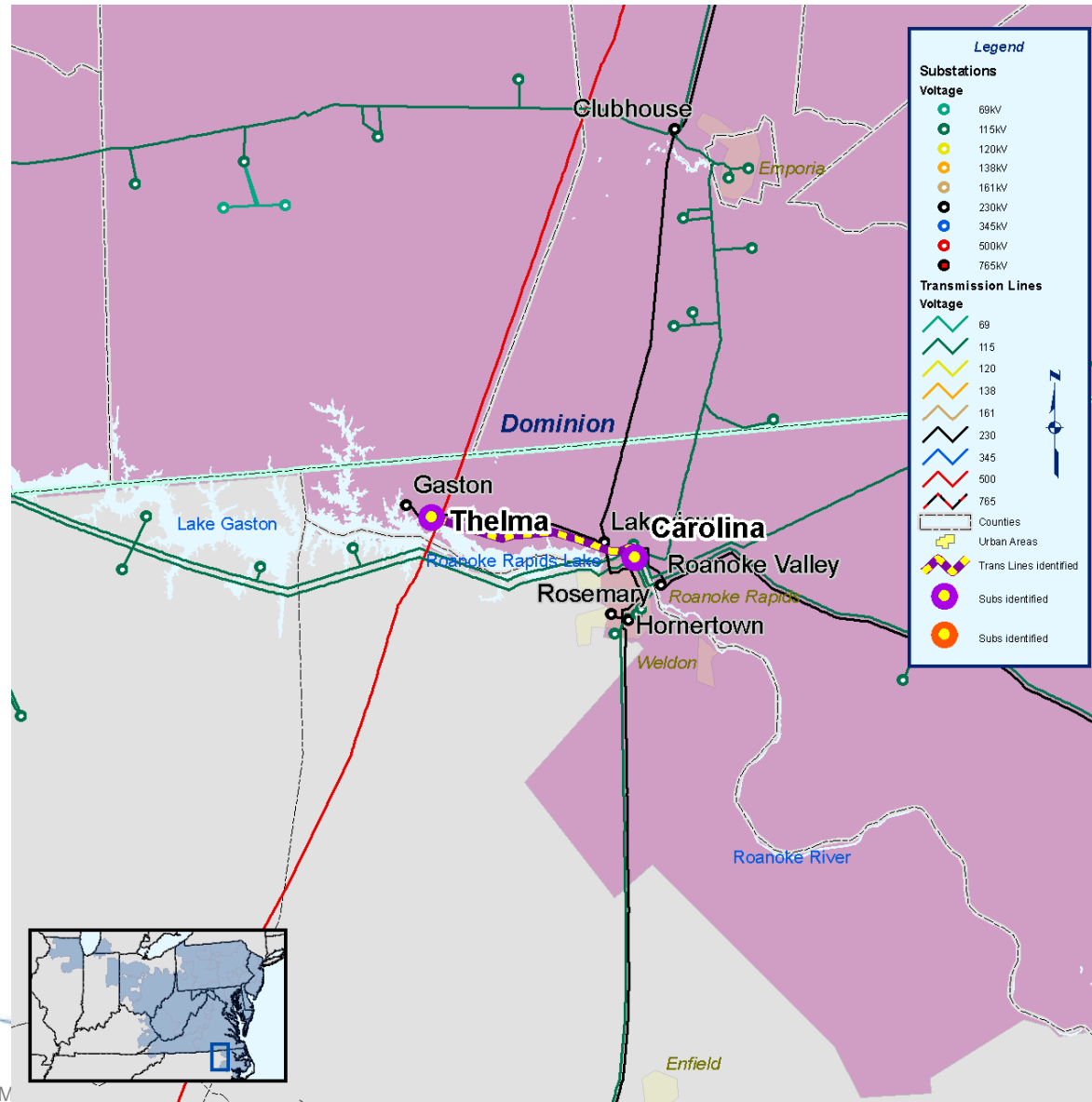
- The Bayside to Greenwich - Virginia Beach 115 kV overloads for the loss of Greenwich - Amphibious Base 115 kV
- The Greenwich to Davis Corner portion of Greenwich - Amphibious Base 115 kV overloads for the loss of Greenwich to Virginia Beach 115 kV
- Solution: Reconductor Greenwich to Virginia Beach 115 kV to bring it up to a summer rating of 261 MVA. Reconductor the Greenwich to Amphibious Base 115 kV line to bring it up to 291 MVA
- In-service: May 2011
- Est. Cost: \$2.1 M



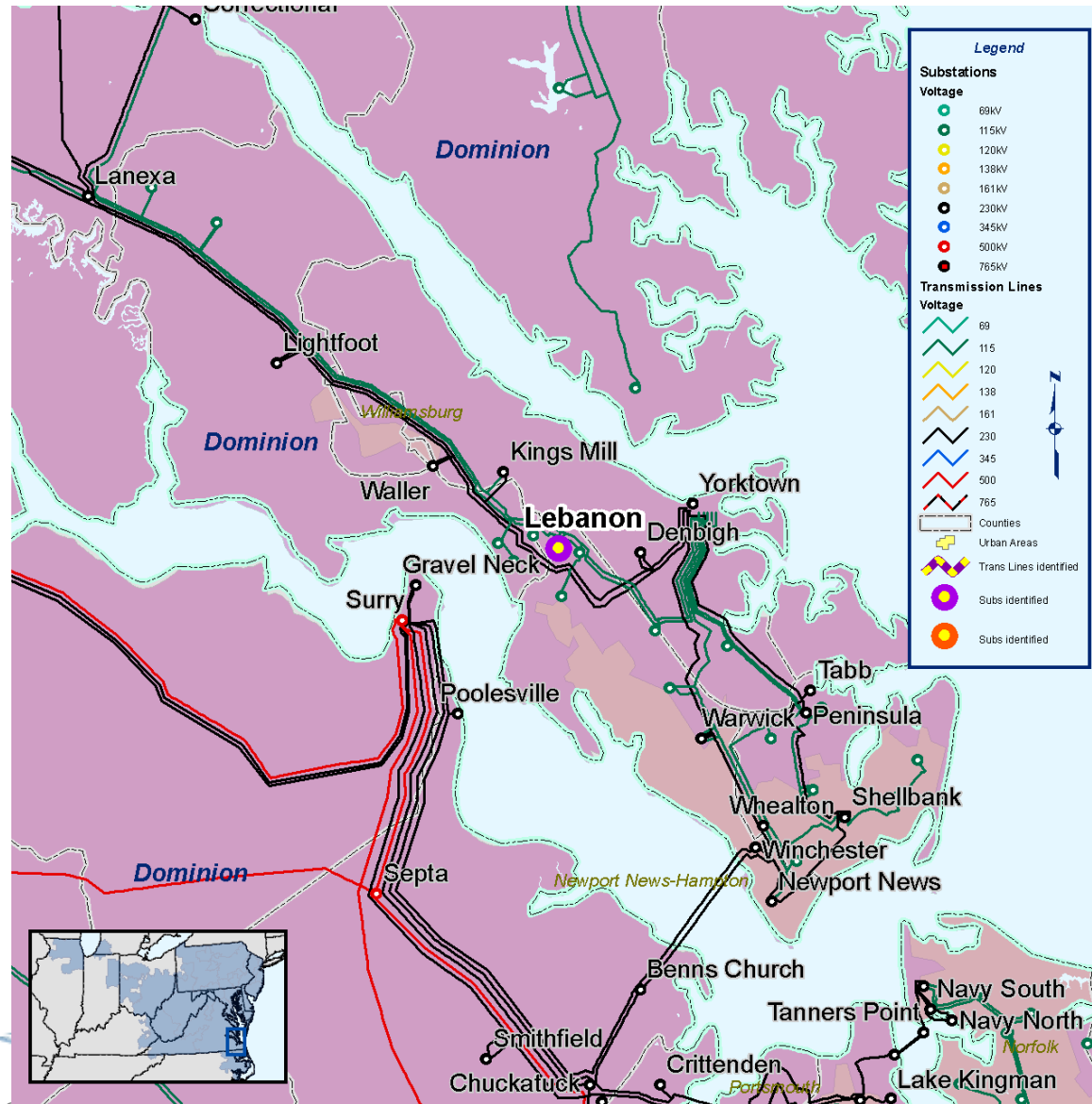
- The Trowbridge to Winfall 115 kV overloads for the outage of the Elizabeth City to Shawboro 230 kV and the Suffolk to Winfall 230 kV.
- Solution: Re-build Trowbridge to Winfall 115 kV
- Expected in-service date: June 2011
- Est. Cost: \$16.4 M



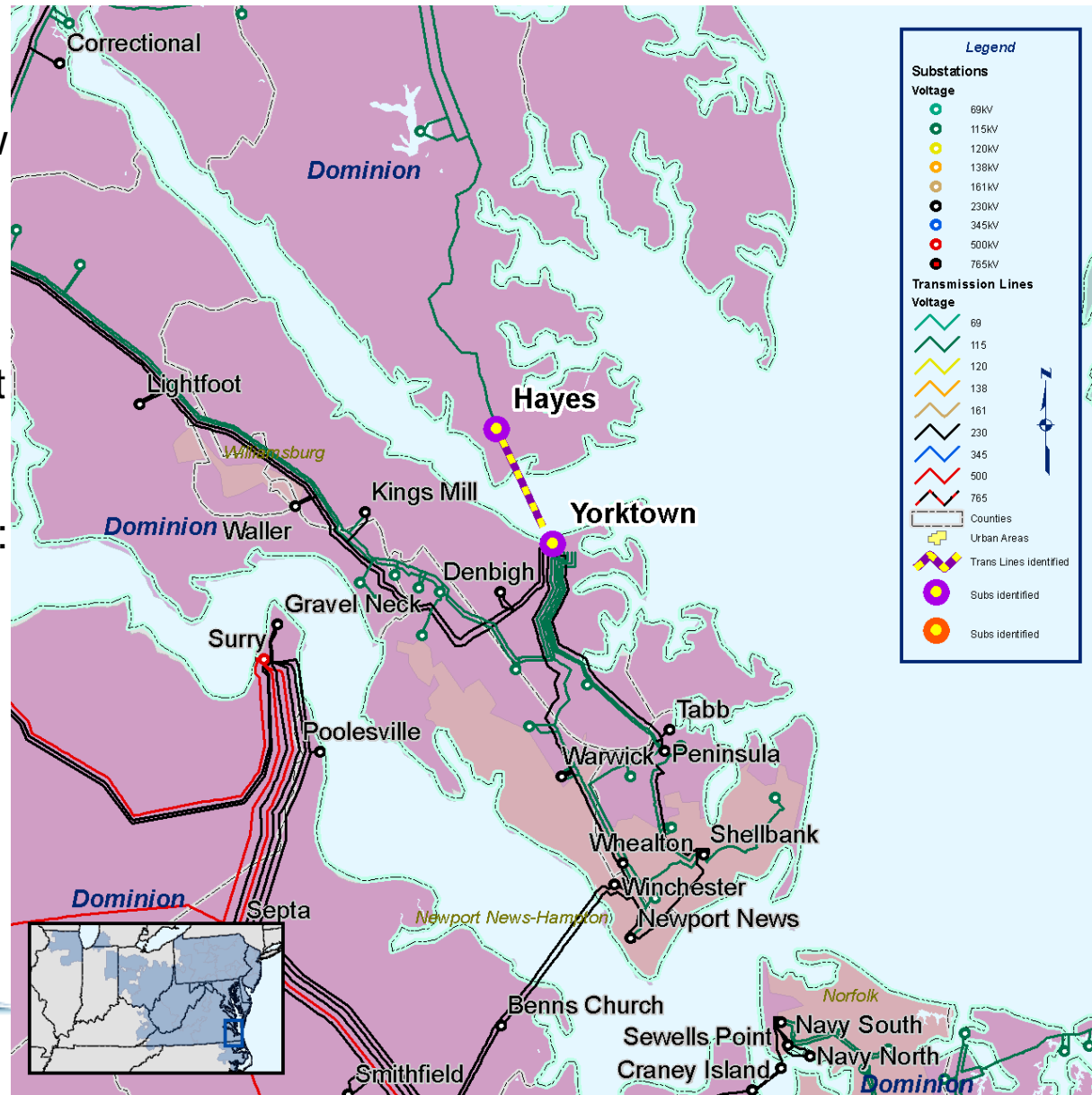
- The Carolina 230-115 kV autotransformer overloads for the loss of Earleys – Roanoke Valley and Carolina – Thelma.
- The Carolina – Thelma line overloads for the loss of Earleys – Roanoke Valley and the Carolina 230-115 kV autotransformer.
- Solution: Terminate the Thelma to Carolina 230 kV circuit into Lakeview 230 kV.
- Expected service date: June 2011
- Est. Cost: \$4.0 M



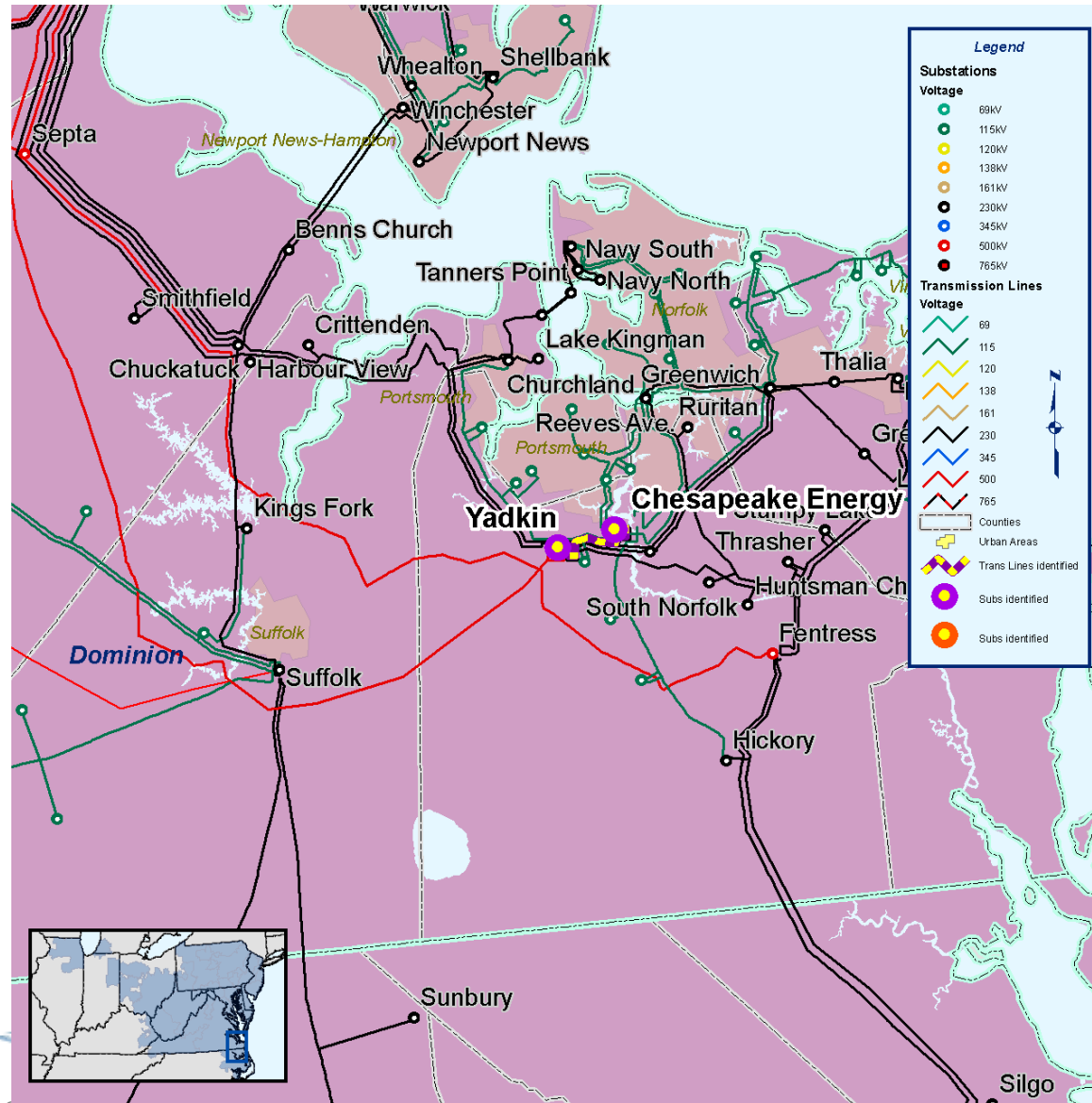
- Loss of the Yorktown to Lanexa 115 kV line results in low voltage at Grafton and Lebanon
- Solution: Install 29.7 MVAR capacitor at Lebanon
- Expected service date: May 2012
- Est. Cost: \$0.5 M



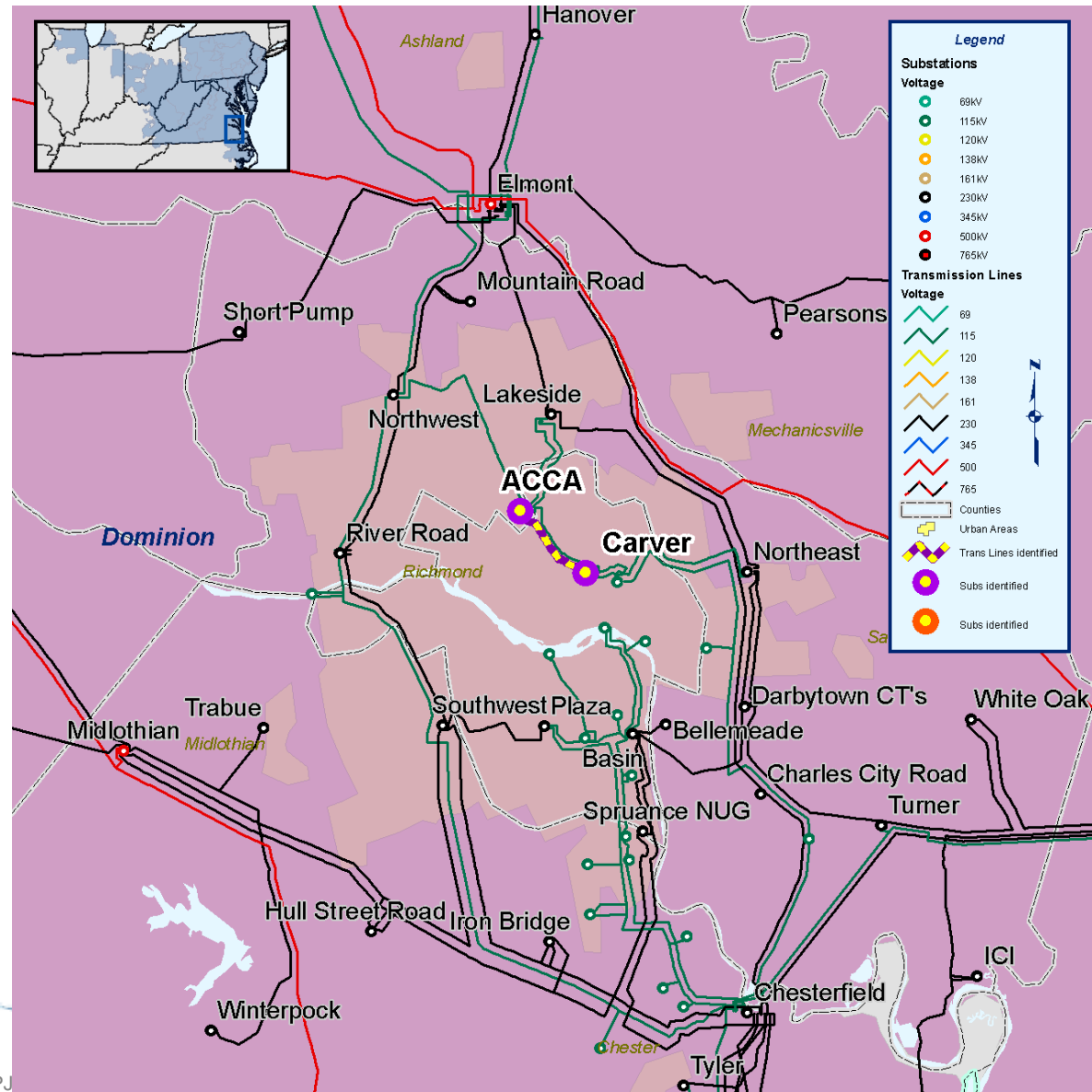
- Loss of Lanexa to Harmony results in low voltage on underlying 115 kV
- Solution: Build a new 230 kV line from Yorktown to Hayes but operate at 115 kV initially
- Expected service date: May 2012
- Est. Cost: \$25.0 M



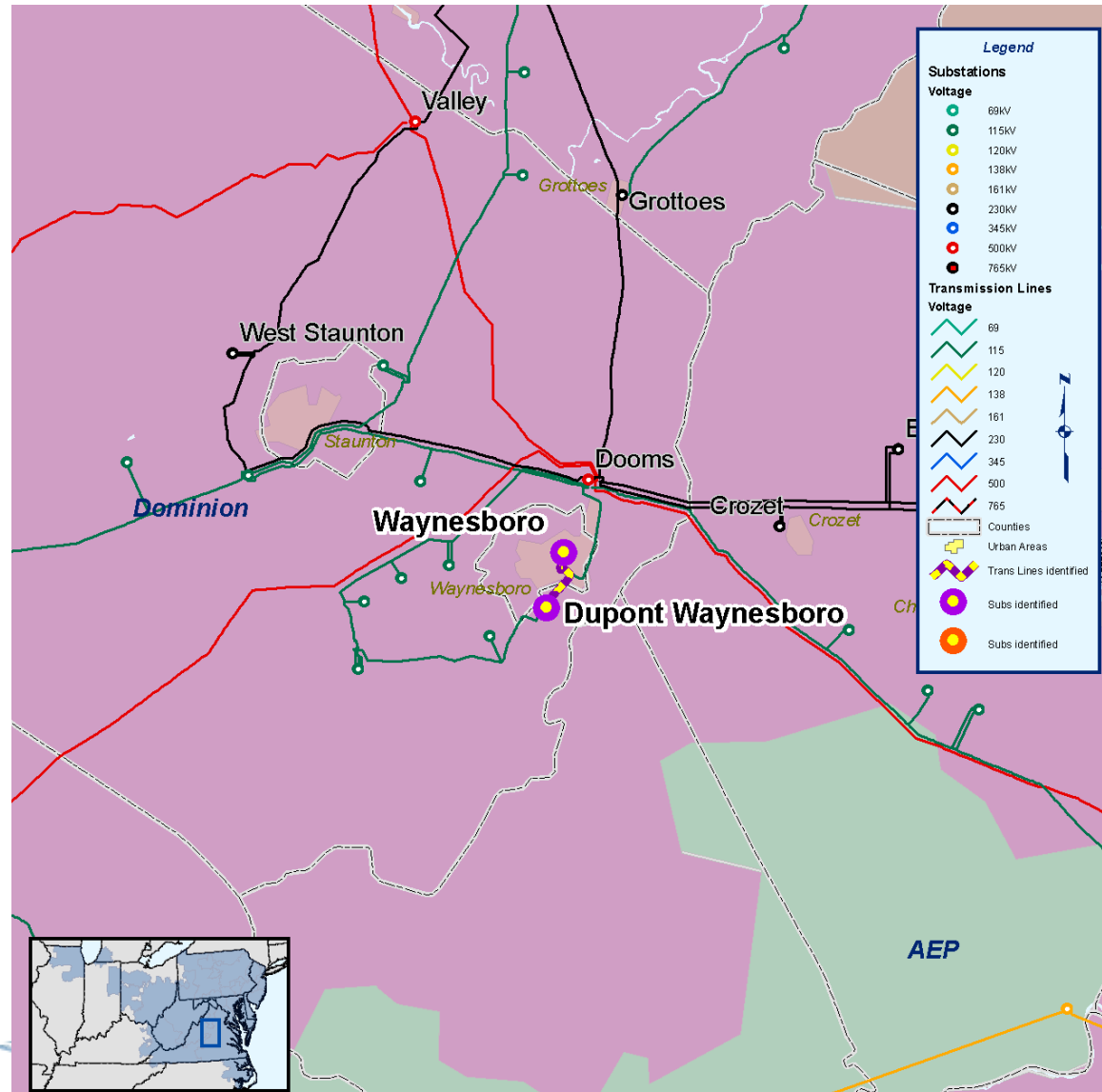
- Chesapeake to Yadkin 115 kV is overloaded for the loss of Chesapeake to Yadkin 230 kV with reduced generation at Chesapeake #4 off (221MW)
- Solution: Reconductor Chesapeake to Yadkin 115 kV line
- Expected service date: May 2012
- Est. Cost: \$2.0 M



- Chesterfield to Shockoe 115 kV is overloaded for the loss of ACCA to Carver and visa-versa
- Solution: Reconductor and replace terminal equipment on line 17 and replace the wave trap on line 88
- Expected service date: May 2012
- Est. Cost: \$0.3 M



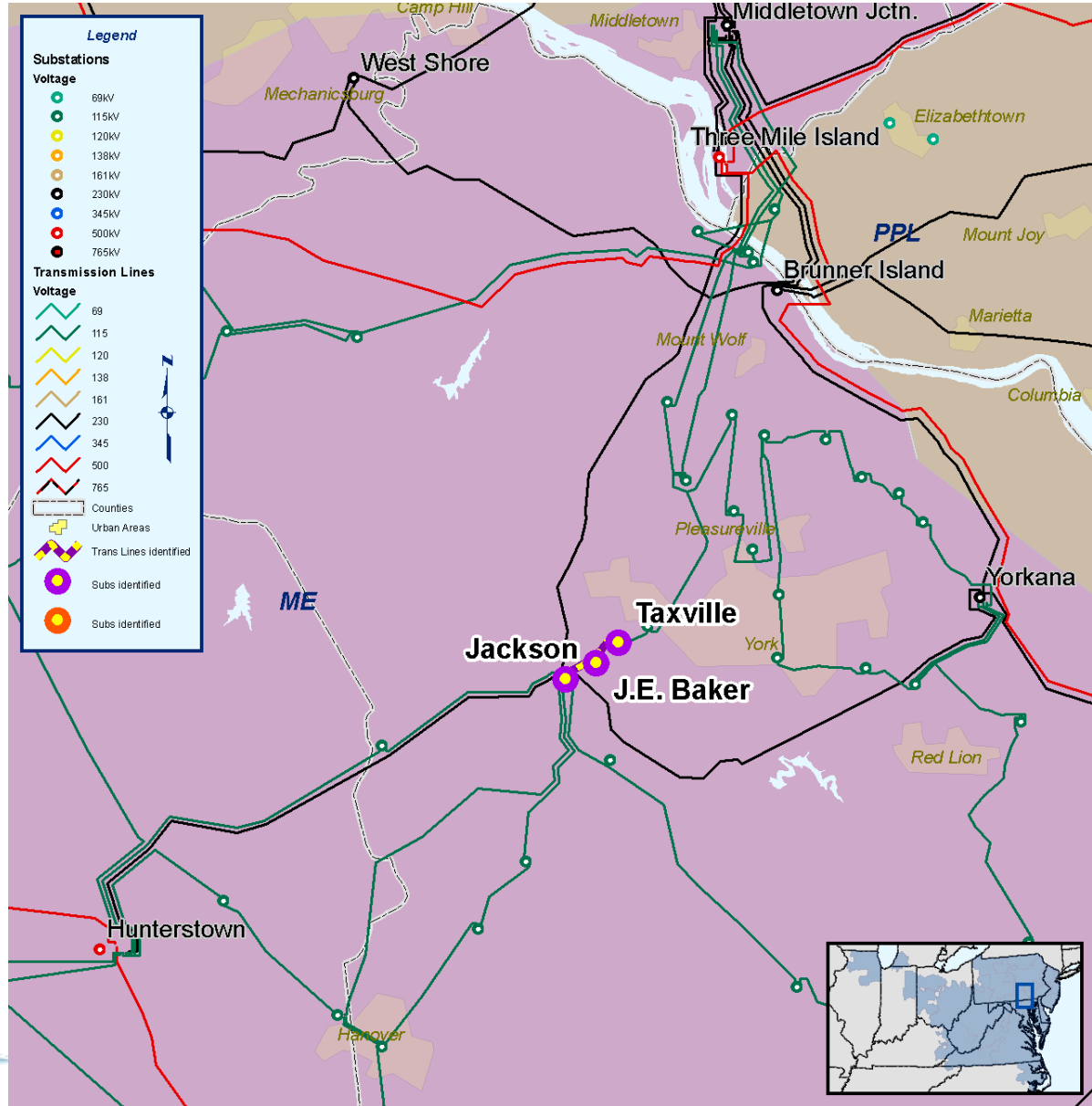
- Loss of the Dooks source of Dooks to Dupont Waynesboro line results in low voltage at Waynesboro
- Install a new 115 kV capacitor at Dupont-Waynesboro substation
- Expected in-service date: May 2013
- Est. Cost: \$0.5 M



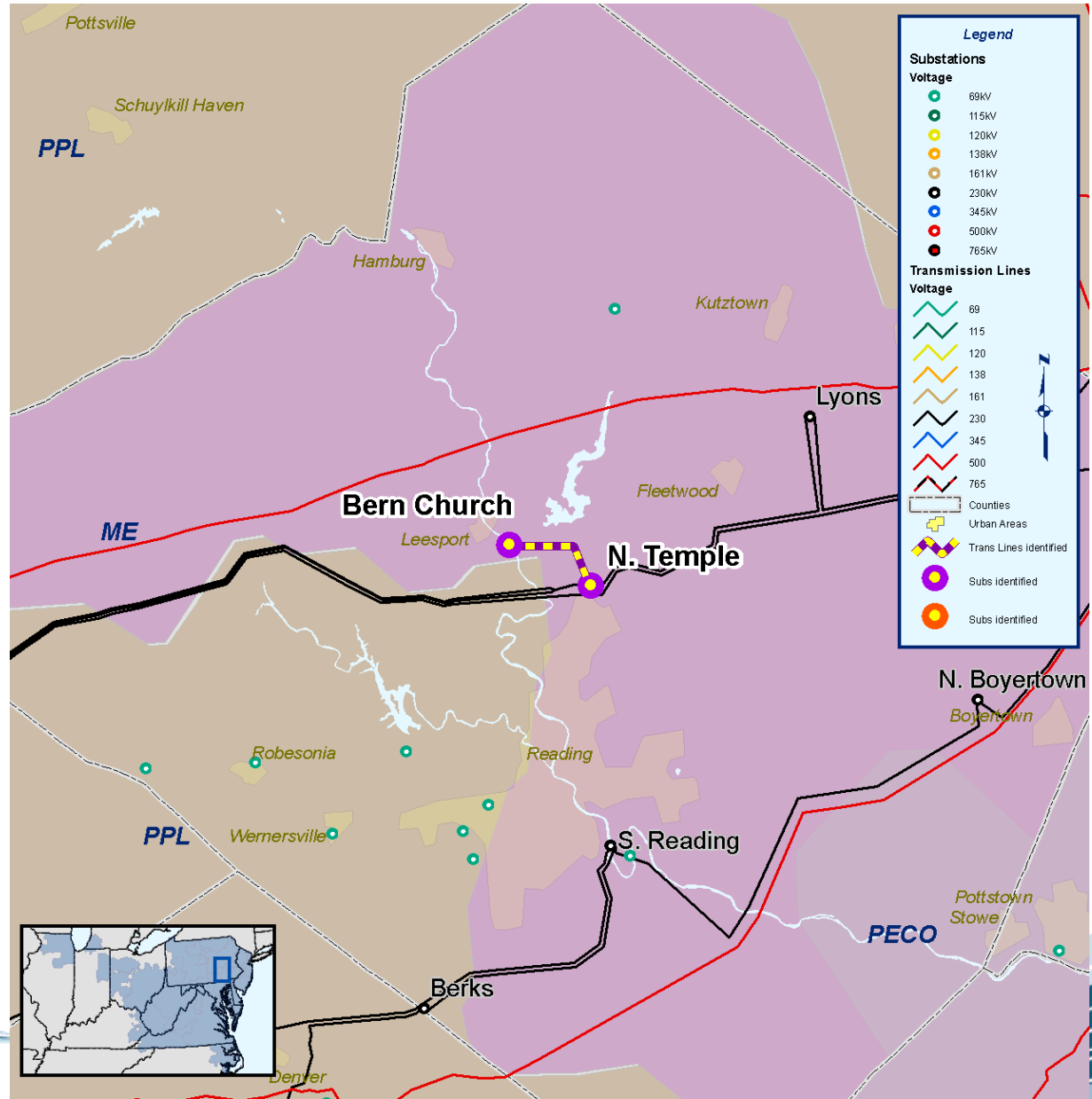


First Energy Baseline Upgrades

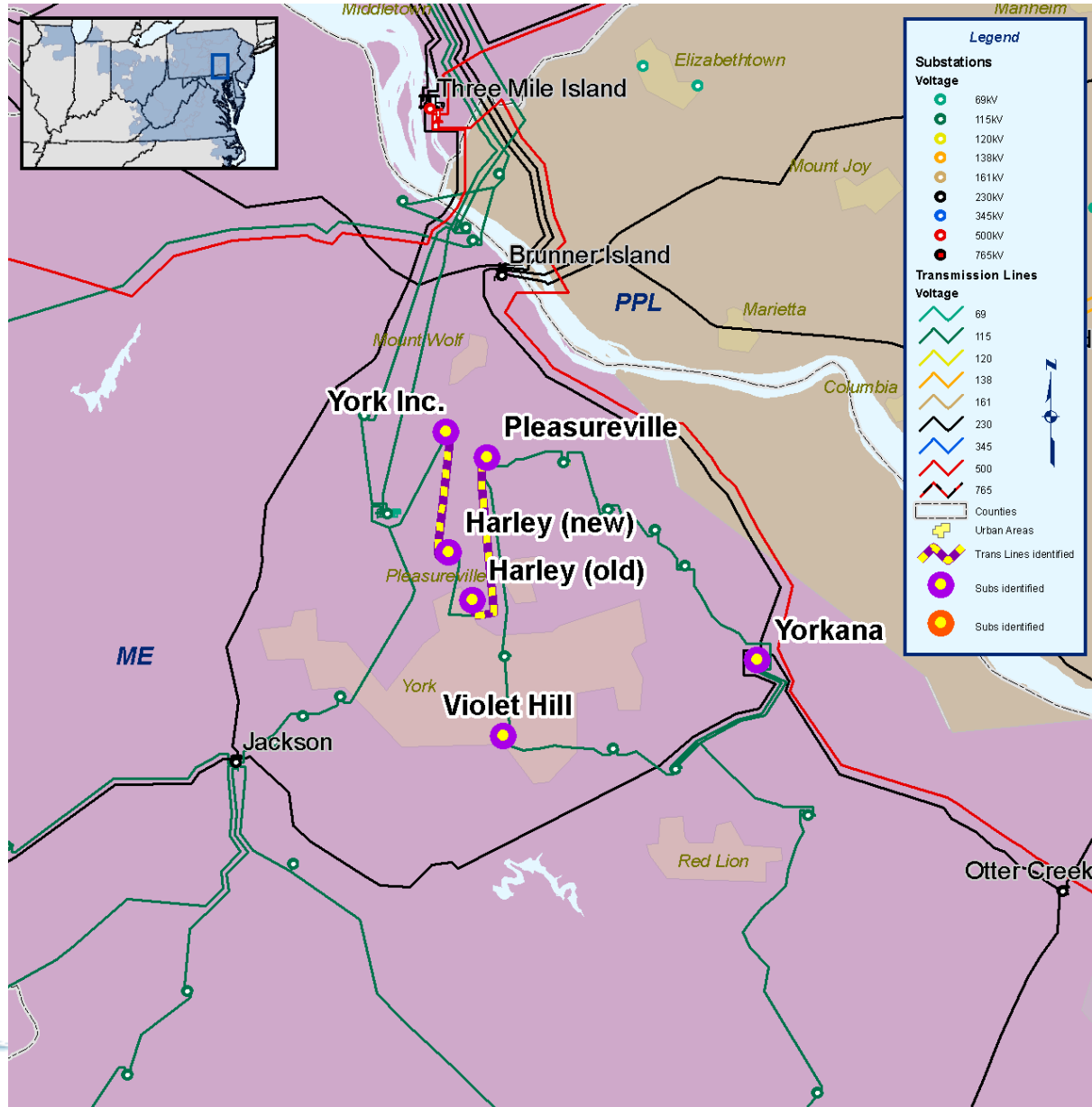
- Jackson-JE Baker Tap-Taxville 115 kV line / loss of the Yorkana 115 kV bus
- Reconductor Jackson-JE Baker Tap-Taxville 115 kV line
- Estimated Project Cost: \$1.19 M
- Expected IS Date: 5/29/09



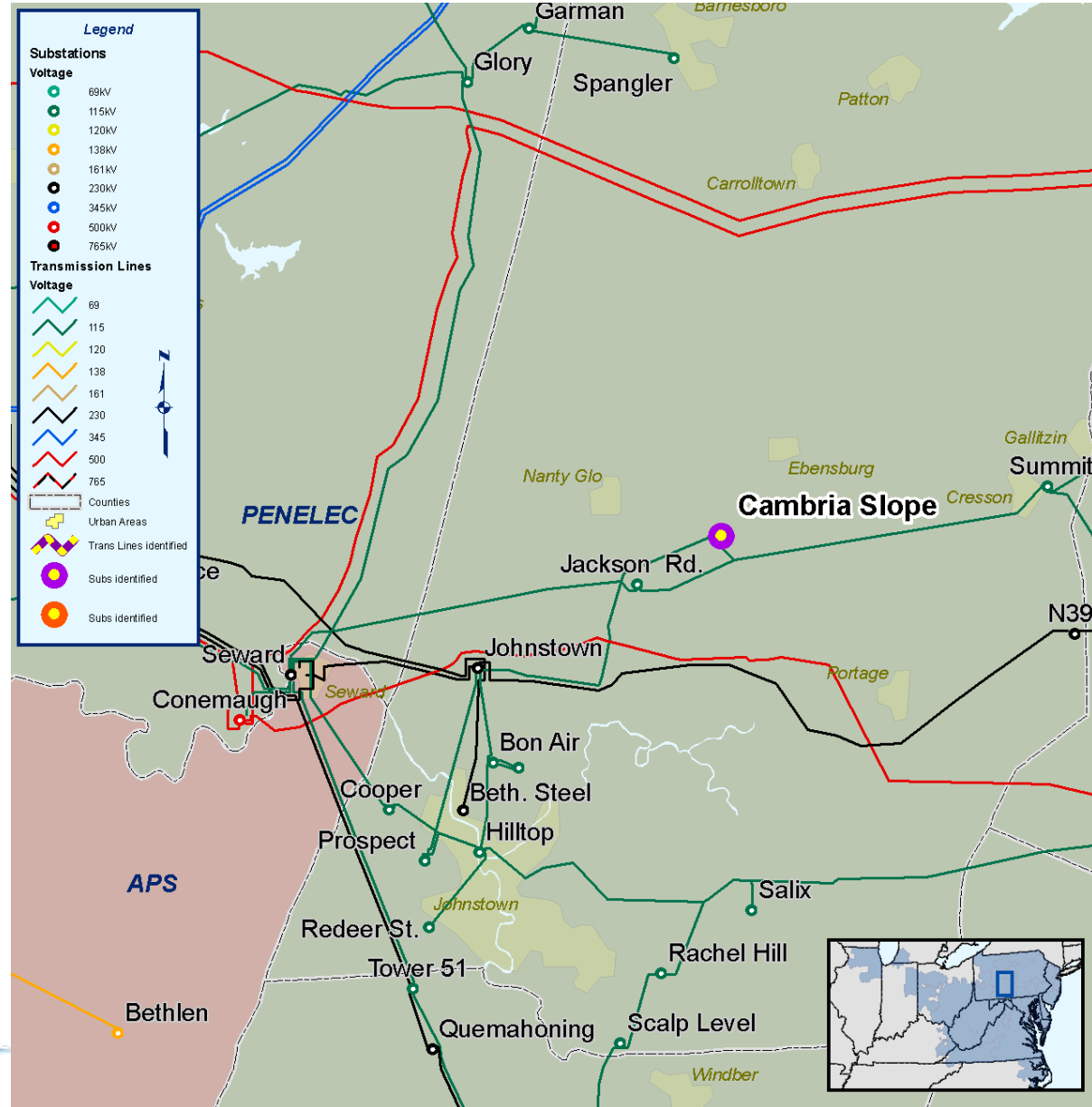
- Low voltage in Bern Church 69 kV area / loss of the North Temple-Berkley 69 kV line
- Install 20 MVAR capacitor at Bern Church 69 kV bus
- Estimated Project Cost: \$0.403 M
- Expected IS Date: 5/29/09



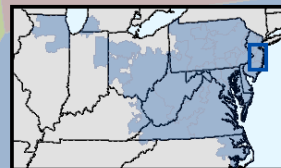
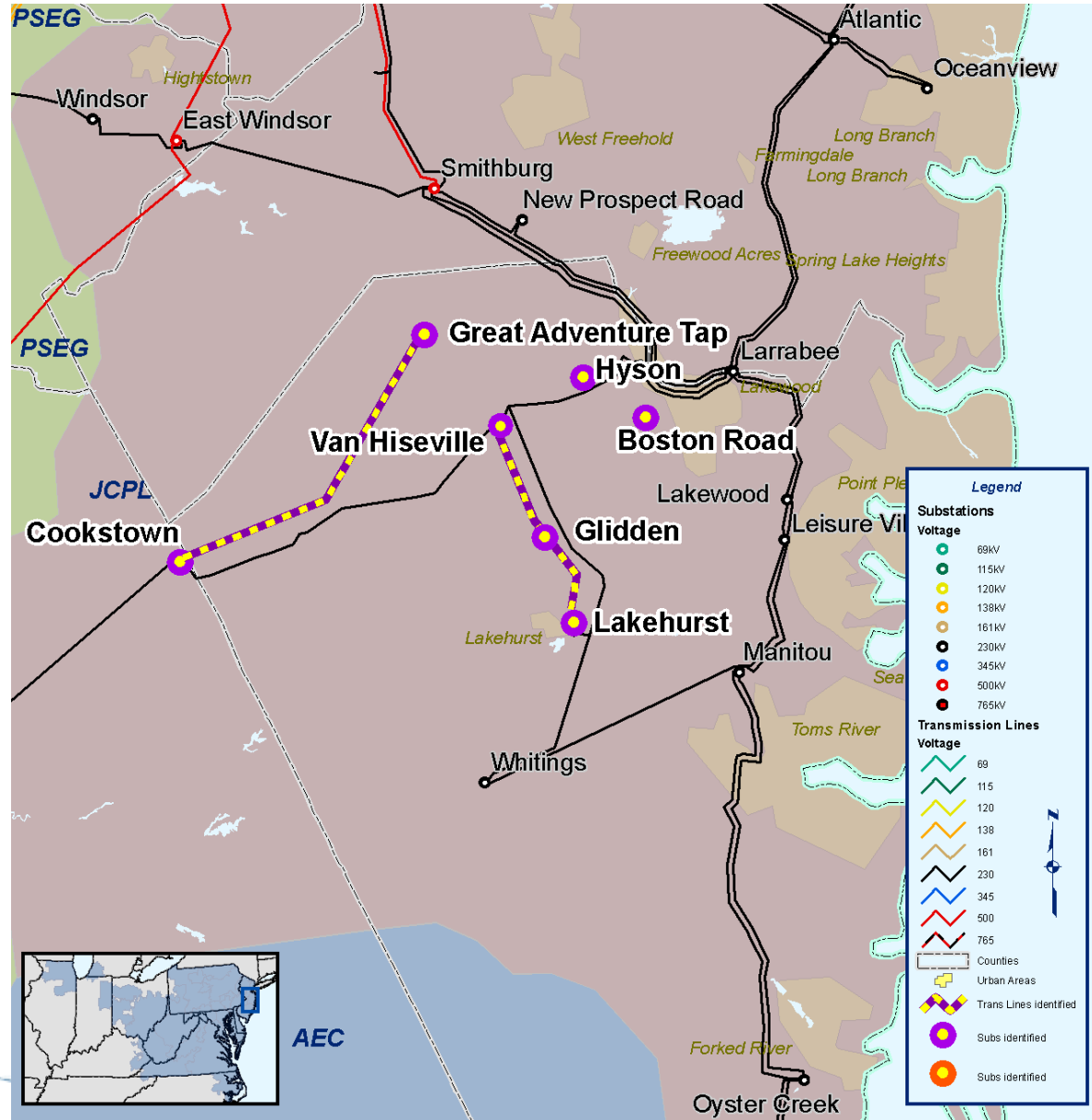
- Harley Davidson-Pleasureville 115 kV line / loss of the Yorkana 115 kV bus
- York Incinerator-Harley Davidson 115 kV line / loss of the Yorkana 115 kV bus
- Undervoltage at Violet Hill 115/69 kV station/ loss of the Yorkana 115 kV bus
- Install Bus Tie circuit breaker on Yorkana 115 kV bus
- Estimated Project Cost: \$0.953 M
- Expected IS Date: 5/01/09



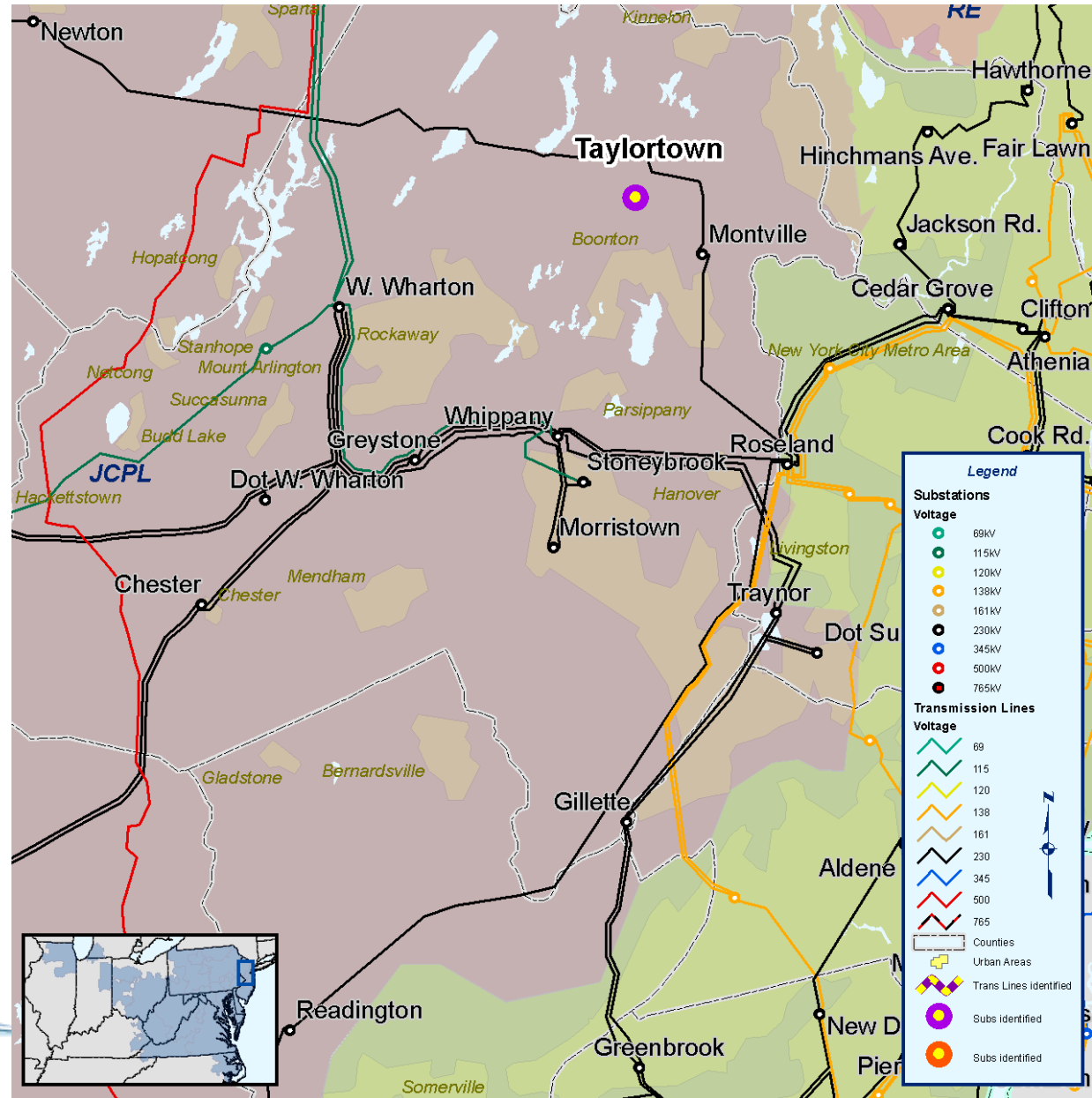
- Cambria Slope 115/46 kV transformer / fault on the Wilmore Junction 115 kV 3-terminal line + failure of Cambria Slope SPS
- Various other 46 kV overloads
- Reconfigure the Cambria Slope and Wilmore Junction 115 kV stations to eliminate the Wilmore Junction 115 kV 3-terminal line
- Estimated Project Cost: \$1.28 M
- Expected IS Date: 5/30/09



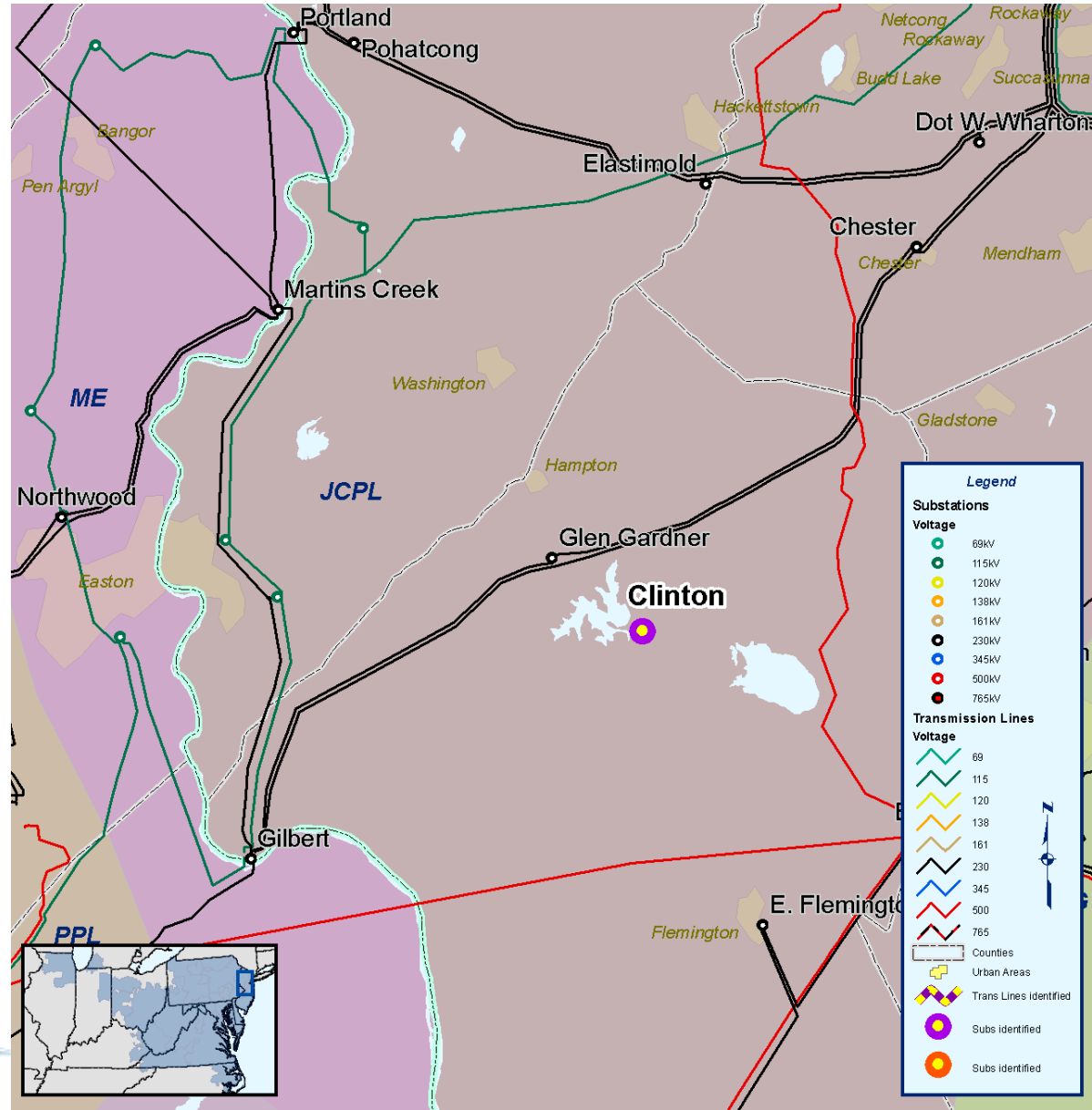
- Lakehurst-Glidden-Van Hiseville 34.5 kV line / loss of Cookstown end of V22 34.5 kV circuit
- Cookstown-Great Adventure Tap 34.5 kV line / loss of Lakehurst end of V22 34.5 kV circuit
- Voltage collapse / loss of Larrabee end of U73 34.5 kV circuit
- Construct Boston Road 34.5 kV station
- Construct Hyson 34.5 kV station
- Add 7.2 MVAR capacitor at Boston Road 34.5 kV
- Estimated Project Cost: \$5.81 M
- Expected IS Date: 6/01/2009



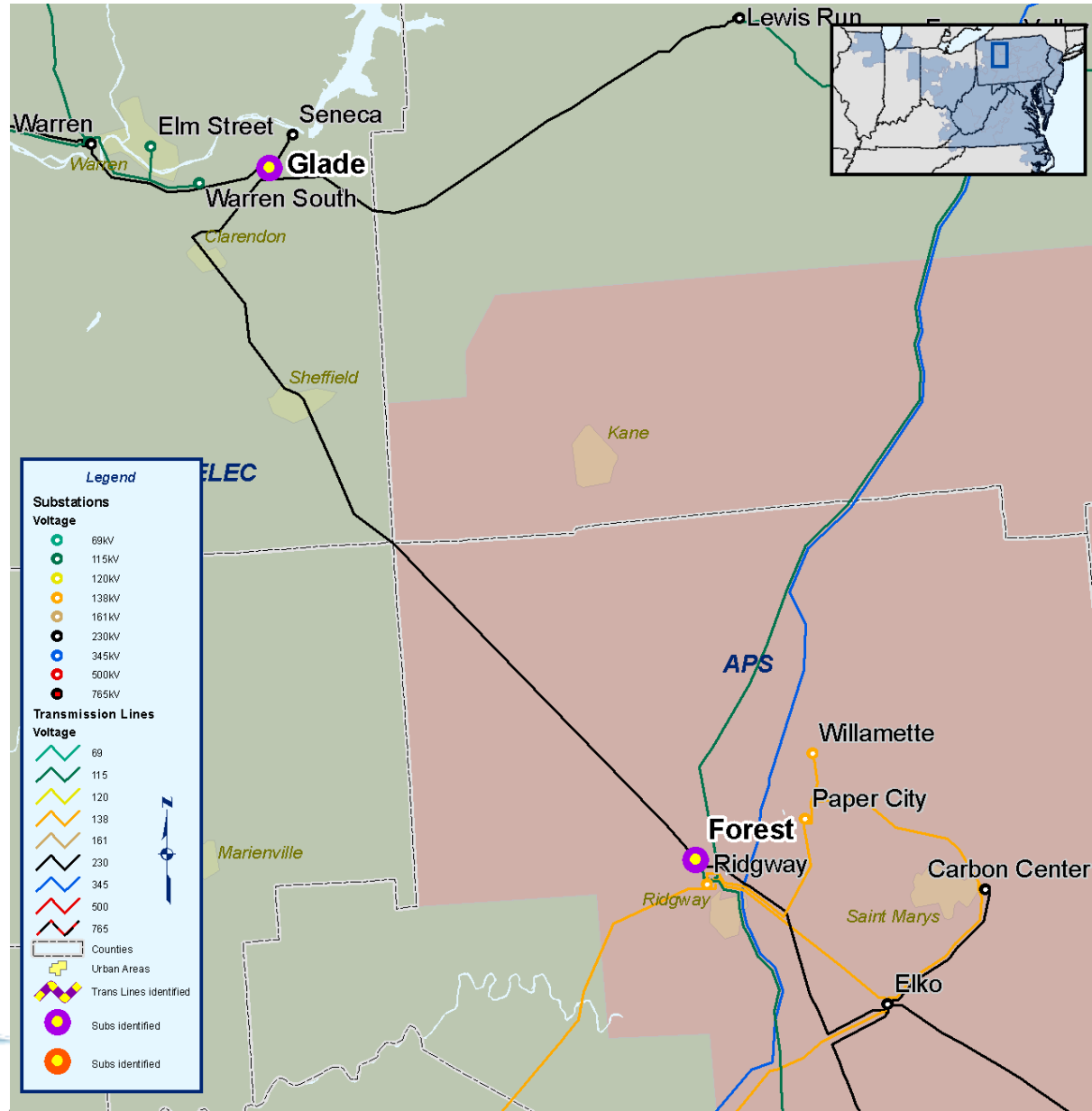
- Low voltage at Taylortown 34.5 kV bus / loss of Montville-Taylortown 34.5 kV line
- Add 6.6 MVAR capacitor at Taylortown 34.5 kV
- Estimated Project Cost: \$0.400 M
- Expected IS Date: 5/20/2009



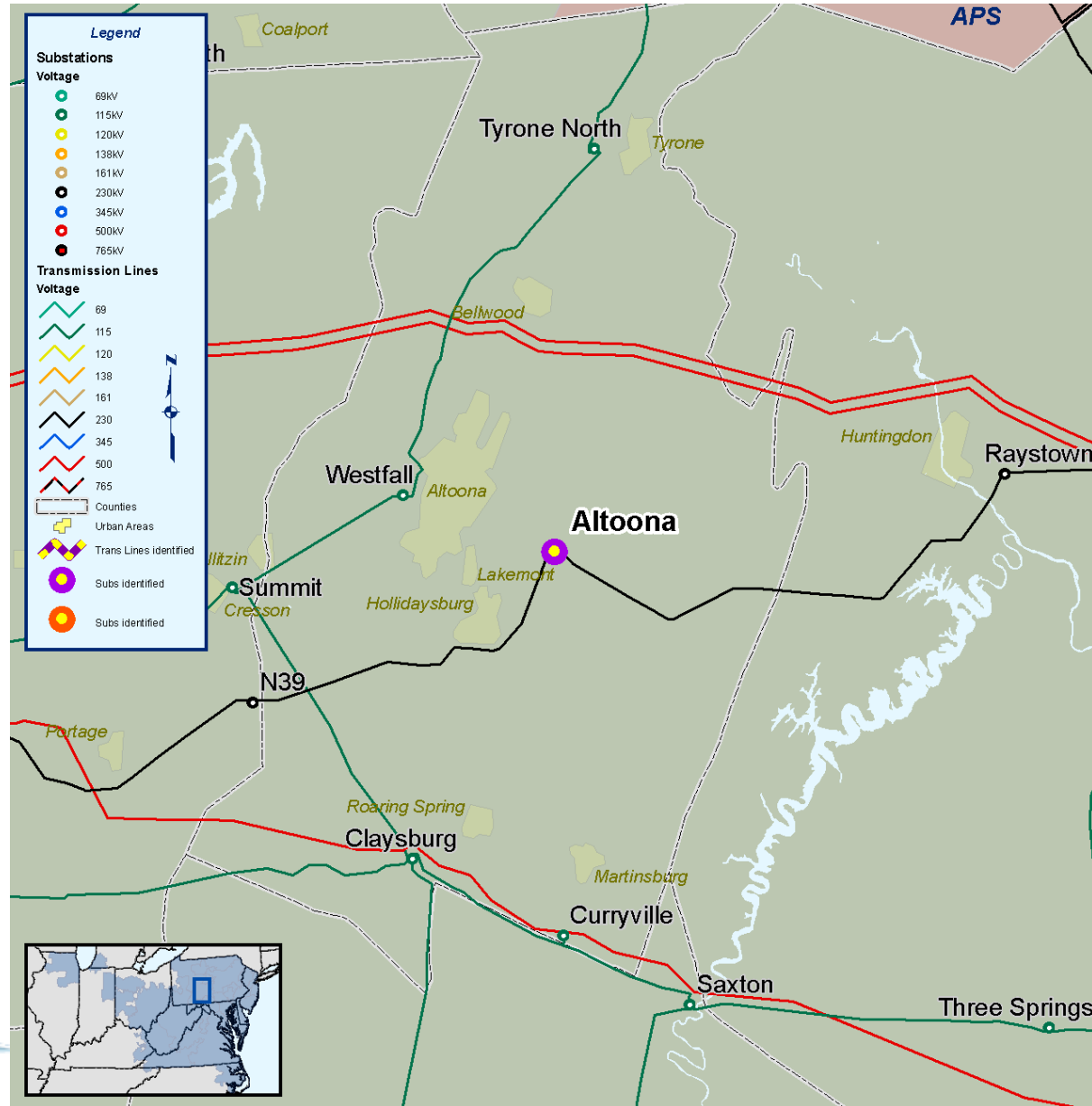
- Low voltage at Clinton 34.5 kV bus / loss of Glen Gardner-Clinton 34.5 kV line
- Add 7.2 MVAR capacitor at Clinton 34.5 kV
- Estimated Project Cost: \$0.400 M
- Expected IS Date: 5/28/2009



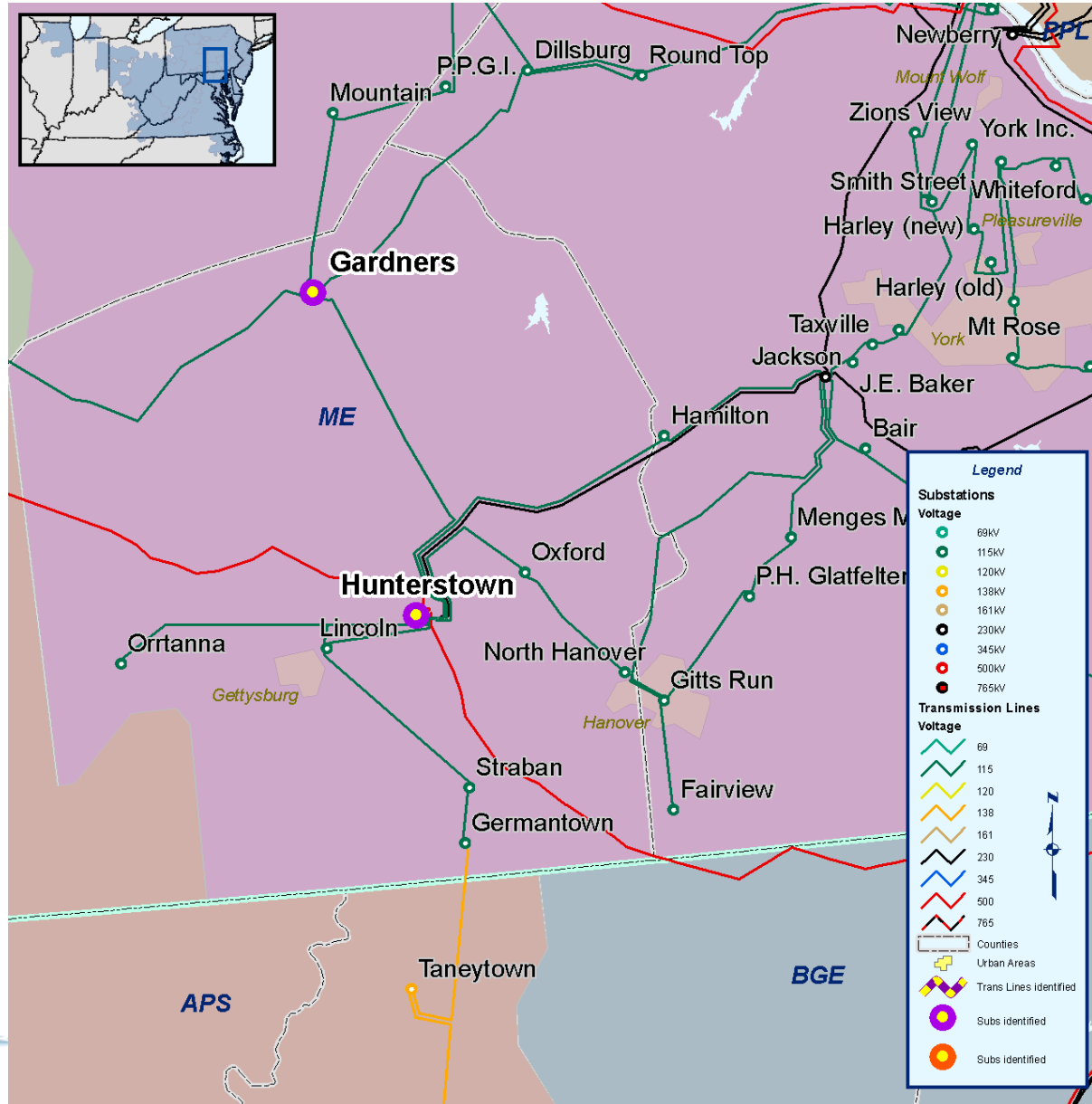
- Voltage collapse / Forest 230 kV circuit breaker fault causing the loss of the Forest-Glade Tap 230 kV line
- Reconfigure and expand the Glade 230 kV ring bus to eliminate the Glade Tap 230 kV 3-terminal line
- Estimated Project Cost: \$5.64 M
- Expected IS Date: 6/01/2010



- Altoona 230/46 kV transformer #1 / loss of Altoona-Raystown 230 kV line and Altoona 230/46 kV transformer #2
- Add 3 breakers to form a ring bus at Altoona 230 kV
- Estimated Project Cost: \$2.73 M
- Expected IS Date: 6/01/2010



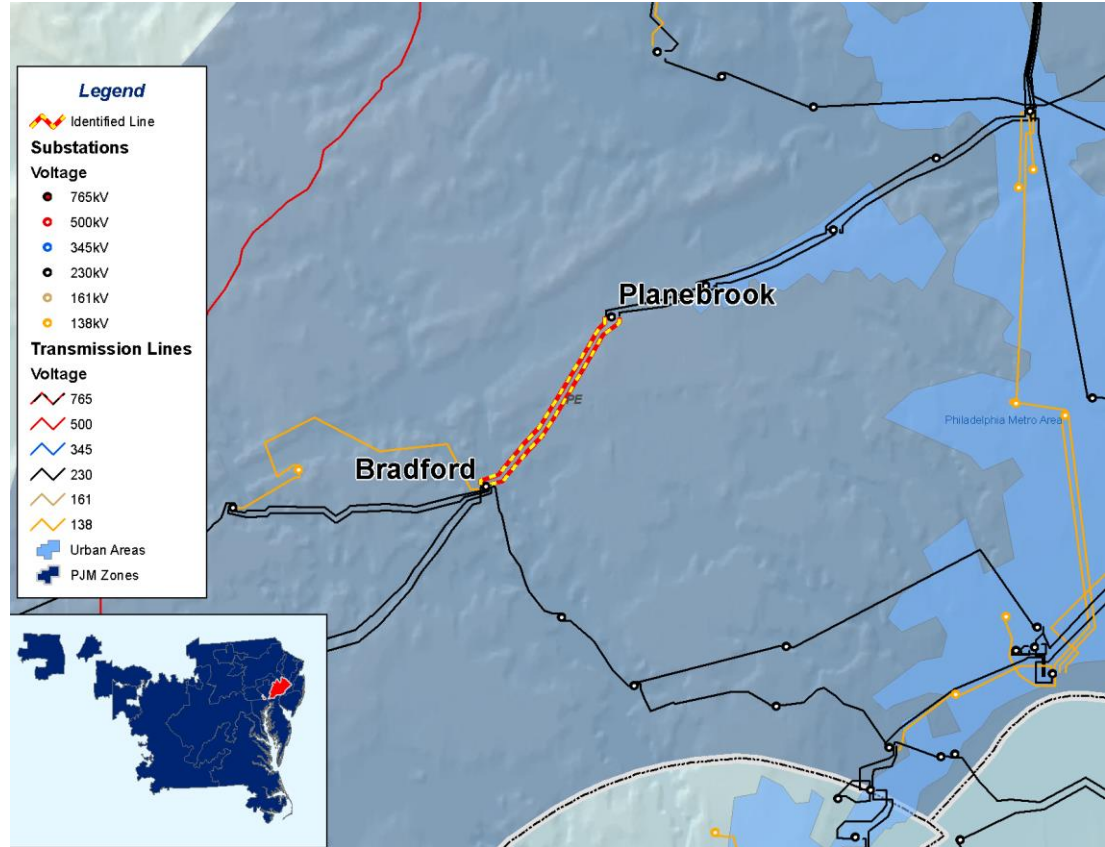
- Driver: Violation of FE Thermal Criteria / Hunterstown - Texas Eastern Tap - Gardners 115 kV
- Solution: Rebuild Hunterstown - Texas Eastern Tap 115
- Estimated Project Cost: \$2.1 M
- IS Date: 6/1/2008
- Solution: Rebuild Texas Eastern Tap - Gardners 115 kV and associated upgrades at Gardners including disconnect switches
- Estimated Project Cost: \$1.9 M
- IS Date: 5/1/2009



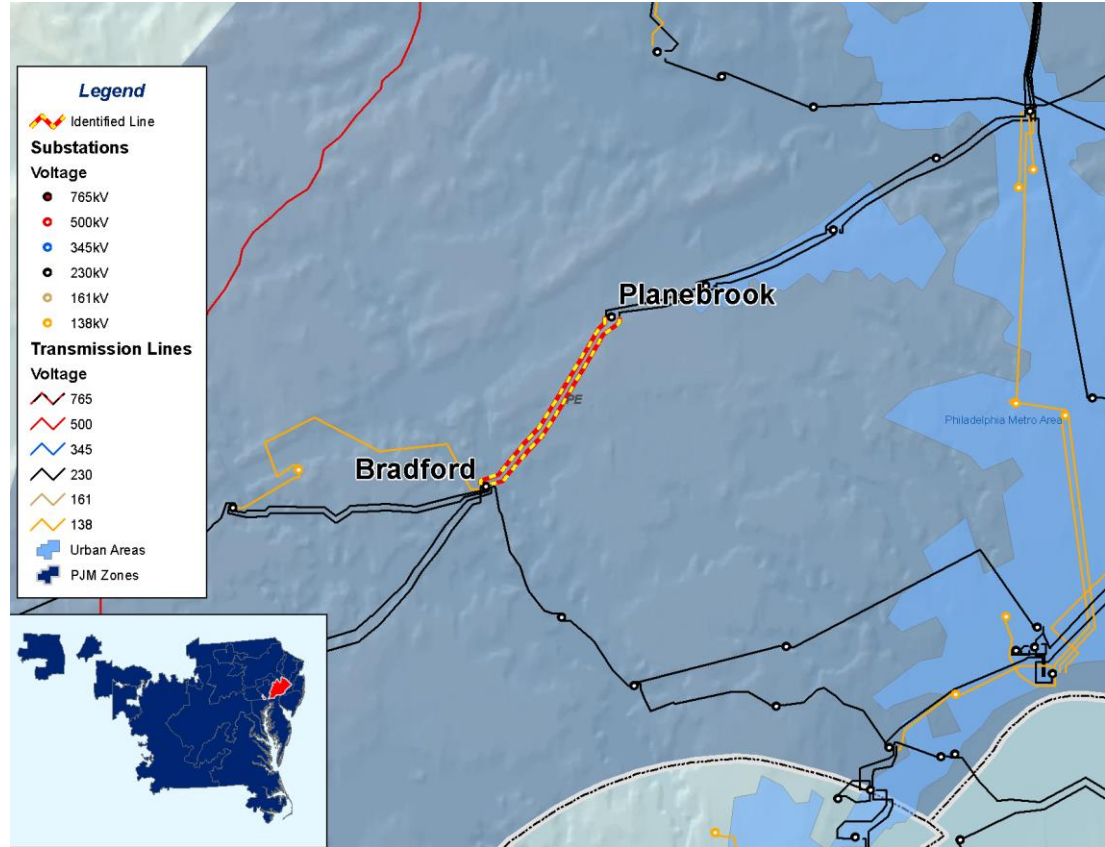


PECO Baseline Upgrades

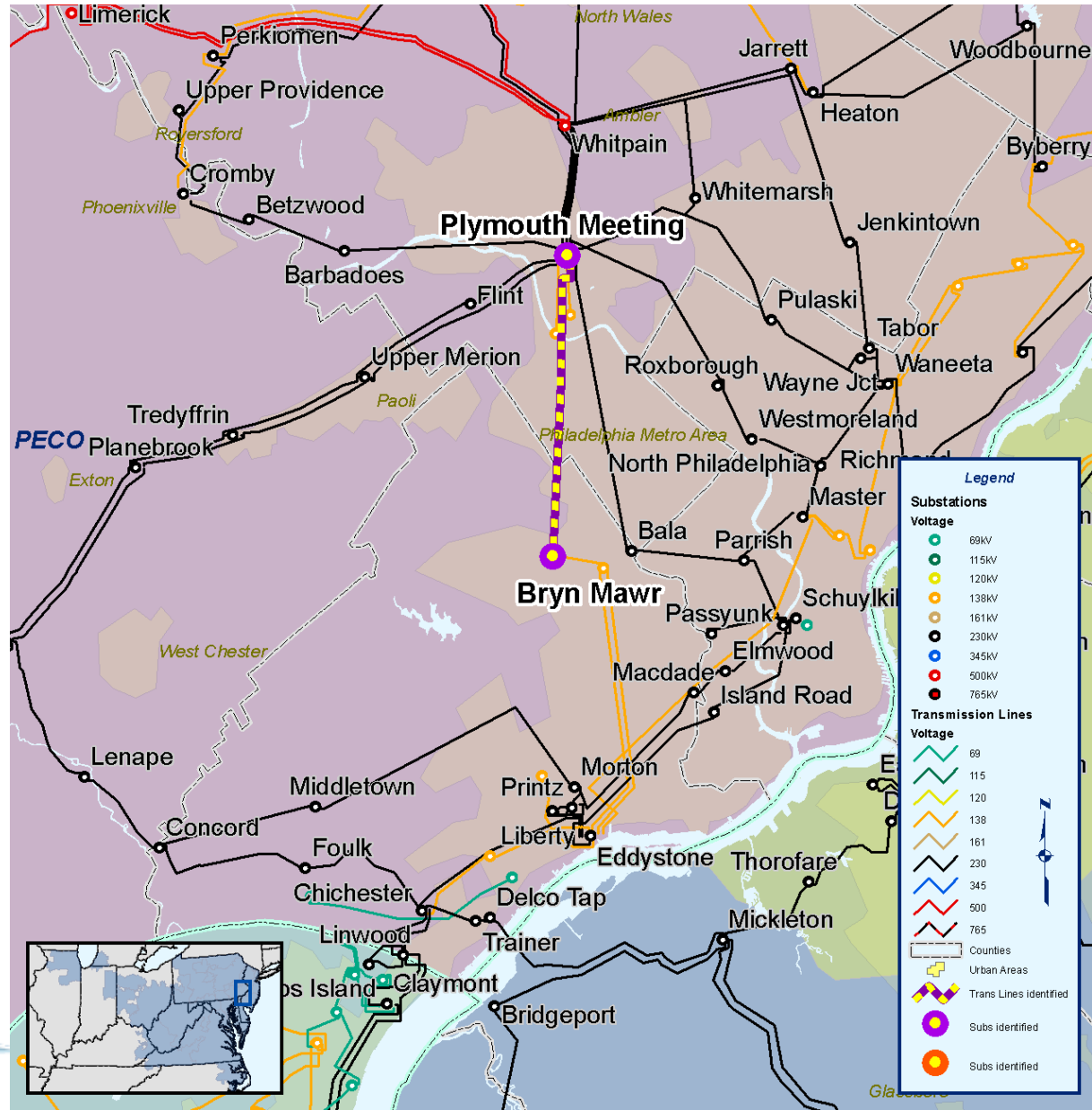
- Bradford – Planebrook 230 kV line CKT 220-02 / Loss of the other 230 kV line (Single)
- Recommended Solution: Reconductor the line to provide a normal rating of 677 MVA and an emergency rating of 827 MVA
- Expected in-service: June 1, 2013
- Estimated cost: \$7.0 M



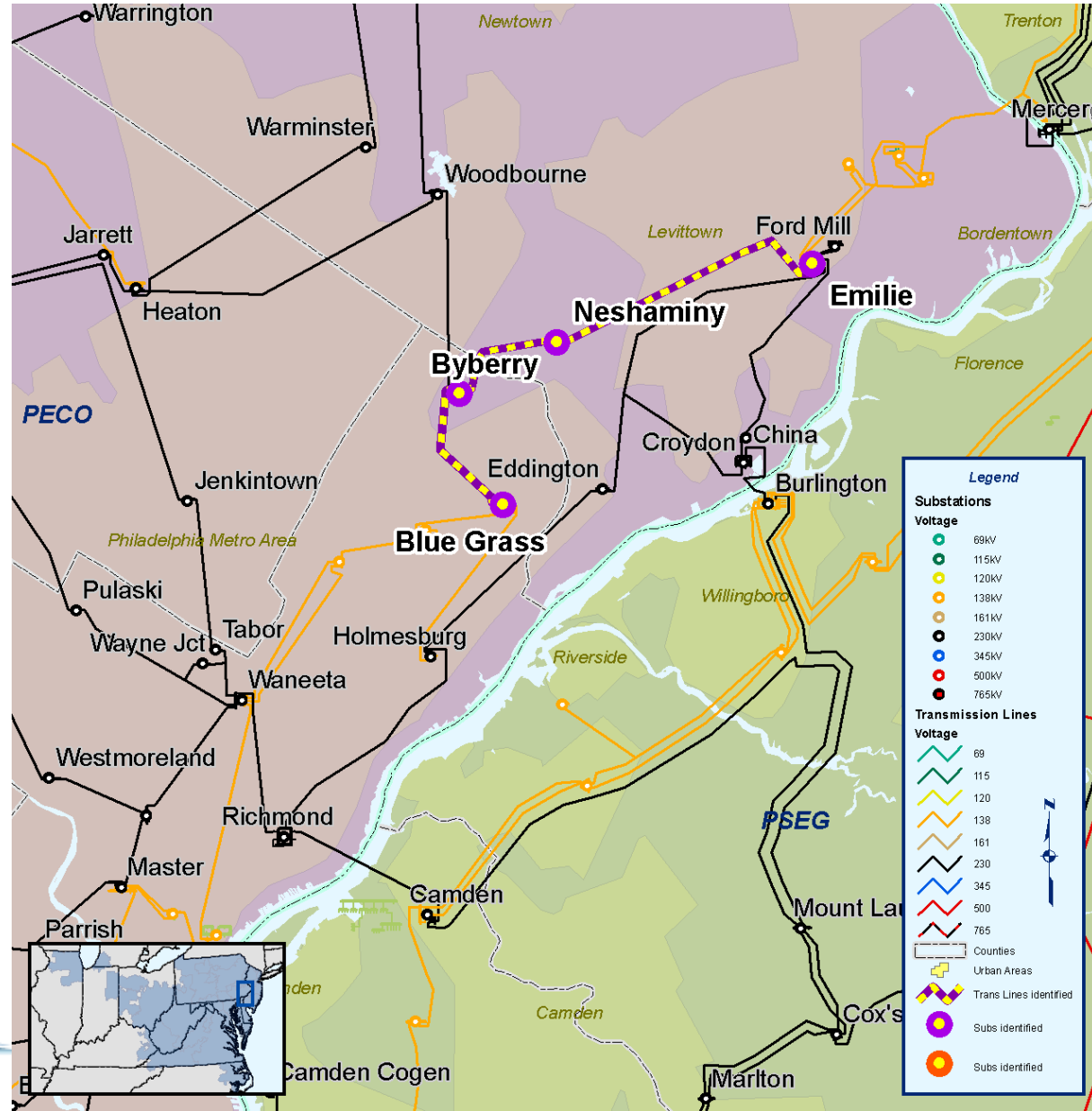
- Bradford – Planebrook 230 kV line CKT 220-31 / Loss of Bradford – Planebrook 230 kV line + Bradford CB 220 failed (Line_FB)
- Recommended Solution: Reconductor the line to provide a normal rating of 677 MVA and an emergency rating of 827 MVA
- Expected in-service: June 1, 2013
- Estimated cost: \$7.5 M



- Bryn Mawr – Plymouth Meeting 138 kV line / loss of Llanerch - Eddystone CKT 130-42 138 kV line + basecase
- Bryn Mawr – Plymouth Meeting 138 kV line / loss of Llanerch – Eddystone CKT 130-42 138 kV line + loss of loss of Llanerch – Eddystone CKT 130-45 138 kV line
- Rebuild Bryn Mawr – Plymouth Meeting 138 kV line
- Estimated Project Cost: \$12.5 M
- Expected IS Date: 6/01/2013



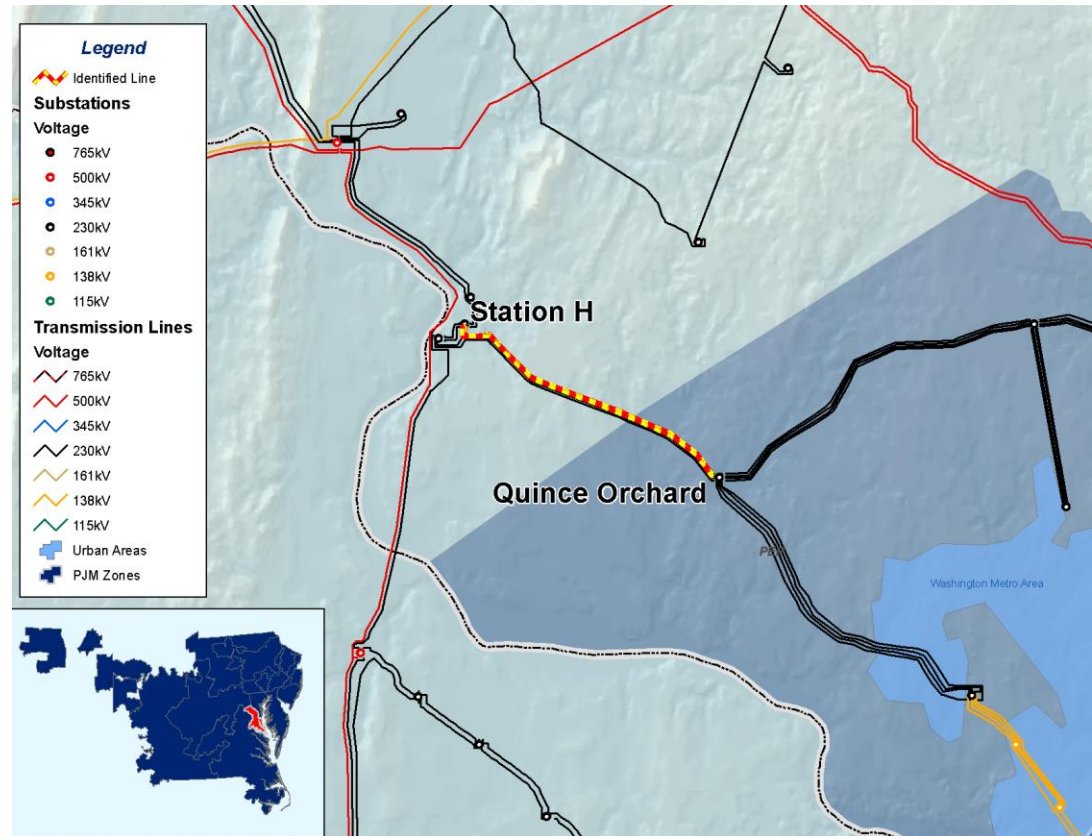
- Bluegrass – Byberry 138 kV line / loss of Woodbourne – Byberry 230 kV line + loss of Neshaminy – Emilie 138 kV line
- Switching Procedure: If the Woodbourne - Byberry 230 kV line were to occur first, then open the low side of Neshaminy #17 transformer so that all of the load (94 MVA) at Neshaminy will be dropped when the Neshaminy - Emilie 138 kV line contingency occurs
- Switching Procedure : If the Neshaminy - Emilie 138 kV line contingency were to occur first, then open the Byberry 17-18, 18-19 and 20-21 bus ties so that 85 MVA of Byberry load will be dropped when the Woodbourne – Byberry 230 kV line contingency occurs
- Estimated Project Cost: \$0 M
- Expected IS Date: 6/01/2013



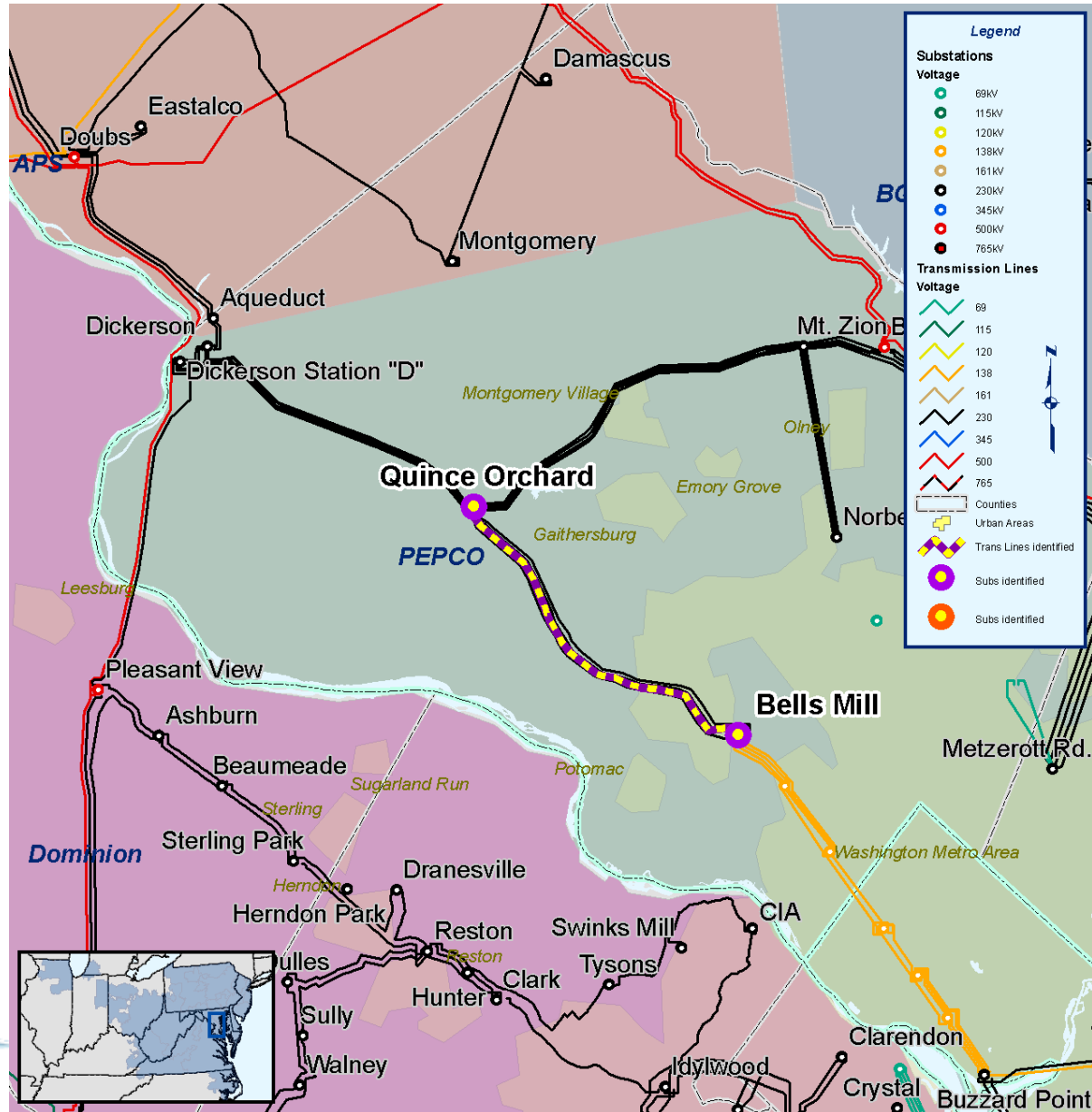


PEPCO Baseline Upgrades

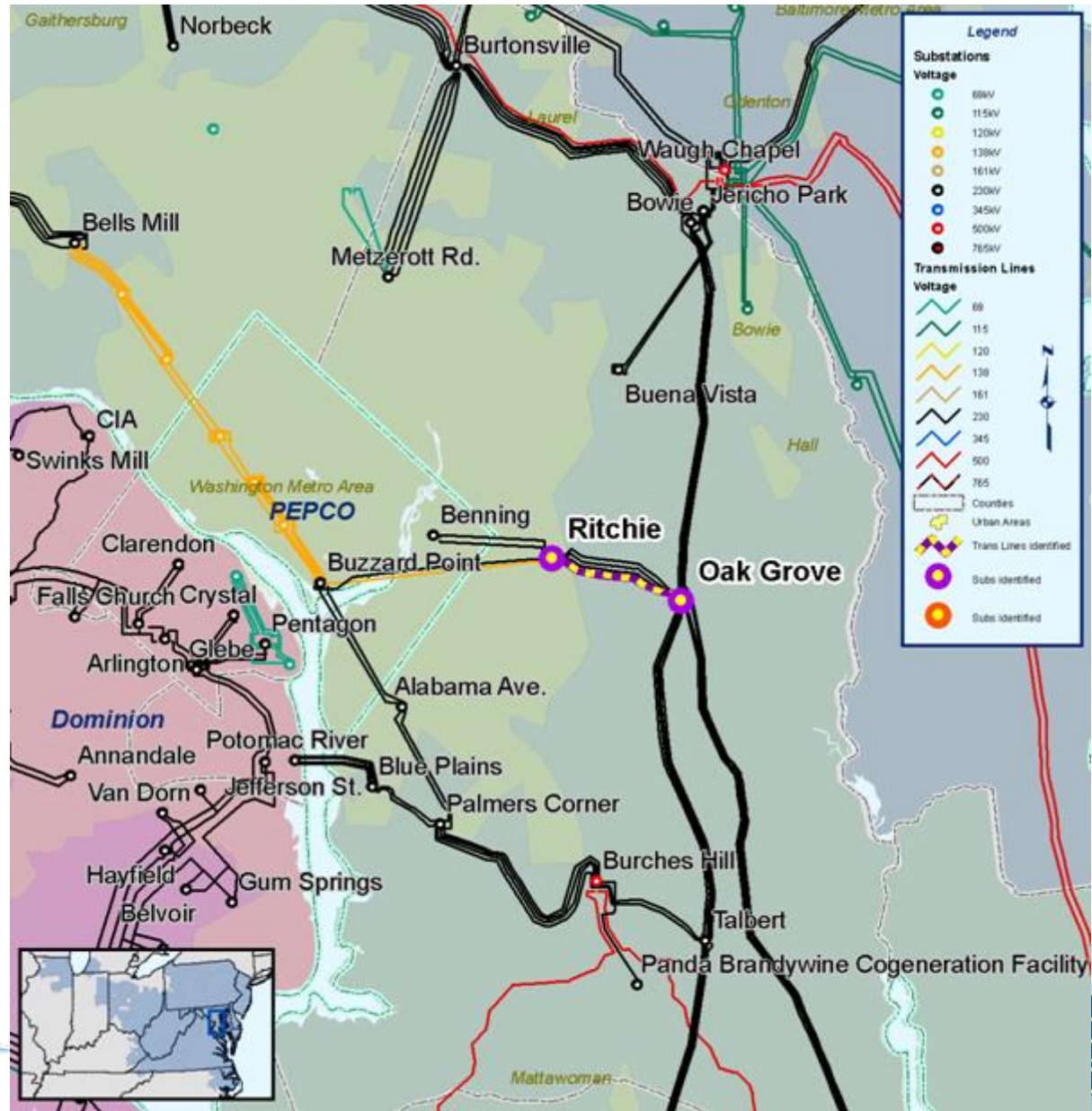
- Station H – Quince Orchard
230 kV line / Loss of Dickerson – Quince Orchard DCTL
- Recommended Solution:
Upgrade circuit to 3,000 amps using the ACCR
- Expected in-service date:
June 1, 2013
- Estimated cost: \$6.252M



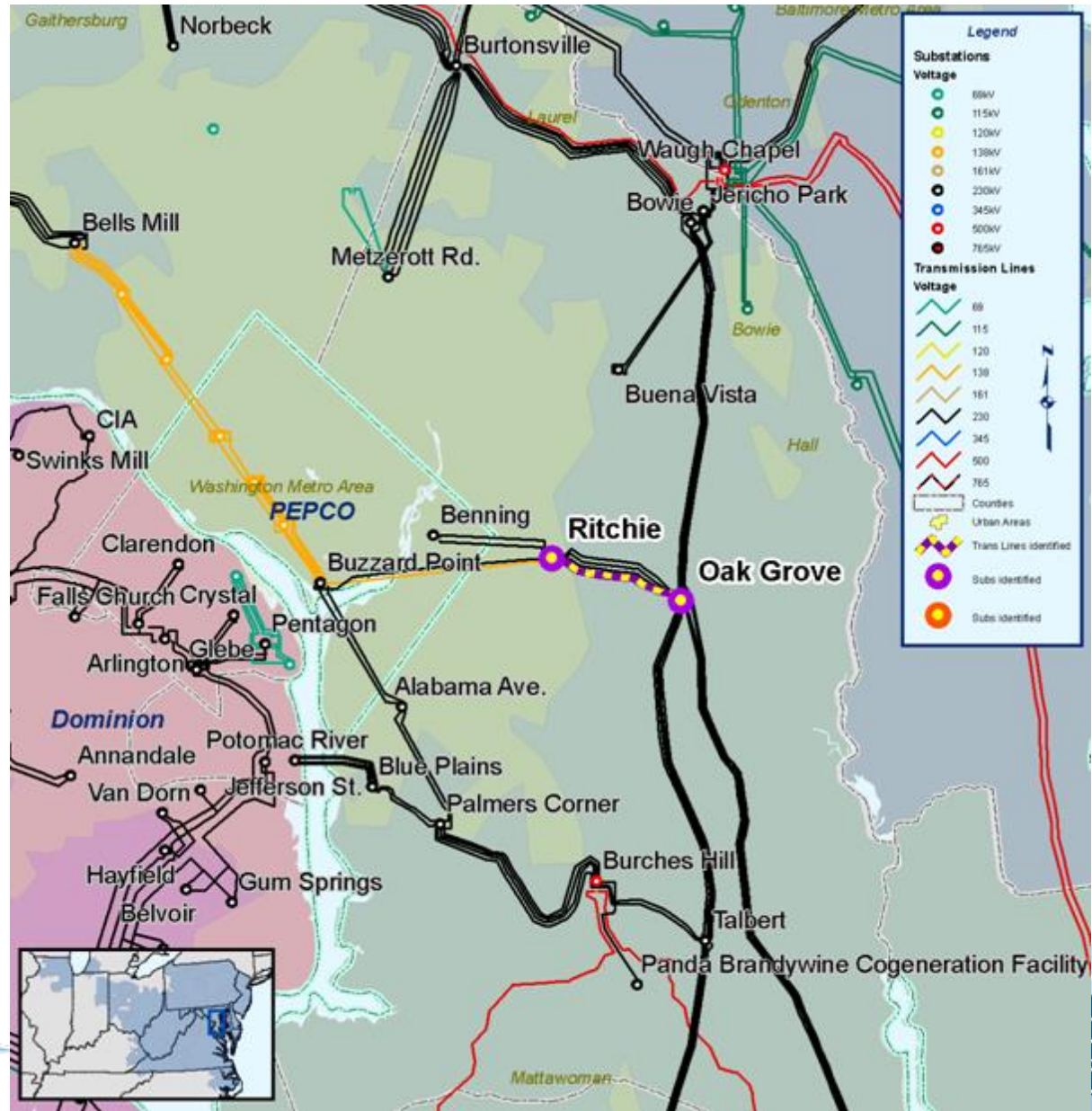
- Quince Orchard – Bells Mill (030) 230 kV line / loss of Bells Mill (028) 230 kV bus + loss of Bells Mill (029) 230 kV bus
- Quince Orchard – Bells Mill (028) 230 kV line / loss of Bells Mill (029) 230 kV bus + loss of Bells Mill (031) 230 kV bus
- Recommended Solution: Upgrade terminal equipment on both lines
- Estimated Project Cost: \$1.415 M
- Expected IS Date: 6/01/2012



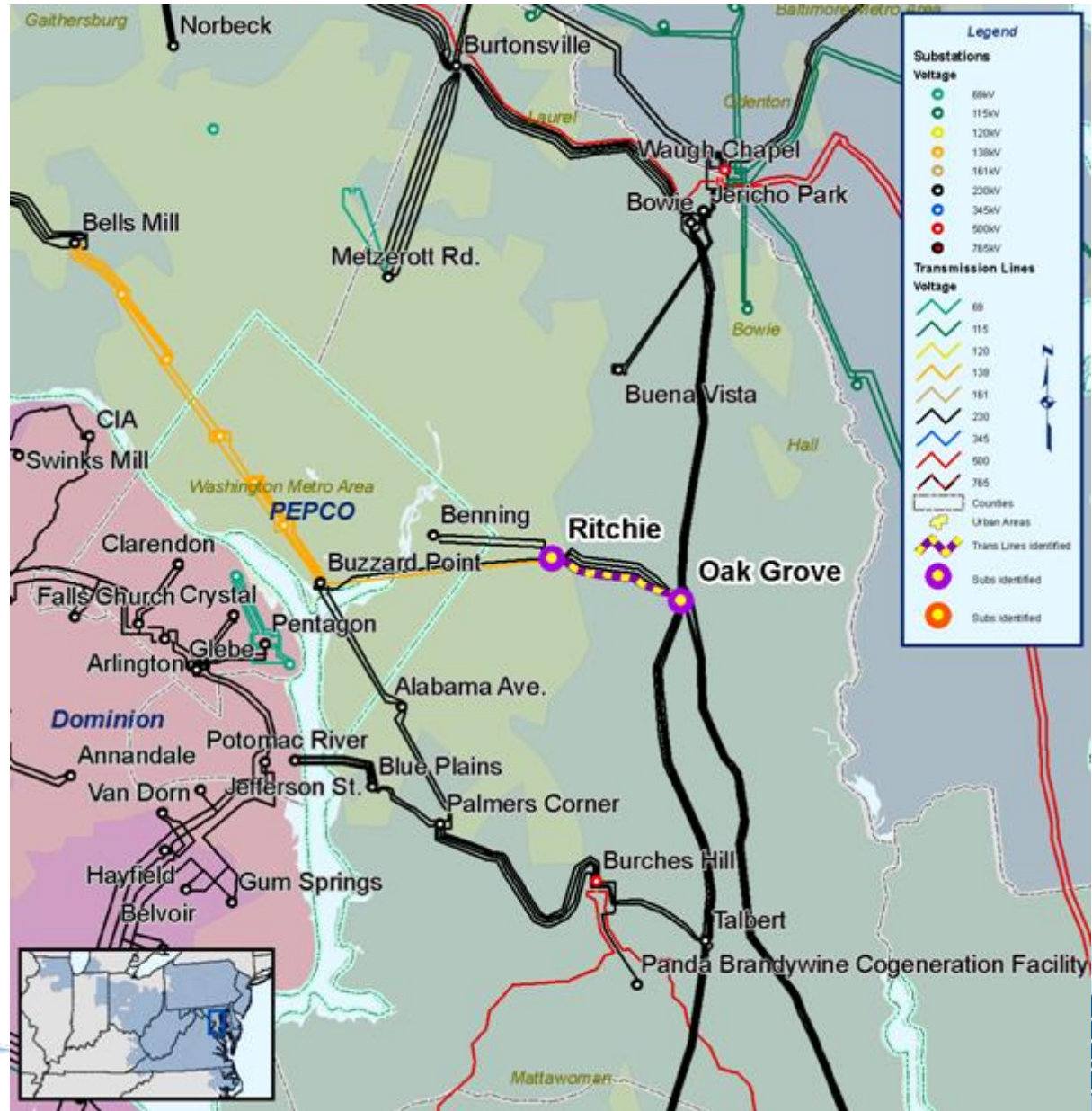
- Oak Grove – Ritchie 23061 230 kV line / loss of Oak Grove – Ritchie 23058 230 kV line + loss of Oak Grove – Ritchie 23060 230 kV line
- Recommended Solution: Upgrade Oak Grove – Ritchie 23061 230 kV line
- Estimated Project Cost: \$3.25 M
- Expected IS Date: 6/01/2013



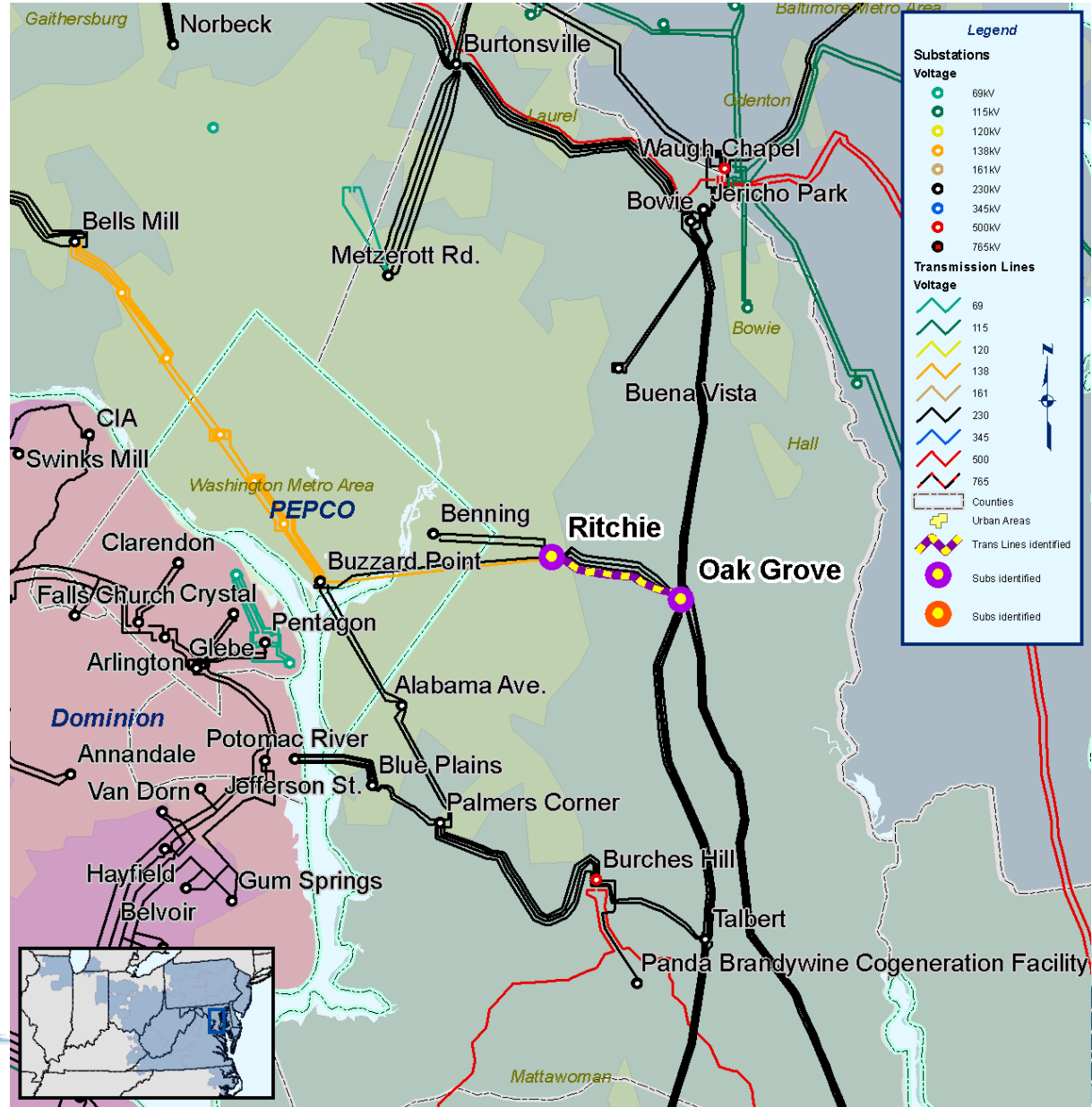
- Oak Grove – Ritchie 23058 230 kV line / loss of Oak Grove – Ritchie 23059 230 kV line + loss of Oak Grove – Ritchie 23060 230 kV line
- Recommended Solution: Upgrade Oak Grove – Ritchie 23058 230 kV line
- Estimated Project Cost: \$3.25 M
- Expected IS Date: 6/01/2013



- Oak Grove – Ritchie 23059 230 kV line / loss of Oak Grove – Ritchie 23058 230 kV line + loss of Oak Grove – Ritchie 23060 230 kV line
- Recommended Solution: Upgrade Oak Grove – Ritchie 23059 230 kV line
- Estimated Project Cost: \$3.25 M
- Expected IS Date: 6/01/2013



- Oak Grove – Ritchie 23060 230 kV line / loss of Oak Grove – Ritchie 23058 230 kV line + loss of Oak Grove – Ritchie 23059 230 kV line
- Recommended Solution: Upgrade Oak Grove – Ritchie 23060 230 kV line
- Estimated Project Cost: \$3.25 M
- Expected IS Date: 6/01/2013





PP&L Upgrades

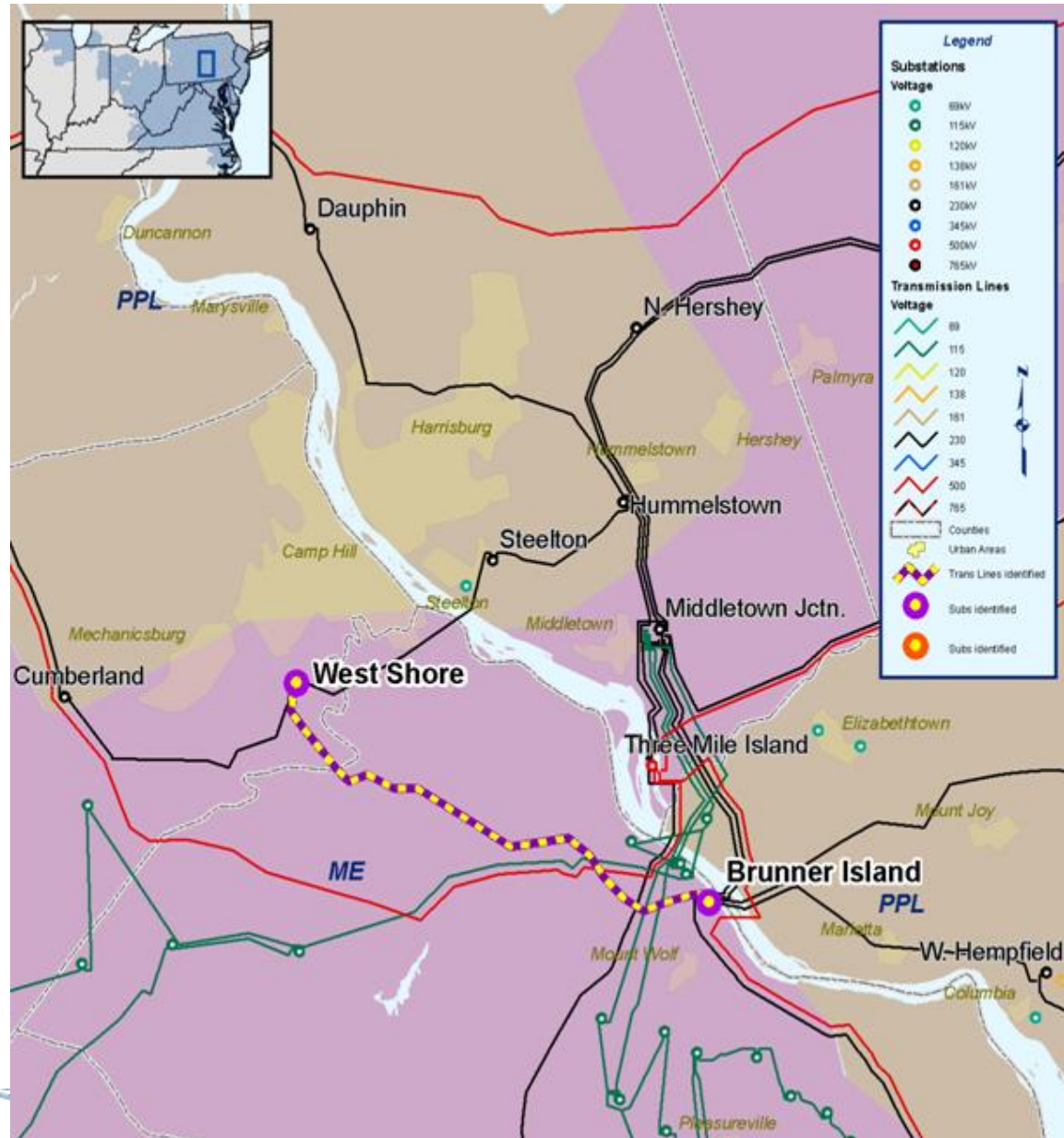
Various overloads for N-2 Events:

- Steel Tap - Steelton 230 kV line
- Steelton-Steel H1 230 kV line
- Steelton-Steel H3 230 kV line
- Brunner Island - West Shore 230 kV line
- West Shore - Steelton 230 kV line
- Juniata - Cumberland 230 kV line

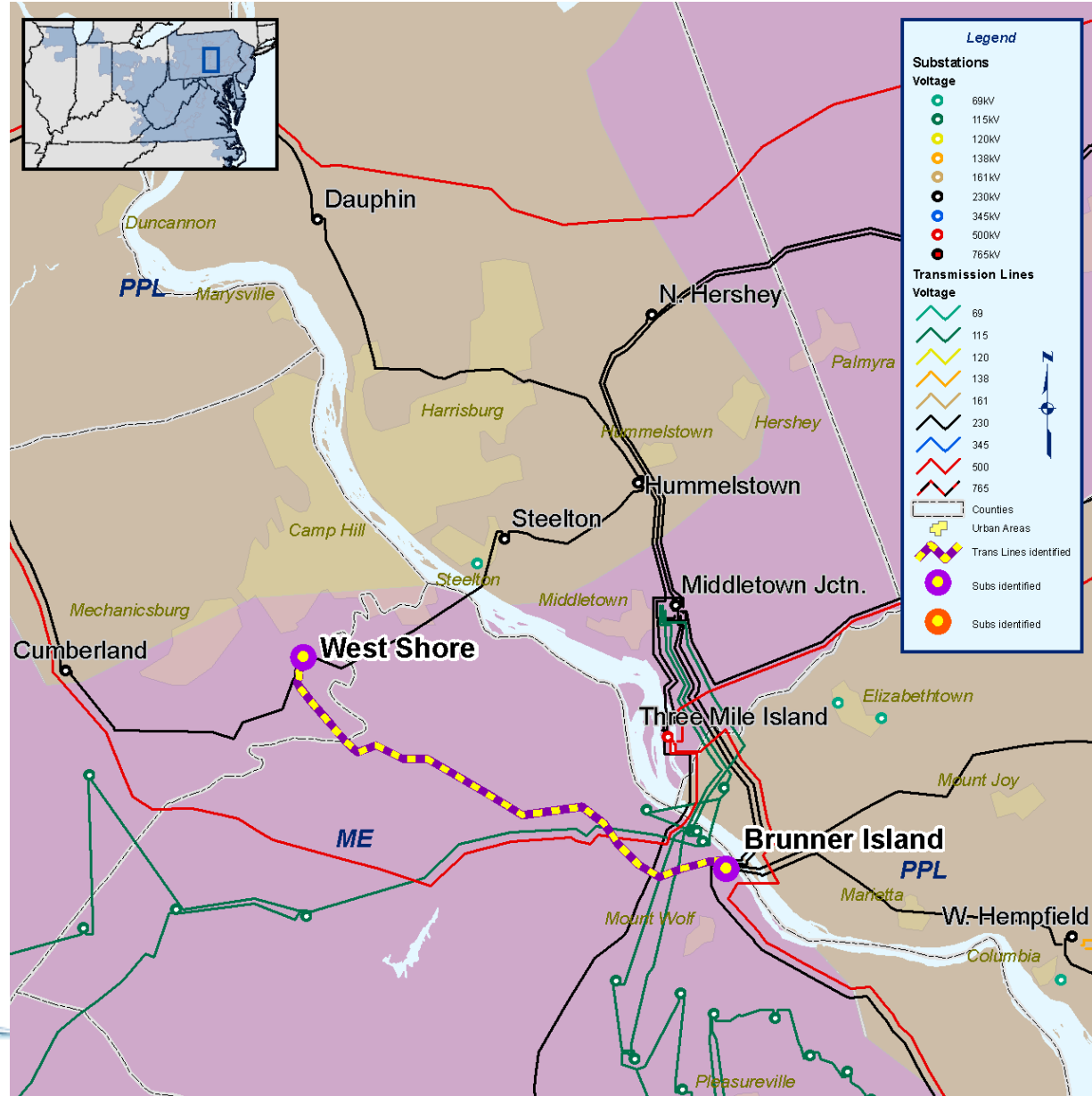
Recommended Solution:
 Rebuild existing Brunner Island – West Shore 230 kV line and add 2nd Brunner Island – West Shore 230 kV line

Estimated Project Cost: \$34 M

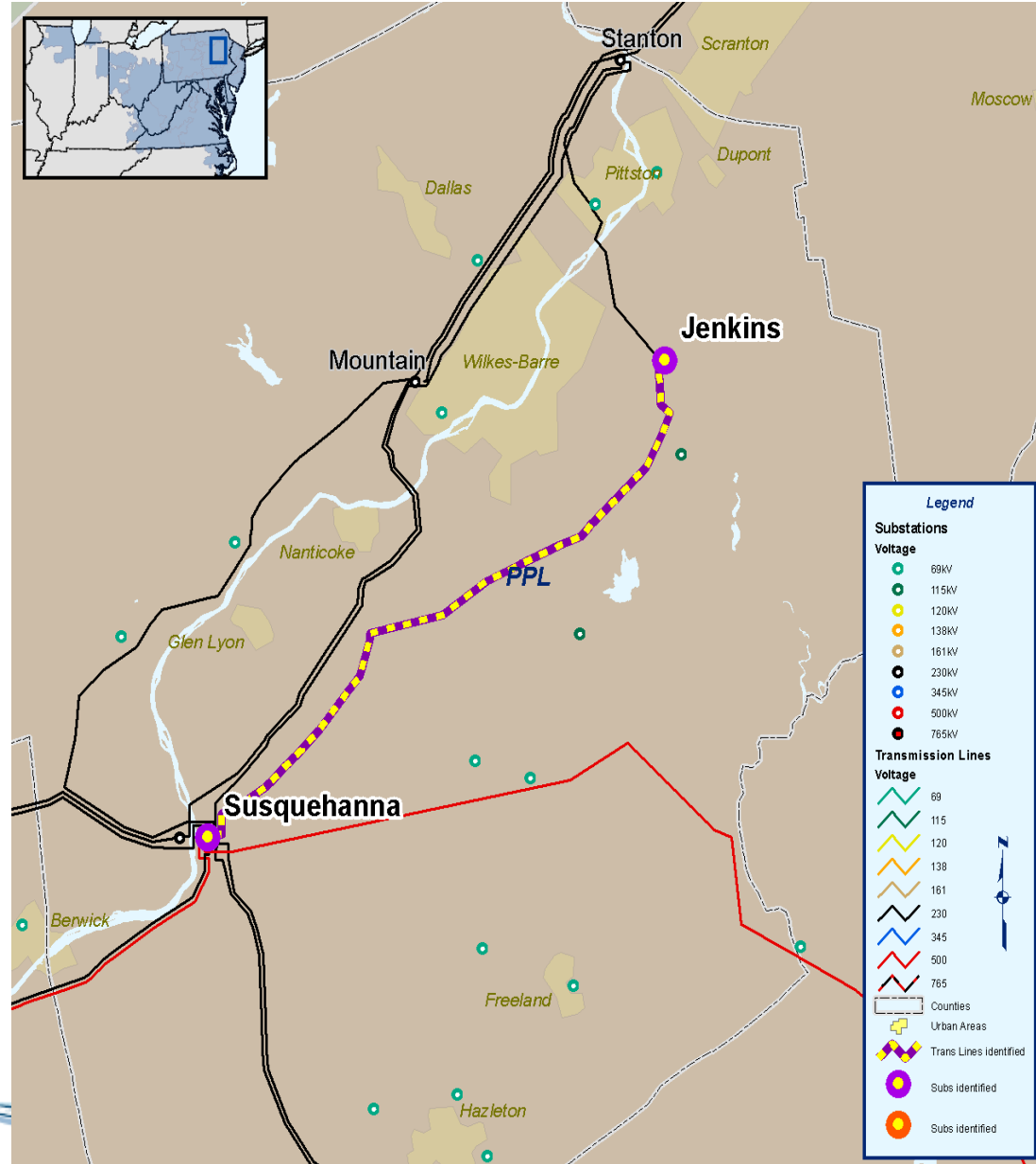
Expected IS Date: 6/01/2013



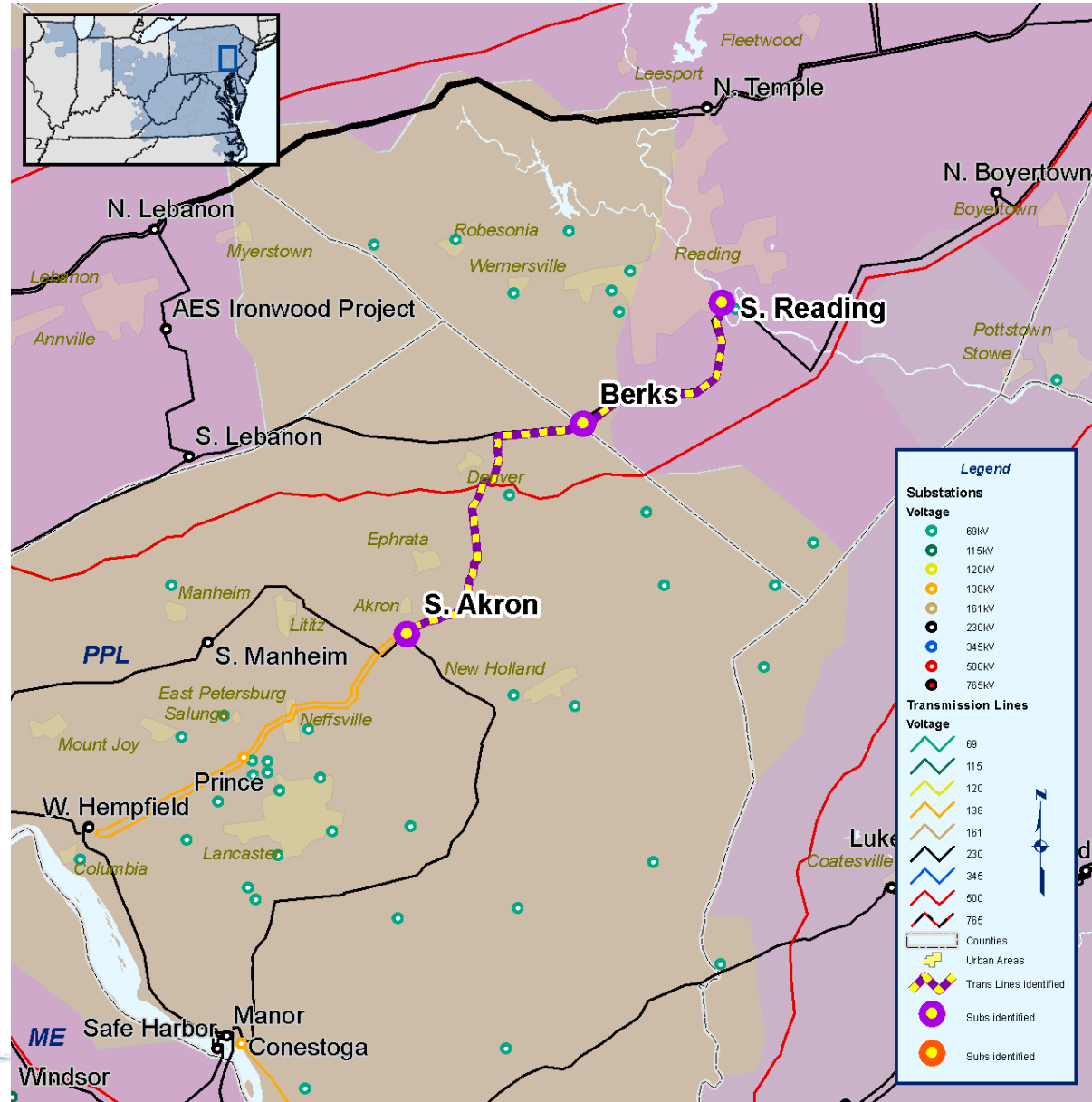
- The following upgrade addresses the previous 6 violations prior to the Brunner Island – West Shore 230 kV line rebuild in 2013
- Recommended Interim Solution: SPS Scheme to drop 190 MVA of 69 kV radial load at West Shore and 56 MVA of 69 kV radial load at Cumberland
- Estimated Project Cost: \$0 M
- Expected IS Date: 6/01/2010



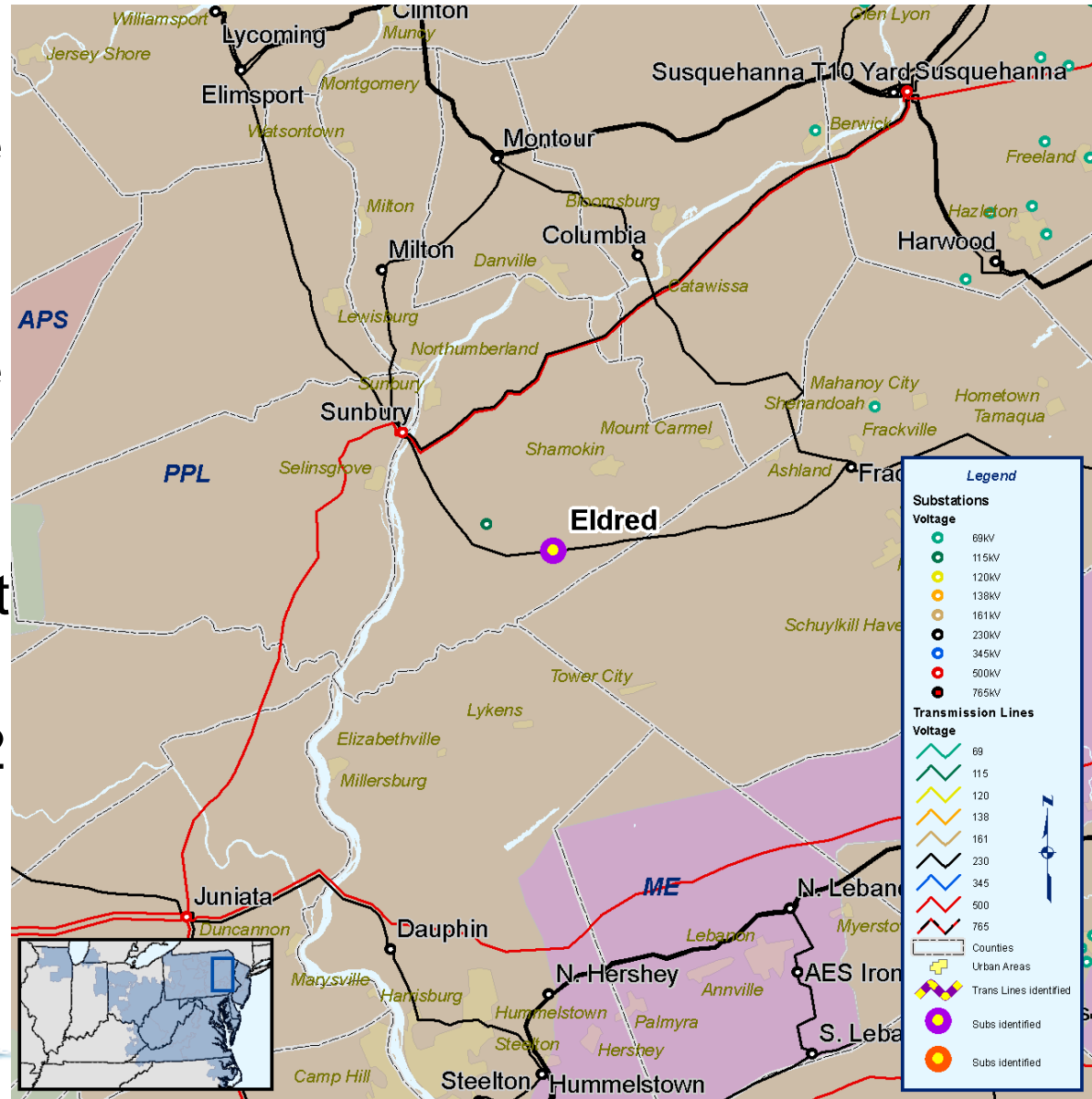
- Susquehanna – Jenkins 230 kV line / loss of Susquehanna – Lackawanna 500 kV line + loss of Mountain Tap 230 kV bus
- Susquehanna – Jenkins 230 kV line / loss of Susquehanna – Lackawanna 500 kV line + loss of Susquehanna-Mountain Tap 230 kV line
- Susquehanna – Jenkins 230 kV line / loss of Susquehanna – Lackawanna 500 kV line + loss of Stanton-H1 230 kV bus
- Recommended Solution: SPS Scheme at Jenkins substation to open the Stanton #1 and Stanton #2 230 kV circuit breakers after the second contingency
- Estimated Project Cost: \$0 M
- Expected IS Date: 6/01/2013



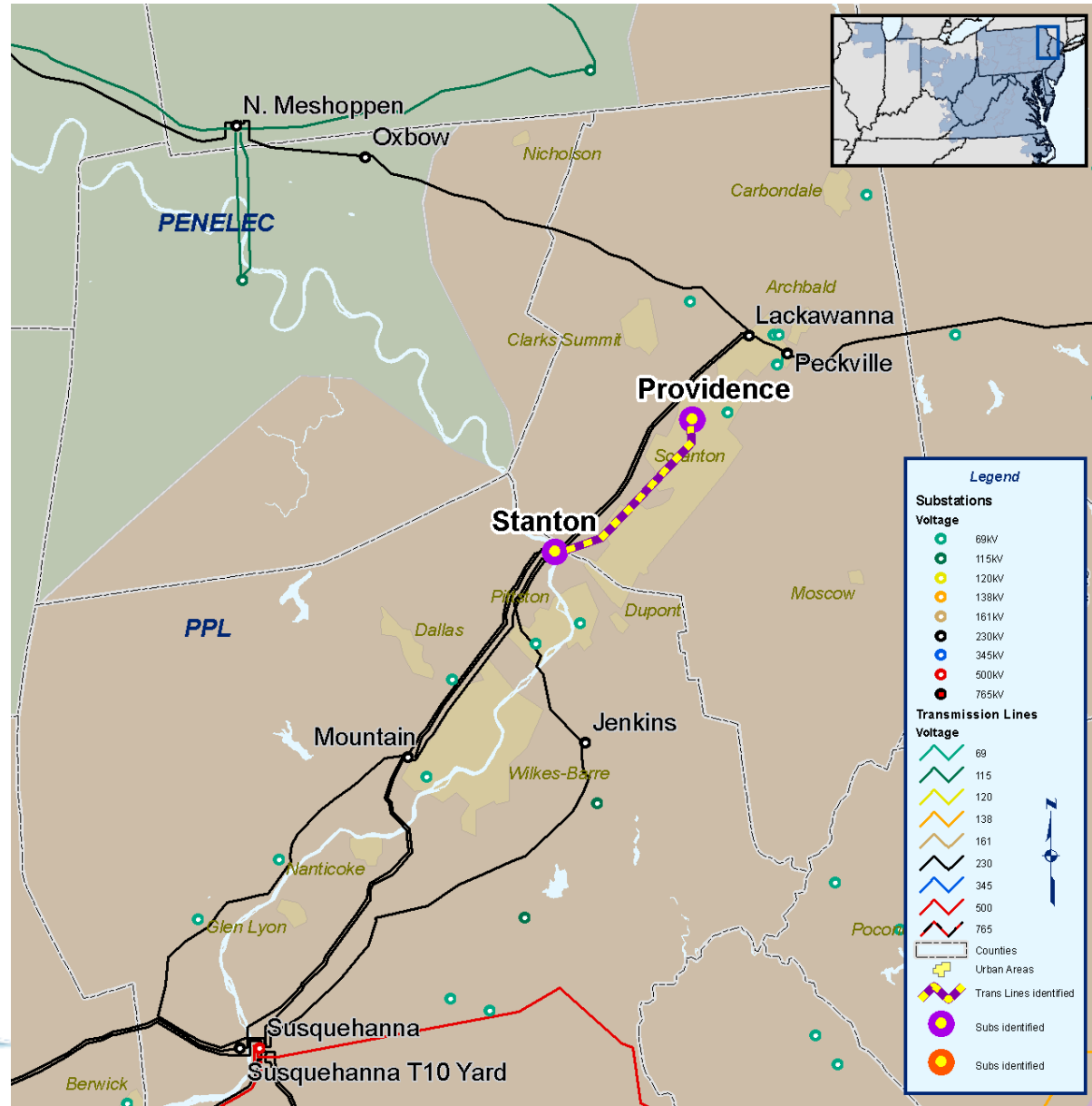
- 210 MVA load loss / loss of double circuit South Akron-South Reading 230 kV lines and Berks transformers #1 and #2
- Exceeds PPL guidelines for maximum allowable load loss
- Berks Substation modification on Berks-South Akron 230 kV Line. Modification will isolate the line fault on the South Akron line and will allow Berks transformer #2 to be energized by the South Lebanon 230kV circuit
- Estimated Project Cost: \$0.523 M
- Expected IS Date: 5/01/2010



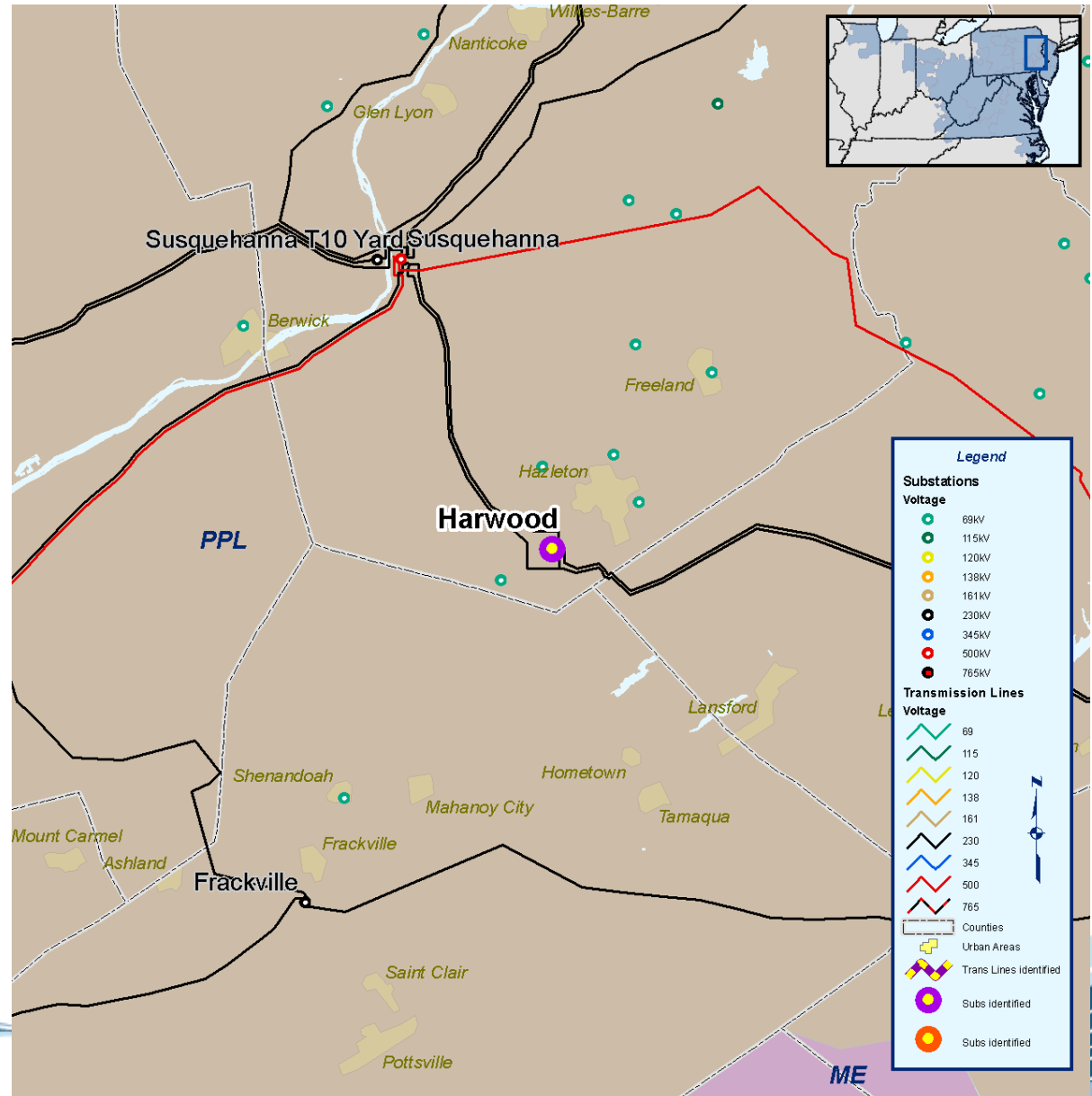
- Eldred-Pine Grove 69 kV Line / basecase
- Eldred-Pine Grove 69 kV Line Rebuild Part 2: 8 Miles
- Estimated Project Cost: \$10.22 M
- IS Date: 5/1/2012



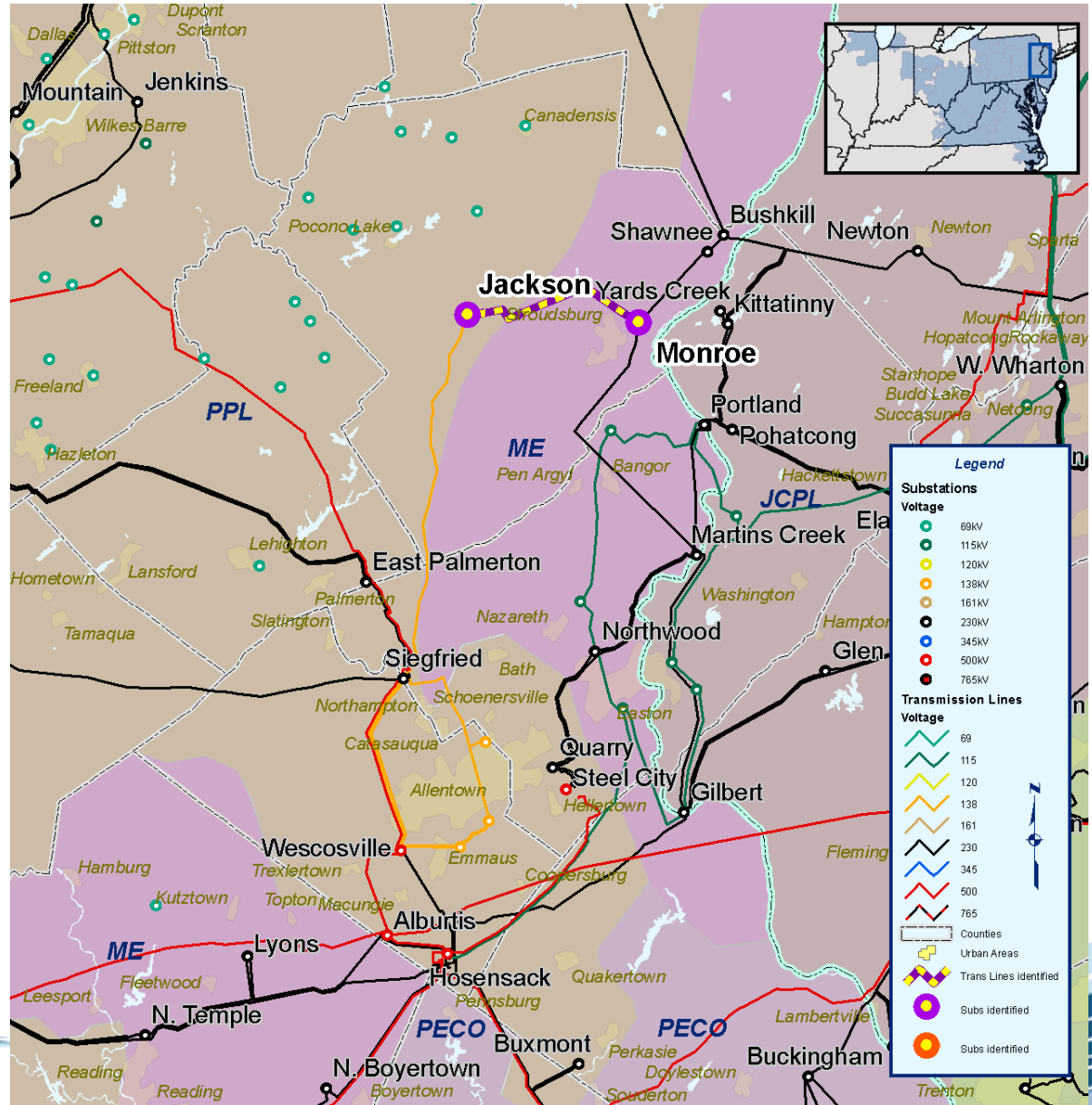
- Several overloads in Lackawanna/Providence 69 kV area / loss of DCTL
Lackawanna-Mountain 230 kV line and Lackawanna-Stanton 230 kV line
- Stanton-Providence #1 & #2 69 kV Line: Reconductor/Rebuild w/ 69 kV Design: Approximately 8 Miles Total
- Estimated Project Cost: \$4.89 M
- IS Date: 5/1/2011



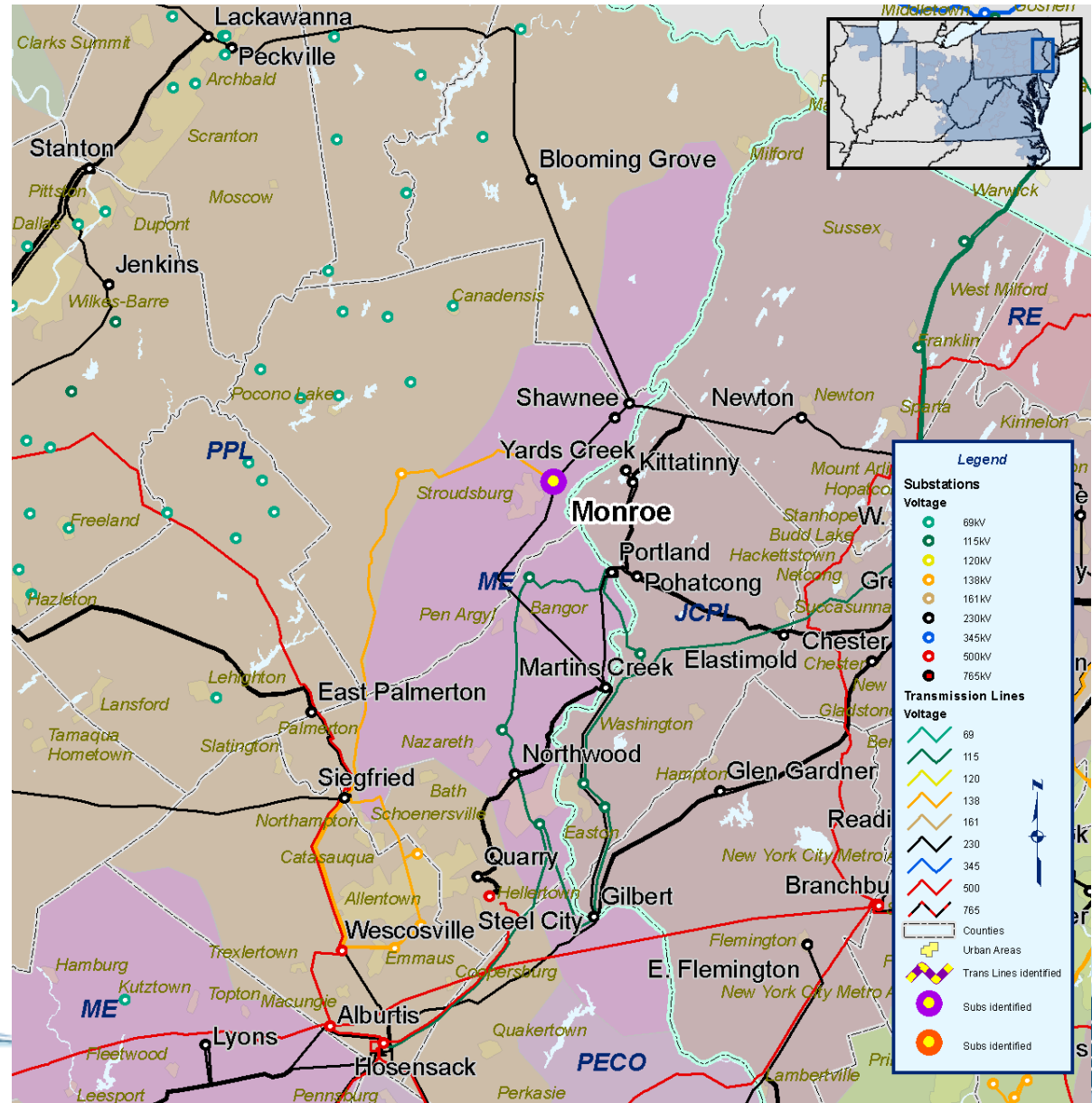
- Harwood 230/69 kV transformer / loss of DCTL
Susquehanna-Harwood #1 & #2 230 kV lines
- Harwood Substation: Add 150MVA, 230/138/69 Transformer #6
- Estimated Project Cost: \$13.97 M
- IS Date: 11/1/2011



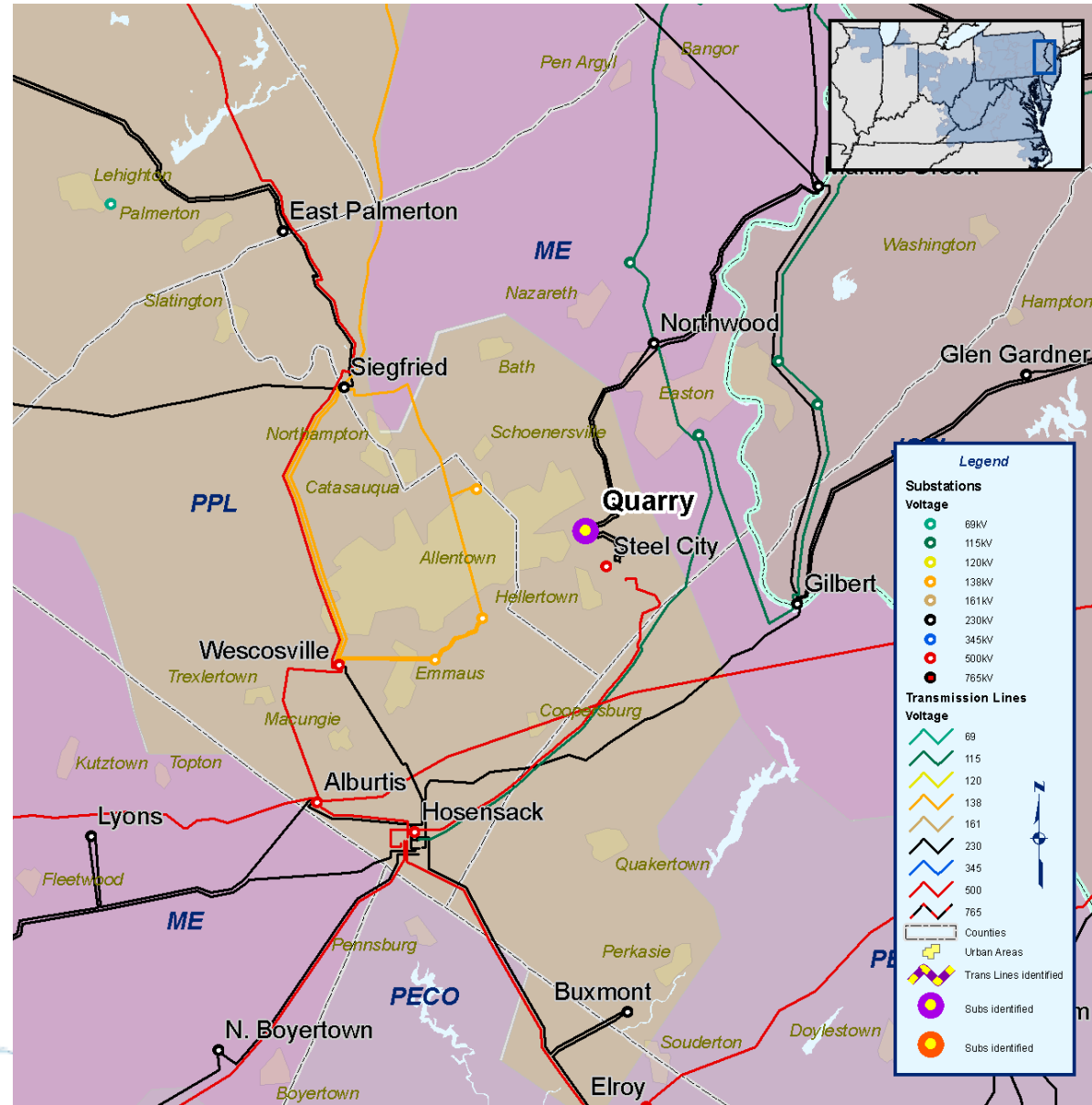
- Siegfried-Jackson 138 kV line / loss of Monroe-Jackson 138 kV line and low voltage in Jackson 69 kV area
- Bartonsville Substation- New 138kV tap off Monroe-Jackson #1
- Stroudsburg Substation: New 138kv Taps from Monroe-Jackson Lines
- Gilbert Substation: New 138kV tap off Siegfried-Jackson #2 to Transformer #2
- Estimated Project Cost: \$1.95 M
- IS Date: 11/1/2010



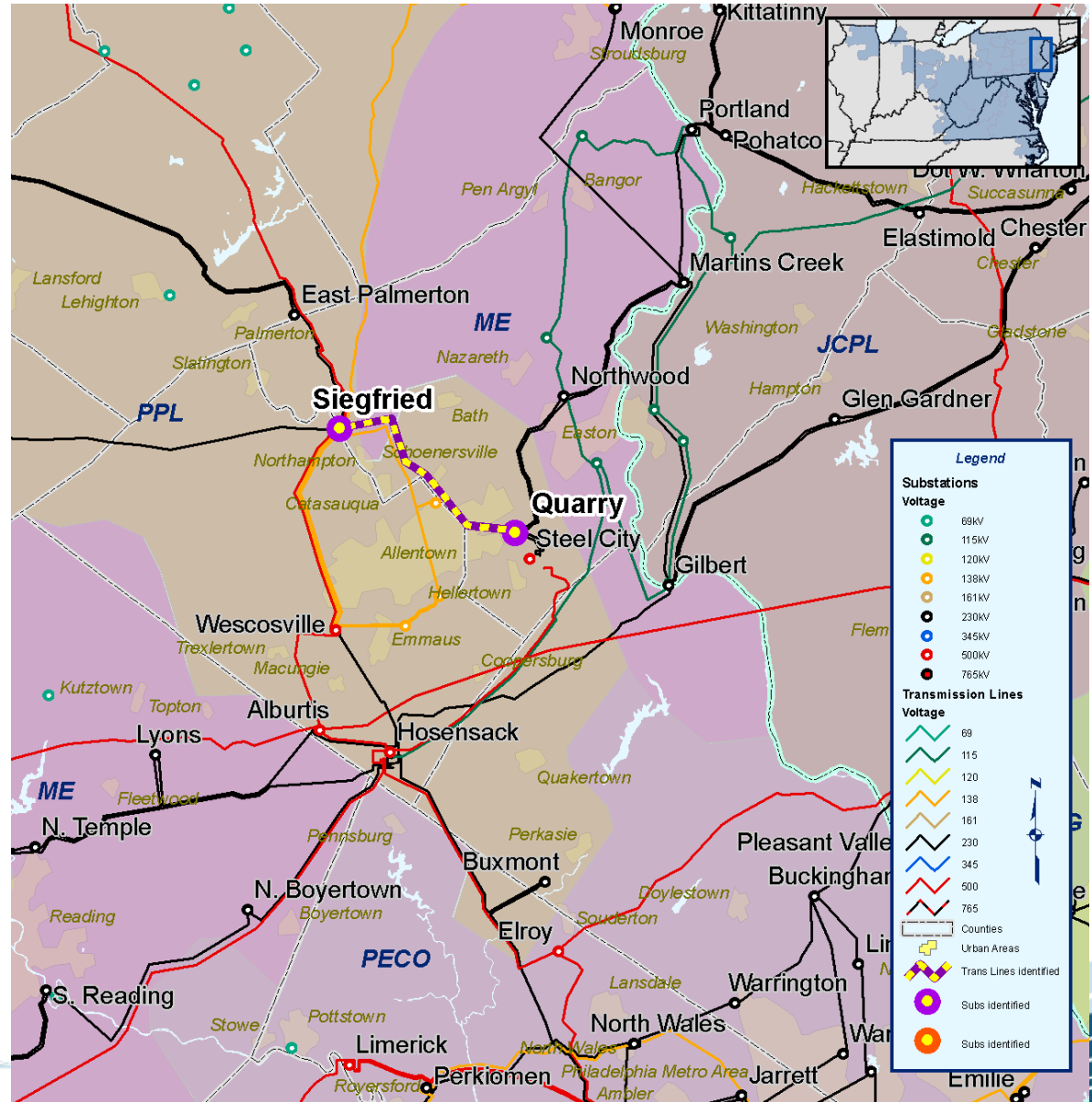
- Siegfried-Jackson 138 kV line / loss of Monroe-Jackson 138 kV line and low voltage in Jackson 69 kV area
- Monroe 230-138 kV Substation: New 138 kV Line and Terminal
- Siegfried 230/138 kV Substation: New 138 kV Line and Terminal, Add Second Circuit to Siegfried-Jackson for 8.0 Miles
- Jackson 138/69 kV Substation: 138 kV Yard Upgrades and Transmission Line Rearrangements
- Estimated Project Cost: \$10.03 M
- IS Date: 11/1/2010



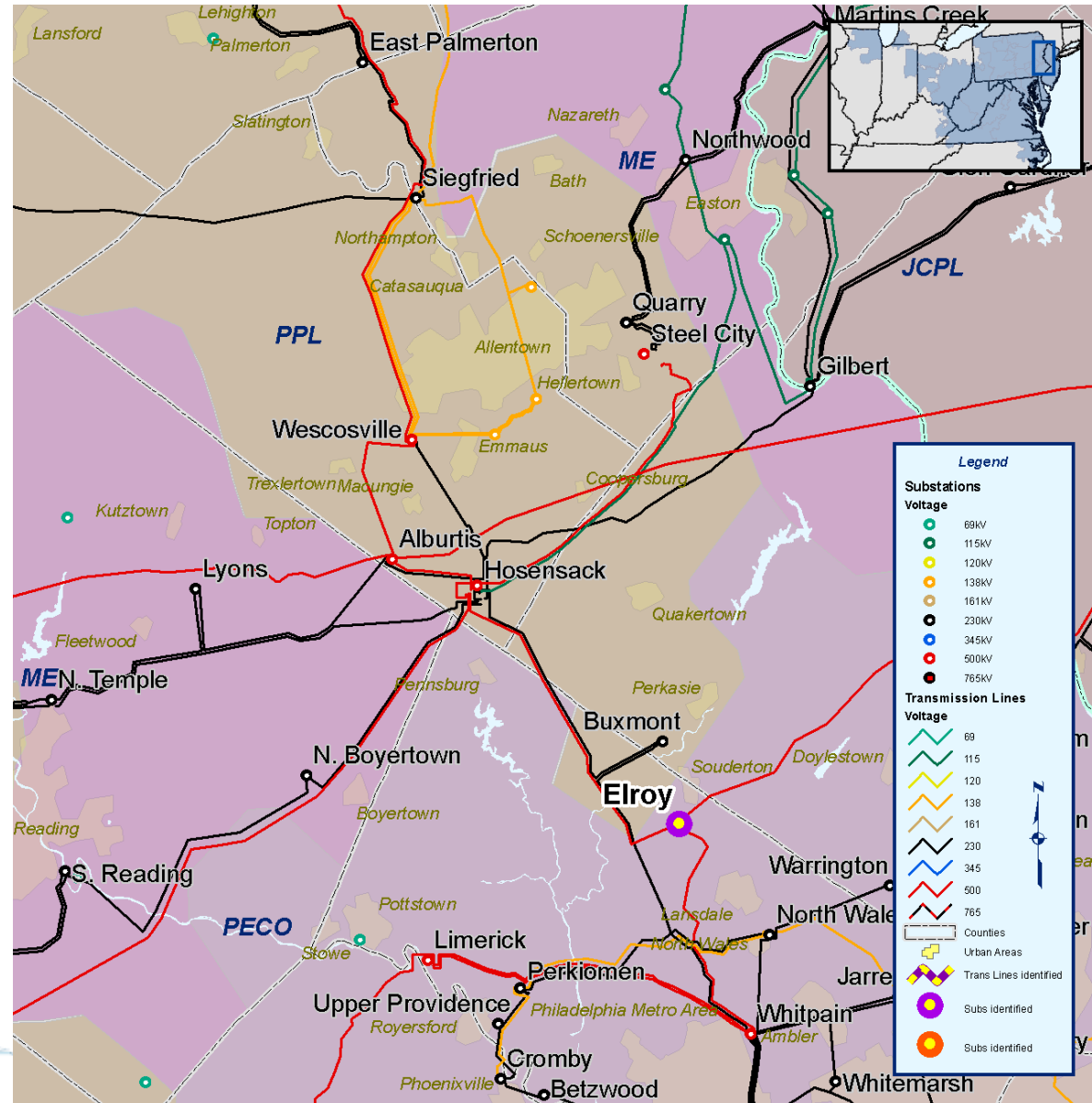
- South Farmersville 69 kV overloads / basecase
- South Farmersville Substation: New 69kV Tap off Nazareth-Quarry #2 to Transformer #2
- Estimated Project Cost: \$0.40 M
- IS Date: 5/1/2011



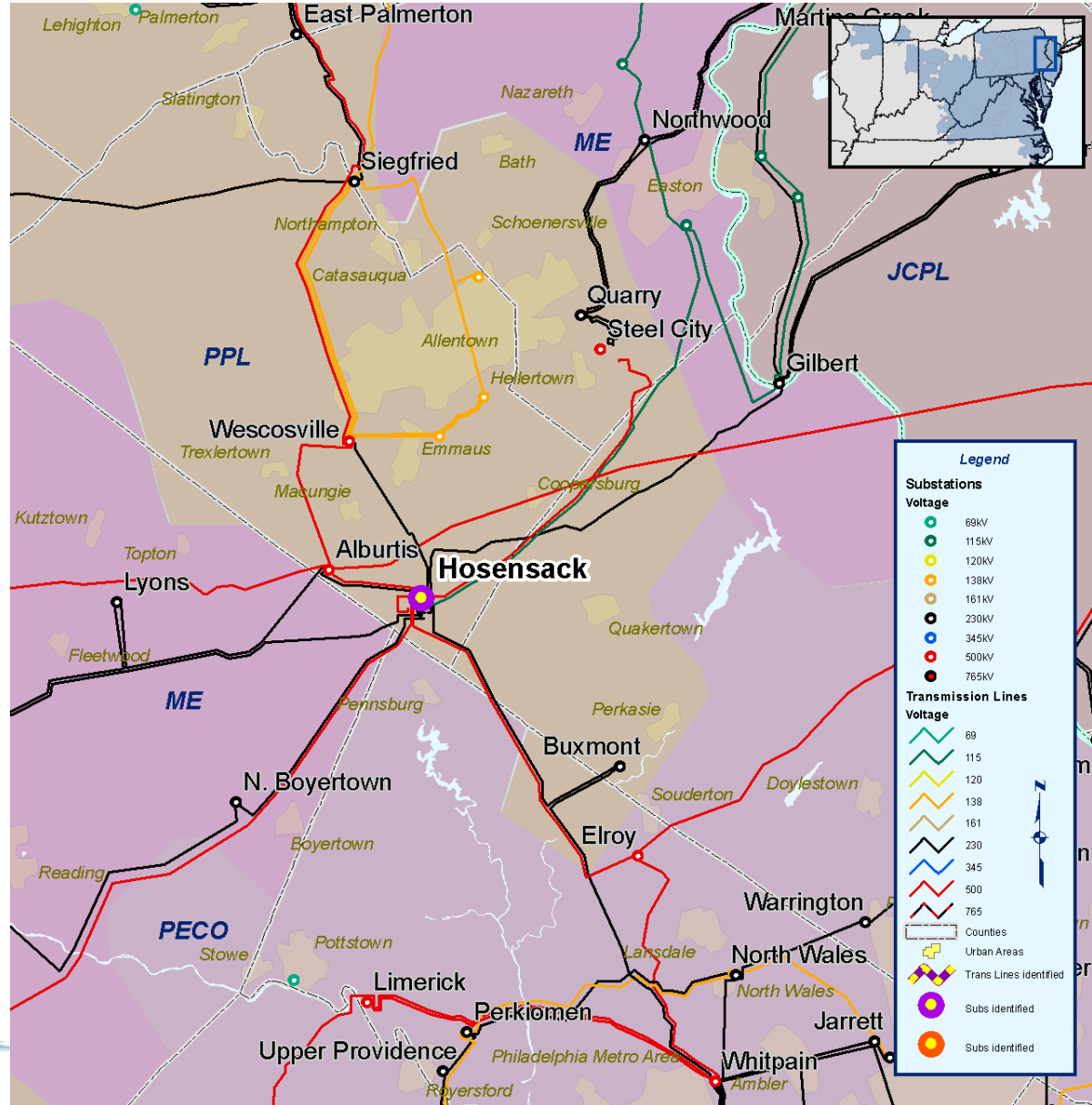
- Siegfried-Quarry 69 kV Line / basecase
- Siegfried-Quarry 69 kV Line Rebuild from Siegfried to North Bethlehem: 6.7 Miles
- Estimated Project Cost: \$5.0 M
- IS Date: 5/1/2011



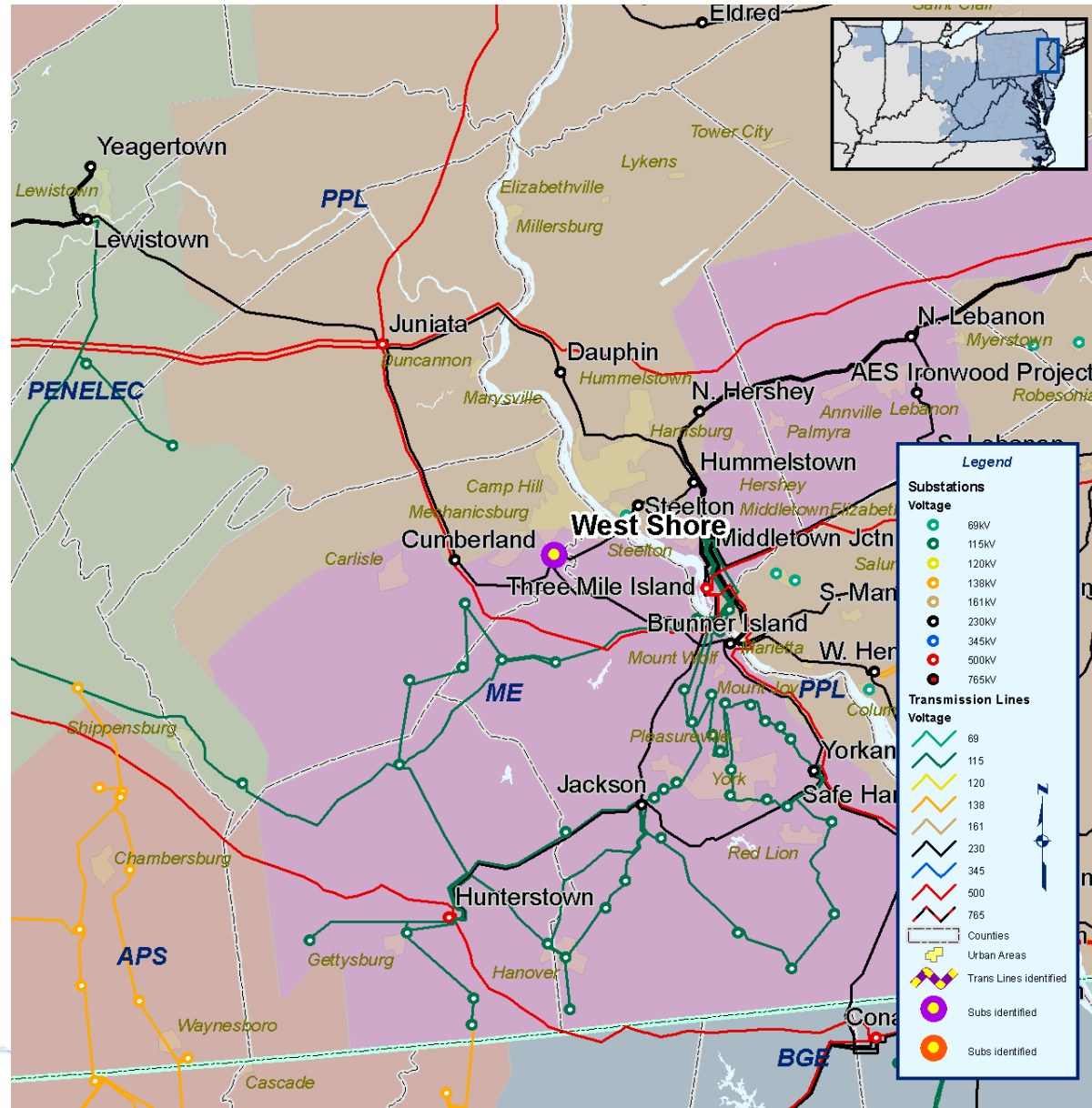
- Buxmont-Hatfield #3 69 kV line / loss of Buxmont-Hatfield #4 69 kV line
- Elroy 138/69 kV transformer / loss of Hosensack-Buxmont 230 kV line and associated Buxmont 230/69 kV T2.
- Elroy Substation Expansion and New Elroy-Hatfield 138/69 kV Double Circuit Lines: 1.9 Miles
- Estimated Project Cost: \$38.42 M
- IS Date: 5/1/2013



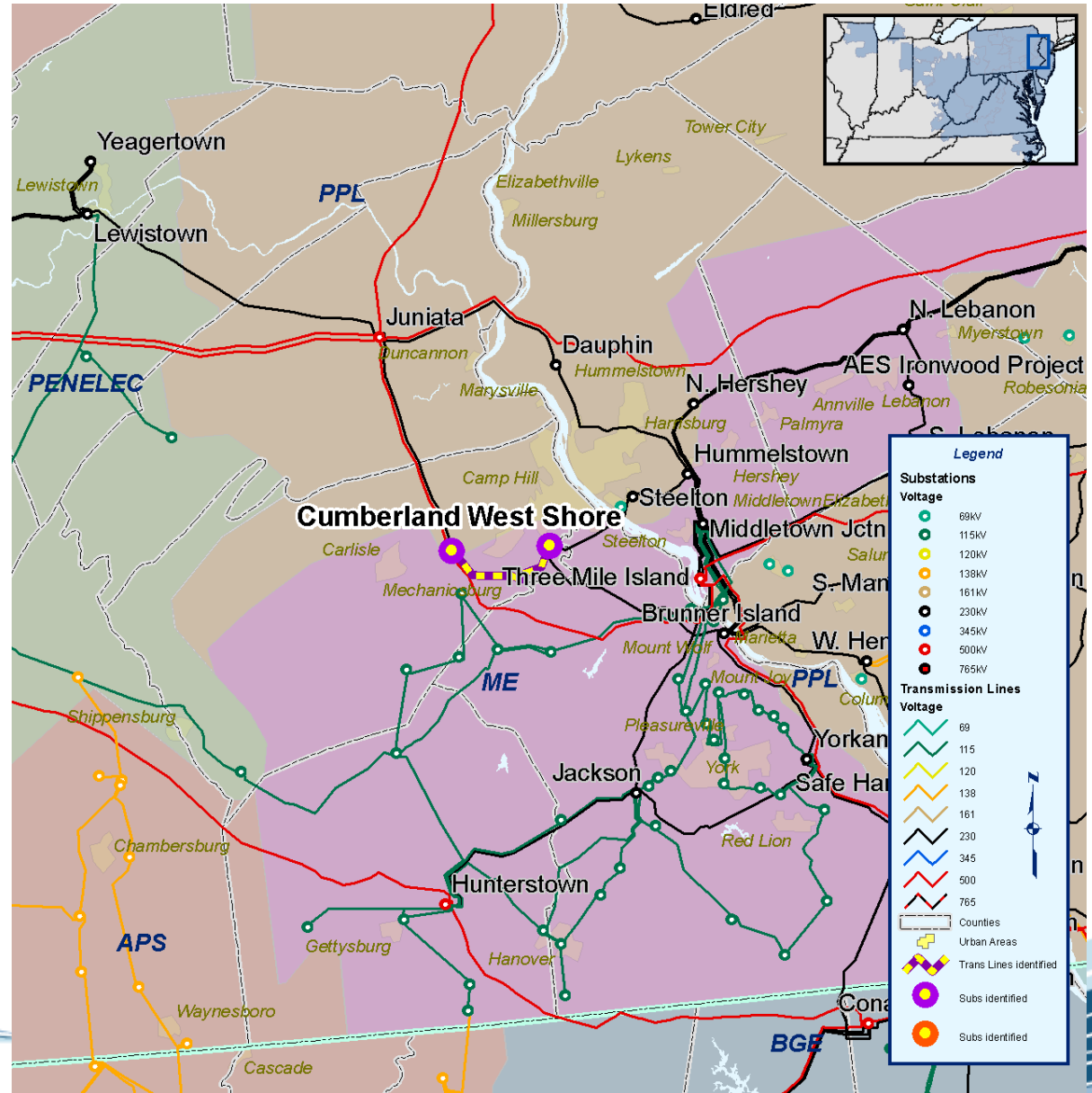
- Quarry-Elliott Heights #1 69 kV Line / loss of Quarry-Elliott Heights #3 69 kV Line
- Seidersville-Quakertown 138/69 kV Reconductor/ Rebuild 12 Miles and Hosensack New 75 MVA, 230/69 kV Transformer #4
- Estimated Project Cost: \$23.14 M
- IS Date: 5/1/2009



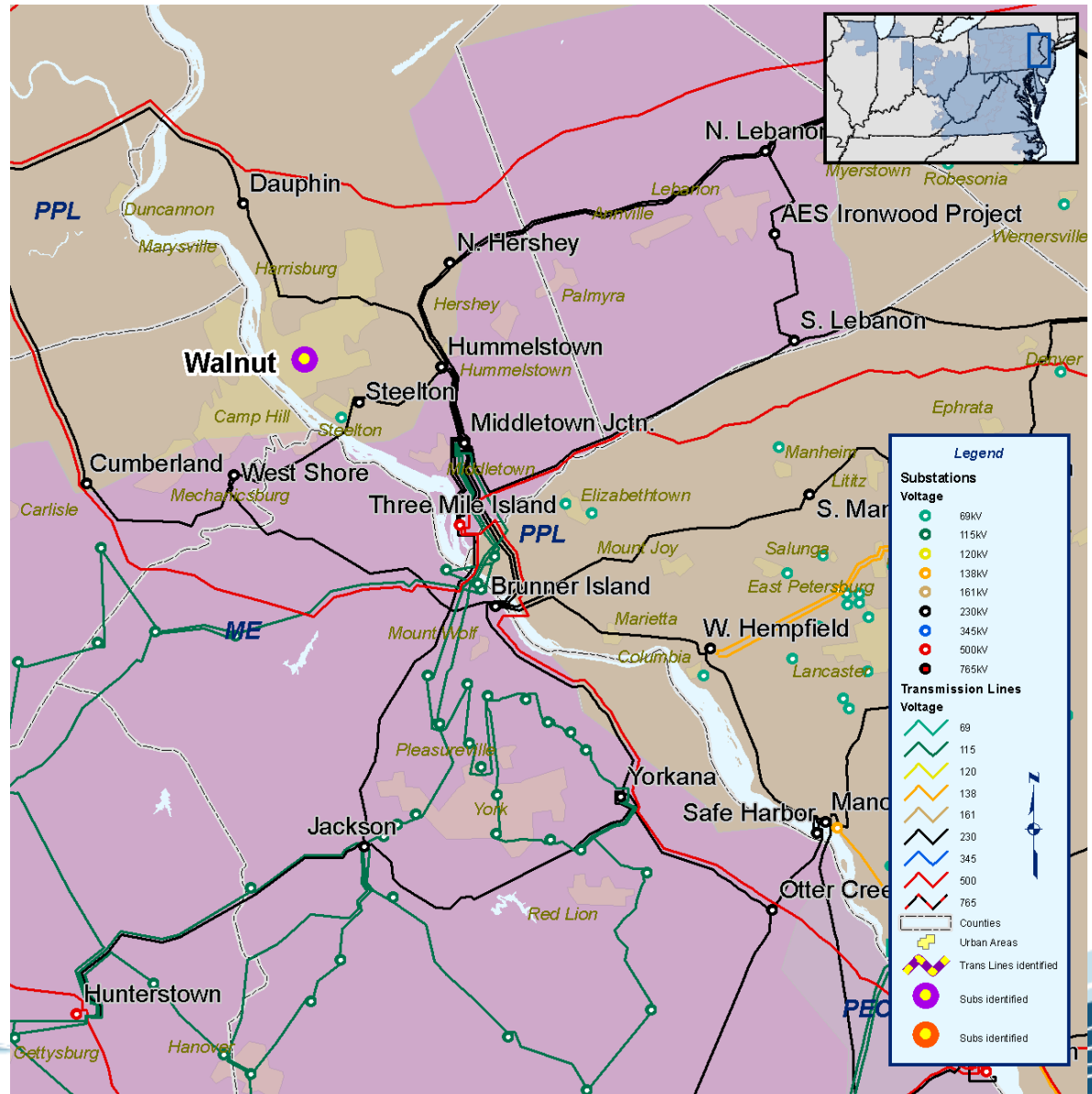
- West Shore-Cumberland #1 69 kV line / loss of West Shore 69 kV bus section 2
- New Double Circuit 138/69 kV Line from West Shore to Whitehill Taps: 1.3 Miles
- Estimated Project Cost: \$4.91 M
- IS Date: 5/1/2013



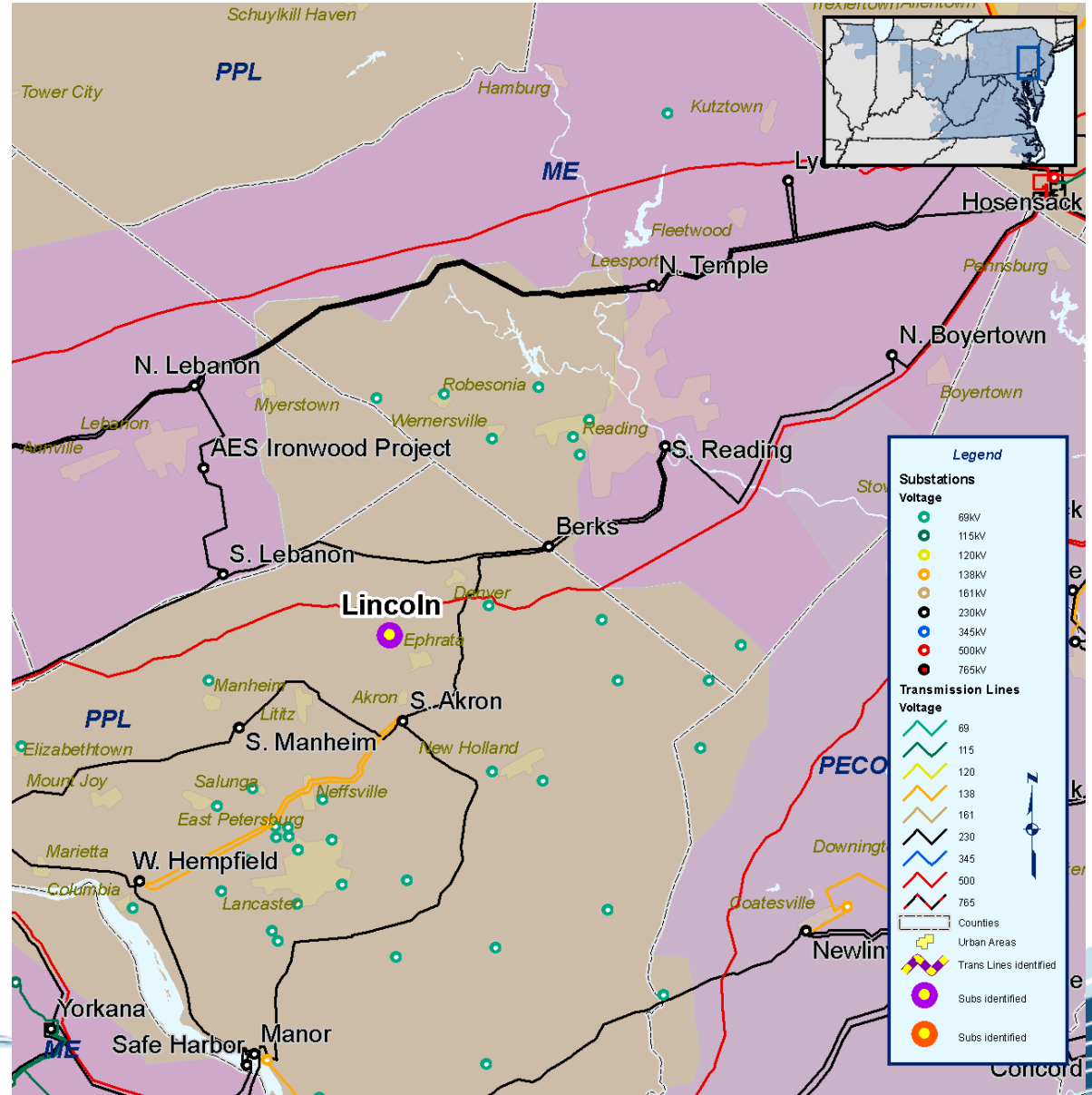
- West Shore-Cumberland #2 69 kV line / basecase
- Cumberland-West Shore 69 kV Double Circuit Line: Reconductor 3.7 Miles from Cumberland to Wertzville
- Estimated Project Cost: \$2.87 M
- IS Date: 12/1/2009
- West Shore-Cumberland #3 & #4 69 kV lines / Cumberland #1 & #2 230/69 kV transformers
- Reconductor West Shore-Cumberland #3 & #4 69 kV Lines from Mt. Allen to Rossmoyne: 1.6 Miles
- Estimated Project Cost: \$1.03 M
- IS Date: 5/1/2013



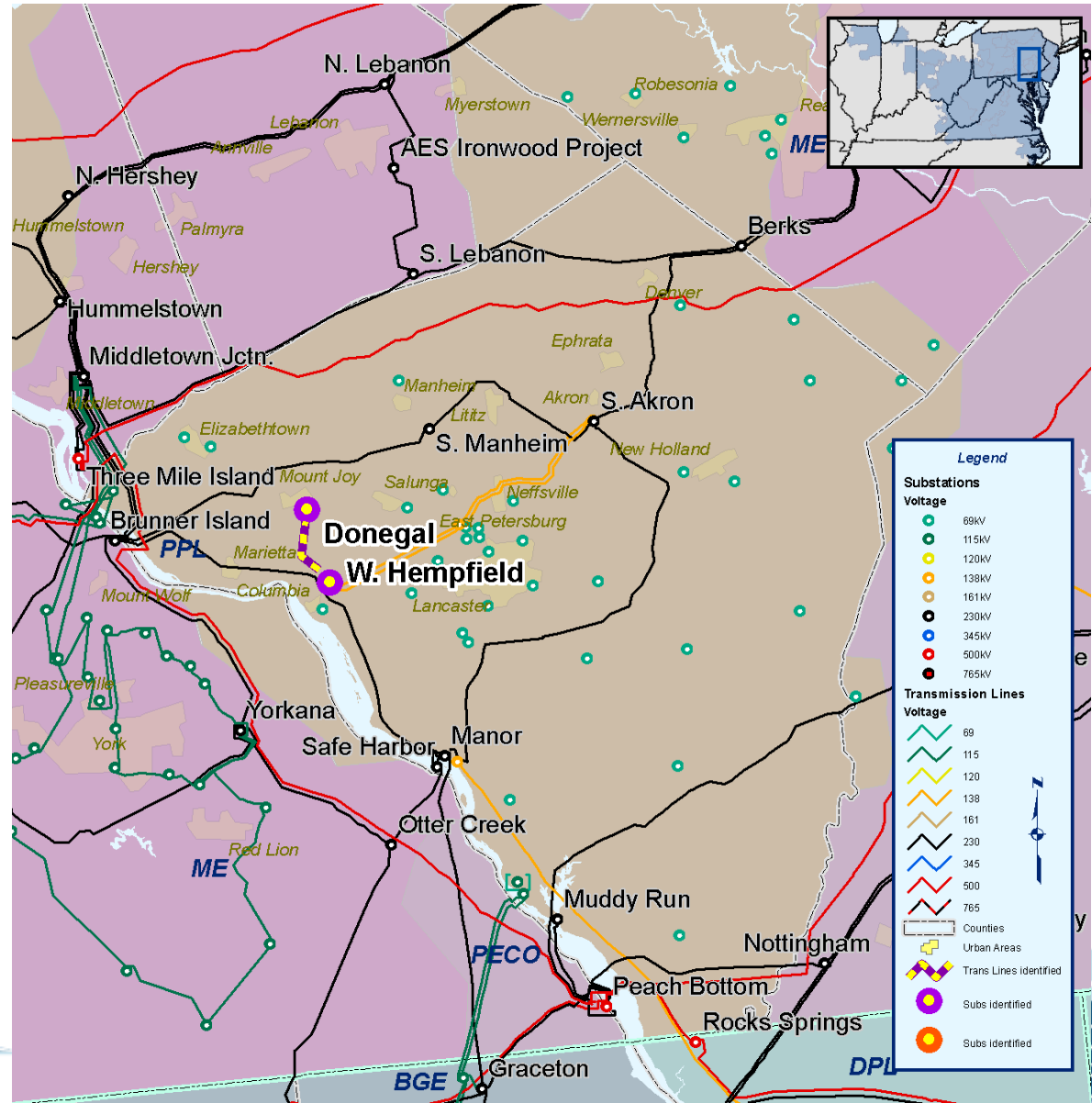
- Harrisburg-Captial Park #1 69 kV line / loss of Dauphin 69 kV bus section 1
- Replace UG Cable from Walnut Substation to Center City Harrisburg Substation for Higher Ampacity: 0.25 Miles
- Estimated Project Cost: \$1.73 M
- IS Date: 5/1/2013



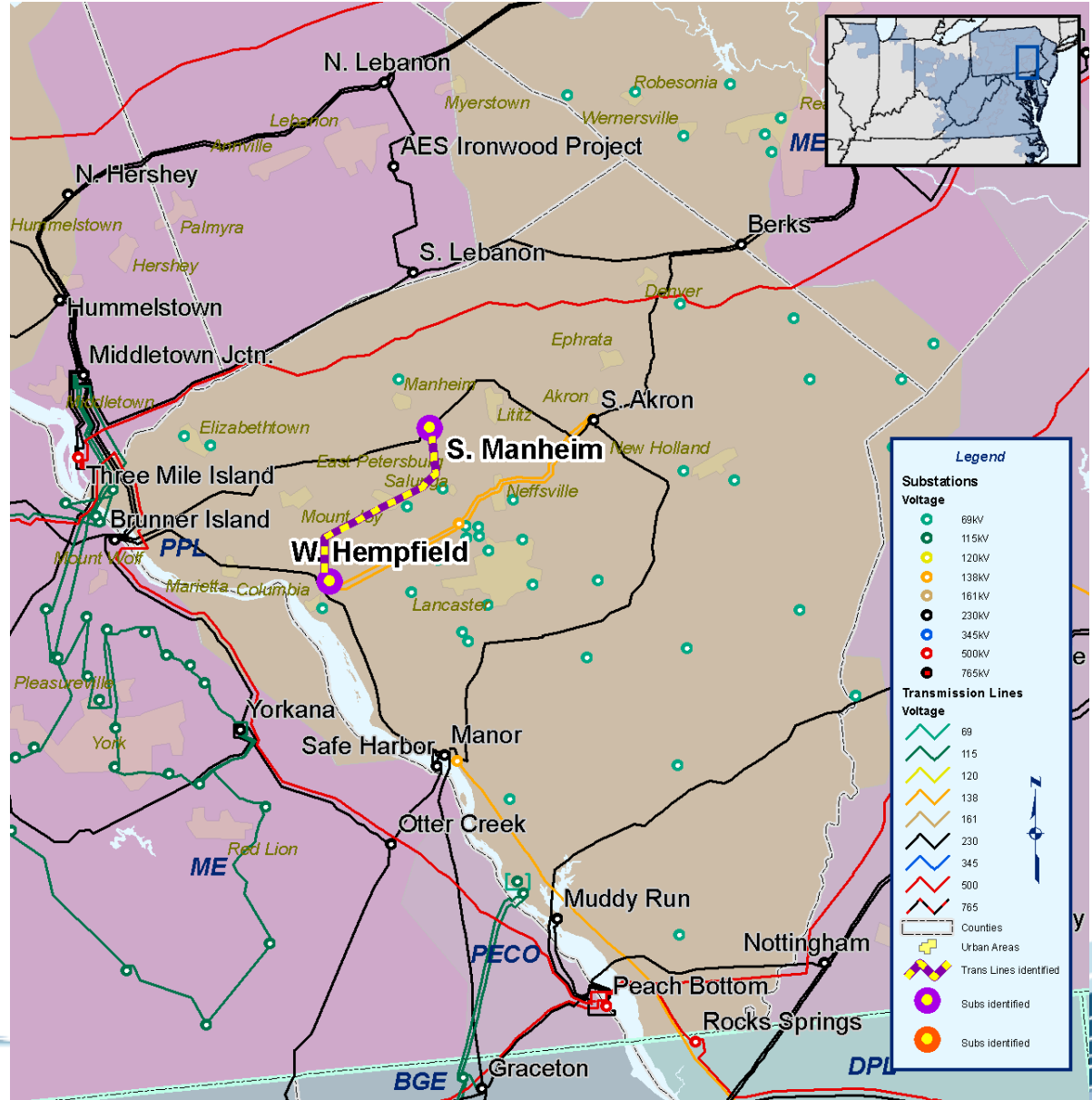
- Lincoln 69 kV transformer / basecase
- Lincoln Substation- 69 kV Tap to Convert to Modified Twin A
- Estimated Project Cost: \$0.12 M
- IS Date: 11/1/2012



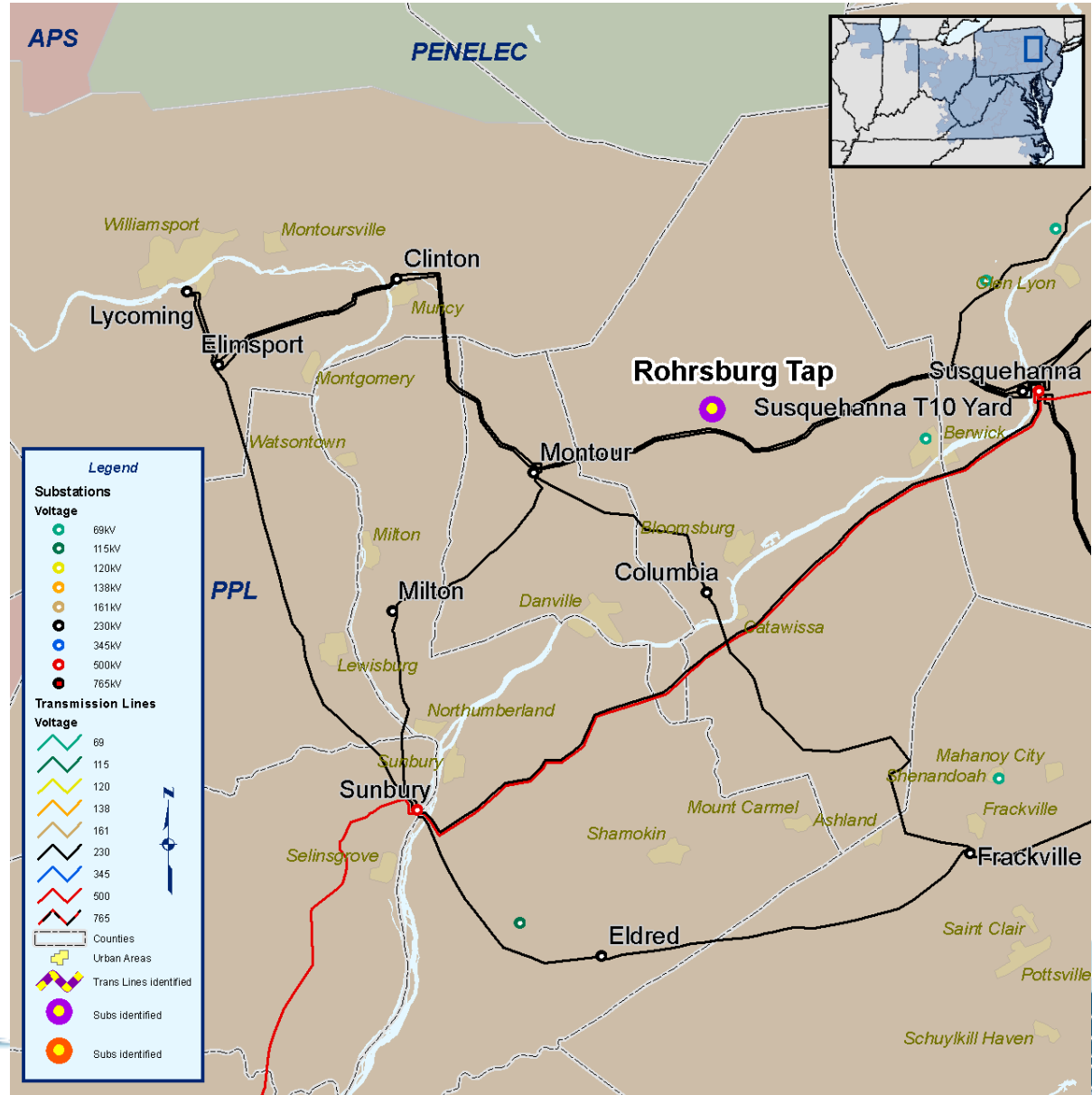
- W. Hempfield - Donegal 69 kV Line / loss of DCTL West Hempfield-Grin & West Hempfield-Hummelston 69 kV lines
- W. Hempfield - Donegal 69 kV Line - Reconductor/Rebuild from Landisville Tap to Mt. Joy Substation to Double Circuit 69 kV: 2 Miles
- W. Hempfield - Donegal 69 kV line - Reconductor/Rebuild to Double Circuit from Mt. Joy Substation to Donegal Substation: 2 Miles
- Terminate new S.Manheim-Donegal 69 kV Circuit into South Manheim #3 69 kV Bay
- Estimated Project Cost: \$4.50 M
- IS Date: 10/1/2013



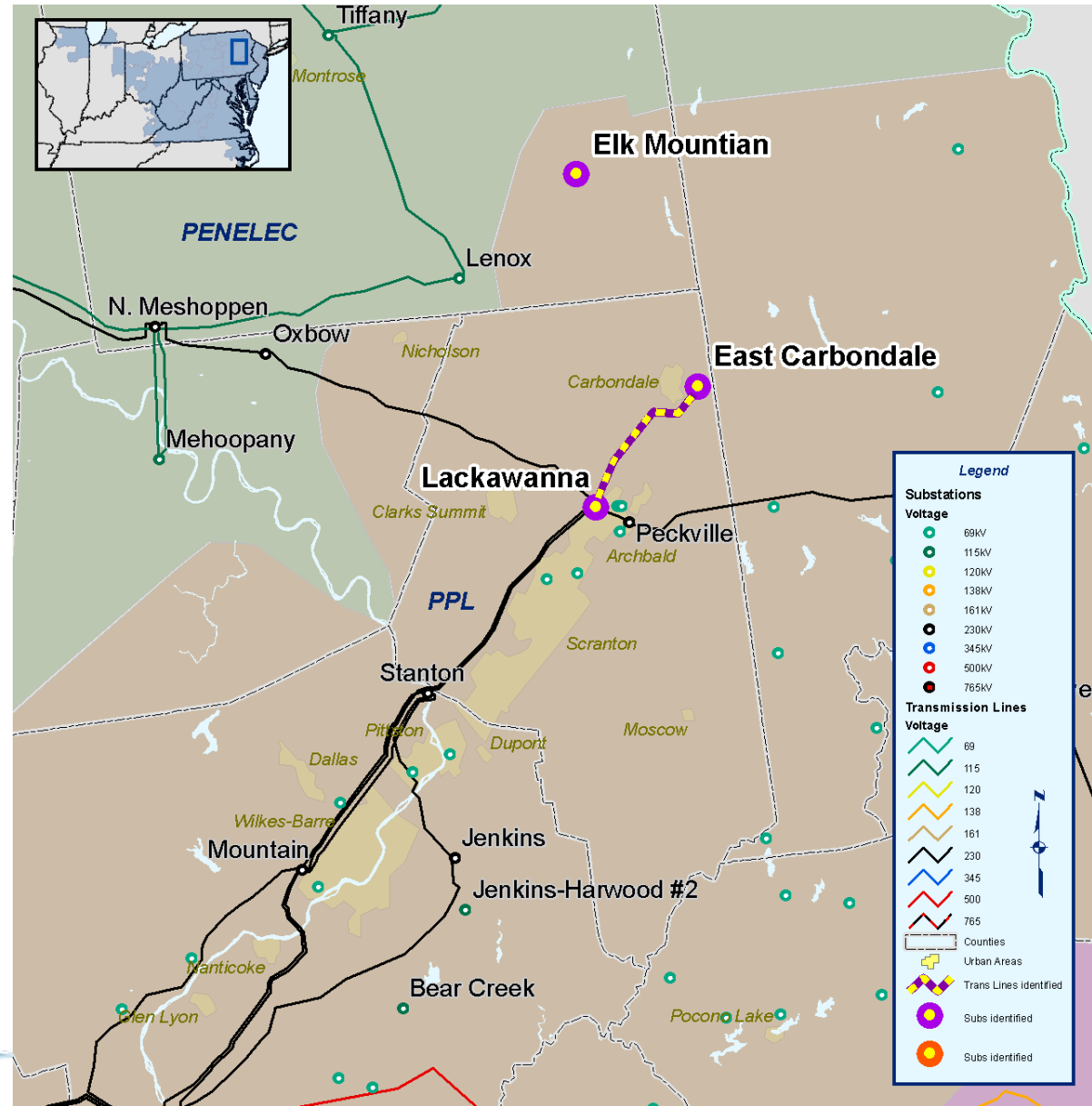
- W. Hempfield - Donegal 69 kV Line / loss of DCTL West Hempfield-Grin & West Hempfield-Hummelston 69 kV lines
- South Manheim-West Hempfield #3 69 kV Line-Rebuild from South Manheim to near Fuller Tap for Double Circuit 69 kV: 1.0 Mile
- West Hempfield - South Manheim #3 69 kV Line - Reconductor from Fuller tap to Landisville: Double Circuit 4.1 Miles
- Estimated Project Cost: \$5.66 M
- IS Date: 9/1/2011



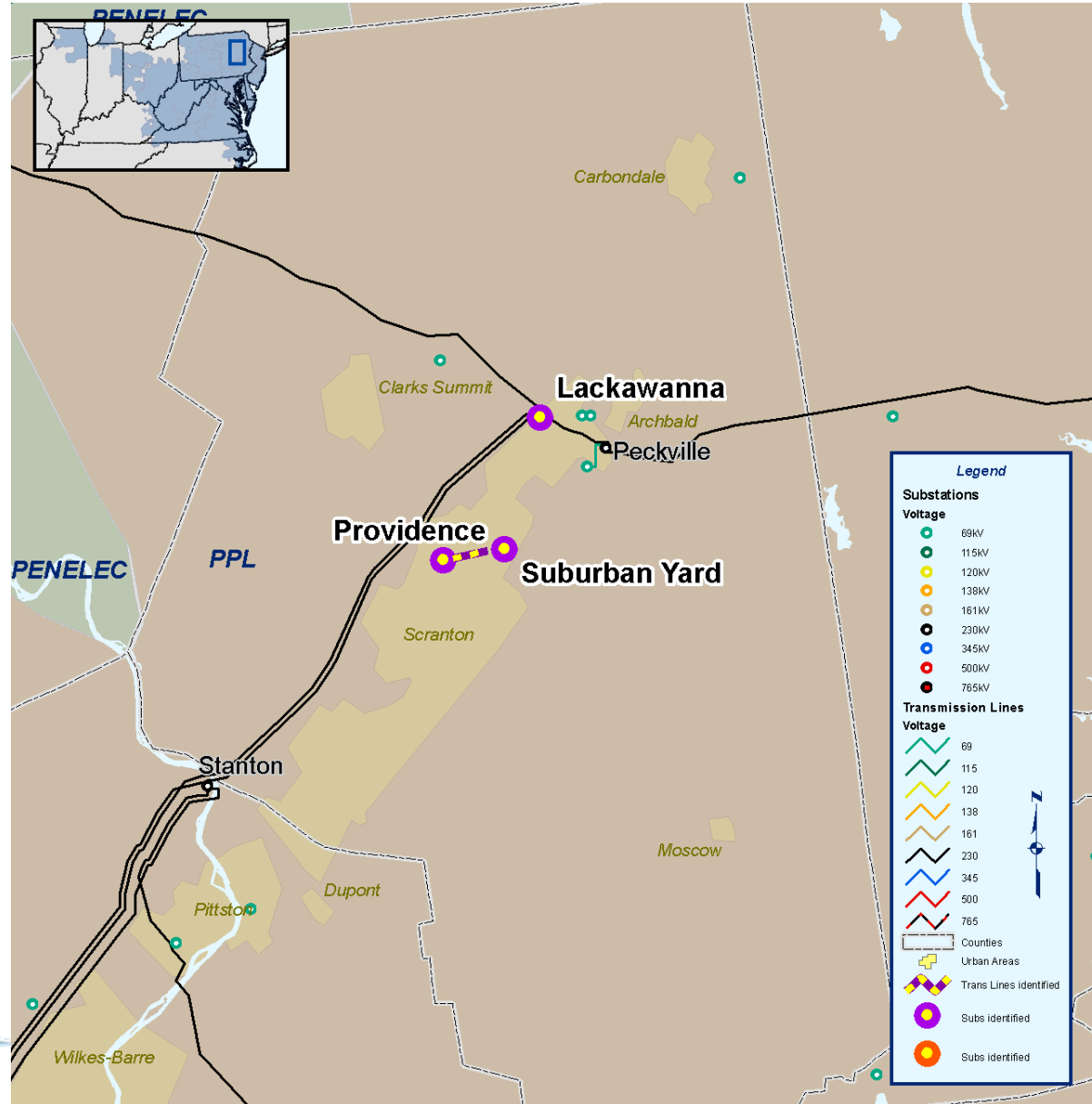
- More than 30 MW load loss / loss of the Rohrsburg Tap 69 kV bus
- Exceeds PPL guidelines for maximum allowable load loss
- New Derry-Millville 69 kV line
- Estimated Project Cost: \$9.35 M
- Expected IS Date: 11/01/2010



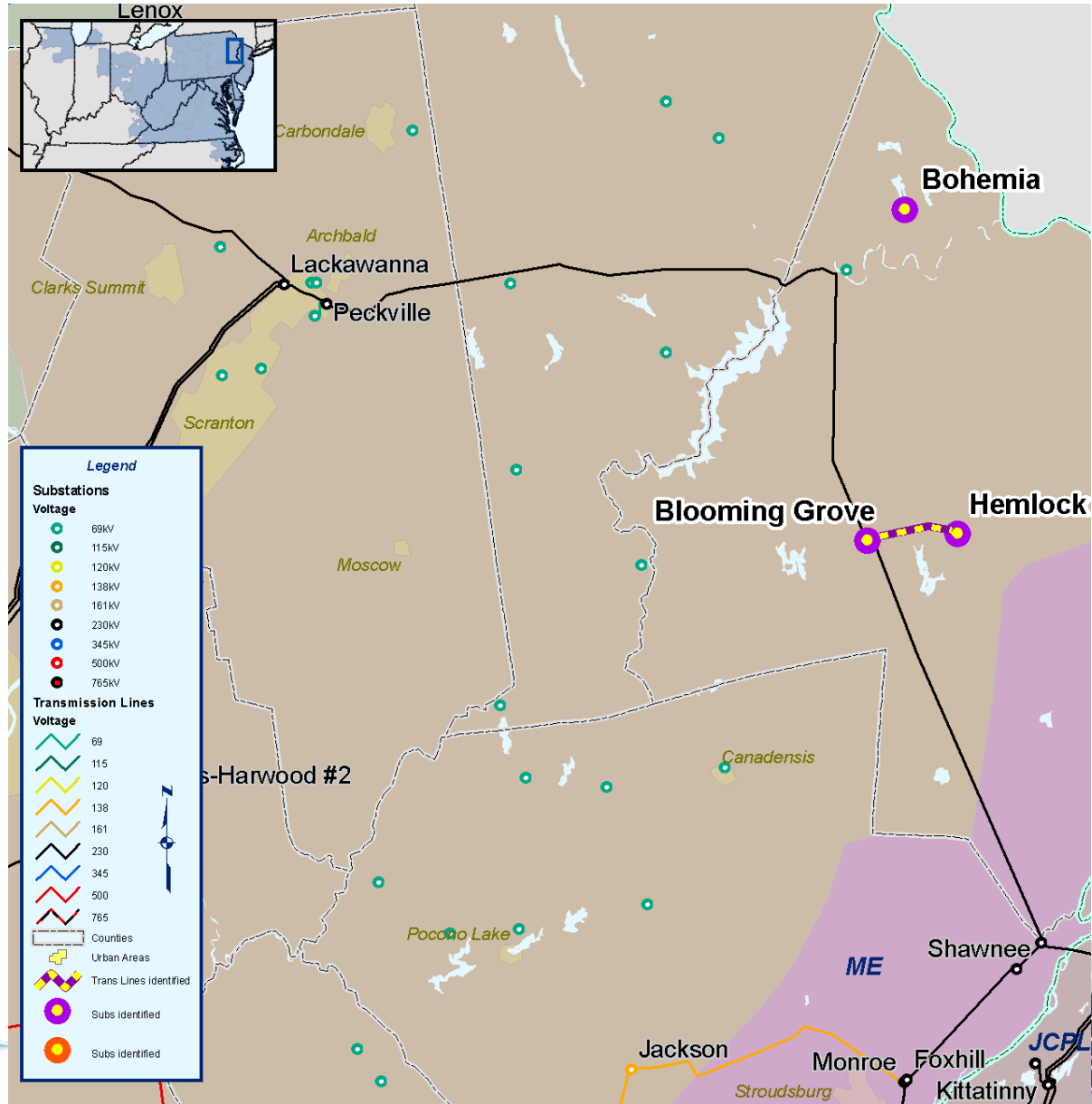
- Greenfield, Tinker, Elk Mountain 69 kV buses undervoltage / loss of Lackawanna-East Carbondale 69 kV line
- Rebuild Lackawanna-Edella 69 kV line to double circuit
- Estimated Project Cost: \$5.09 M
- Expected IS Date: 11/01/2009



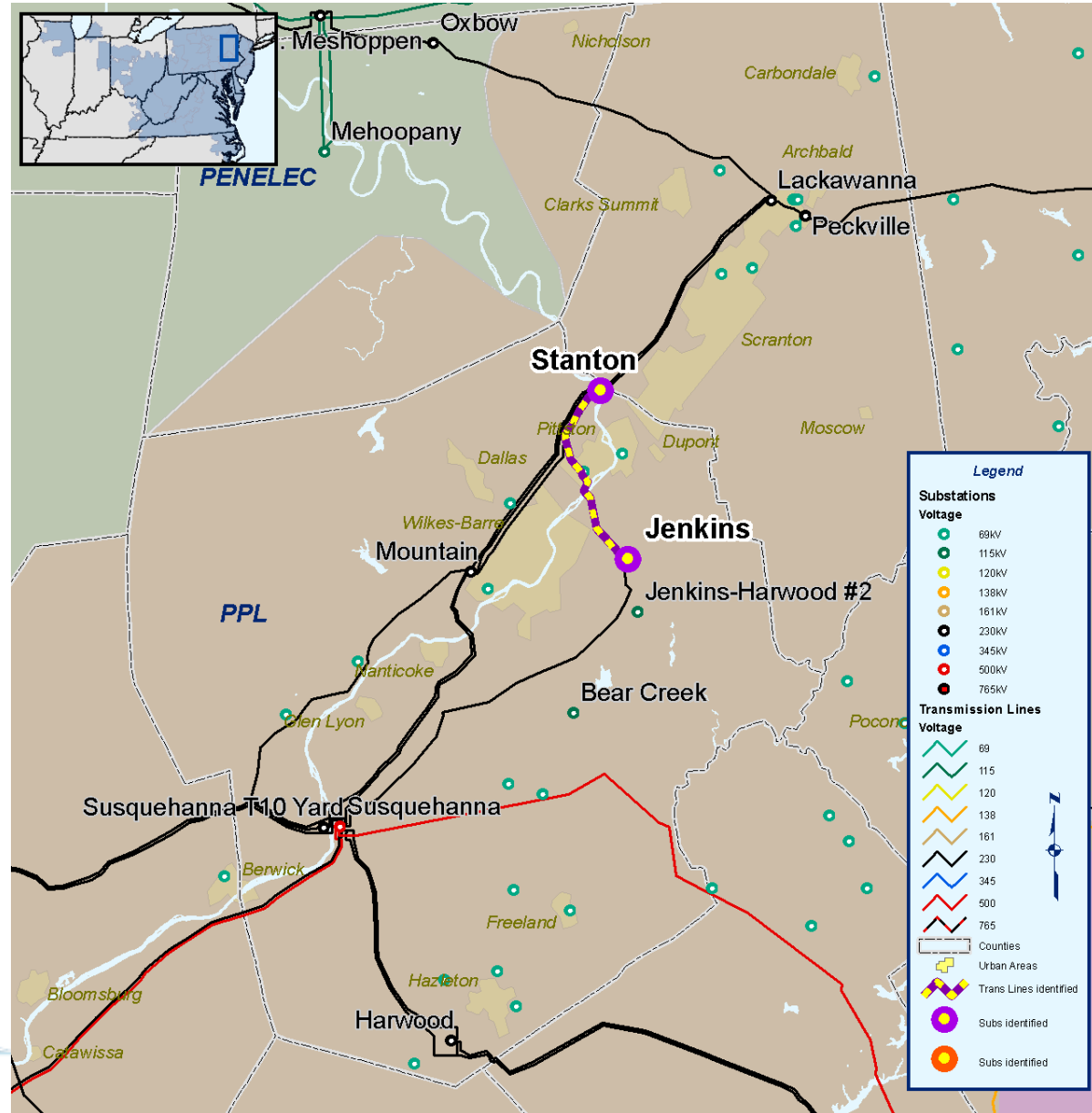
- Lackawanna-Scranton #1 69 kV line / basecase
- Reconductor Suburban-Providence #1 69 kV line & Re-sectionalize the Suburban 69 kV lines
- Estimated Project Cost: \$1.05 M
- Reconductor Suburban Taps #1 and #2 69 kV line portions
- Estimated Project Cost: \$3.84 M
- Expected IS Date: 11/01/2012



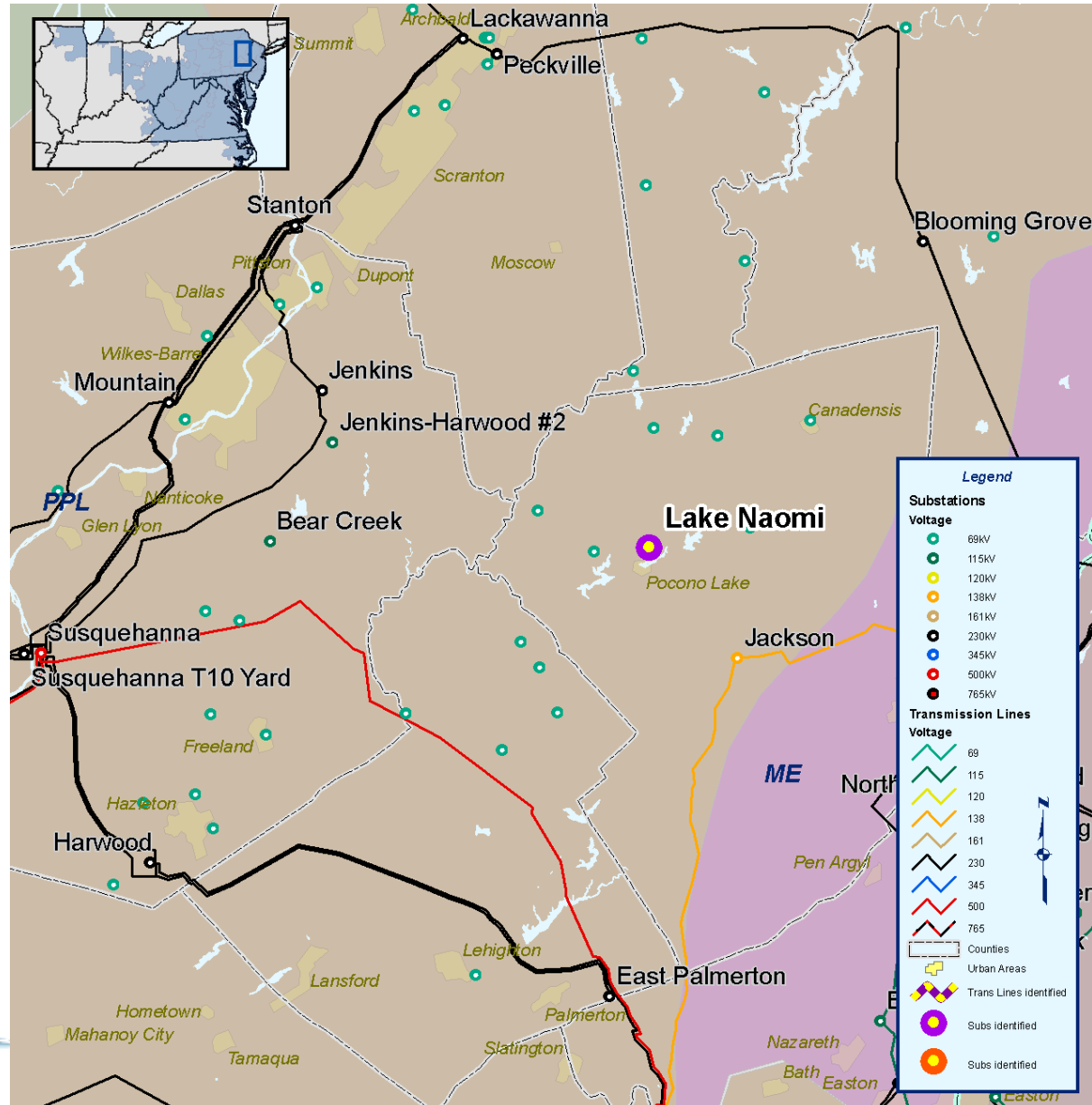
- More than 30 MW load loss / loss of the Blooming Grove-Hemlock 69 kV line
- Exceeds PPL guidelines for maximum allowable load loss
- Construct Bohemia-Twin Lakes 69 kV line
- Install 10.8 MVAR capacitor bank near Bohemia 69 kV station
- Estimated Project Cost: \$18.35 M
- Expected IS Date: 11/01/2013



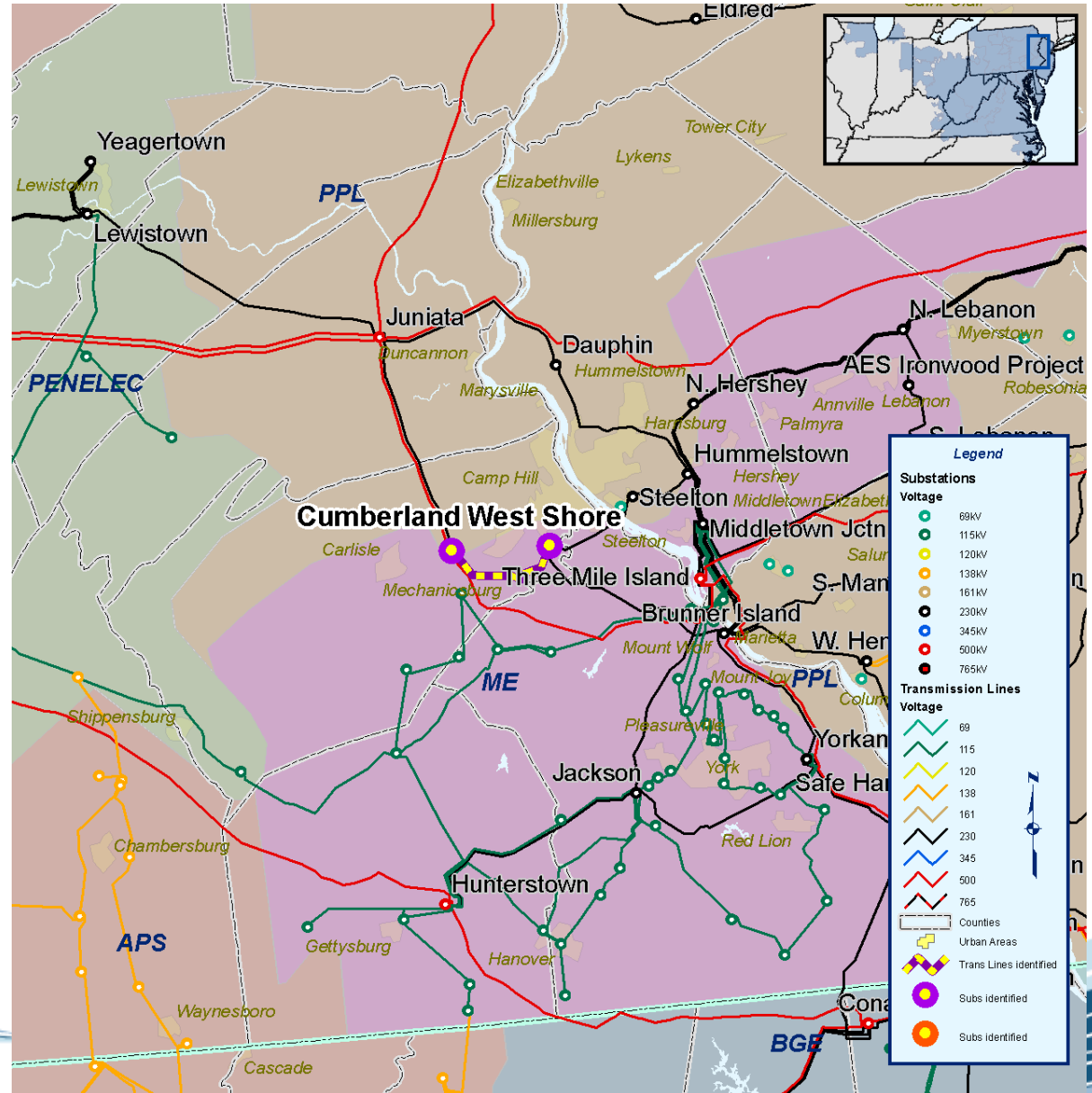
- Jenkins-Scranton 69 kV lines #1 and #2 / basecase
- Reconductor Stanton-Old Forge 69 kV line & Re-sectionalize the Jenkins-Scranton #1 and #2 69 kV lines
- Estimated Project Cost: \$5.29 M
- Expected IS Date: 5/01/2012



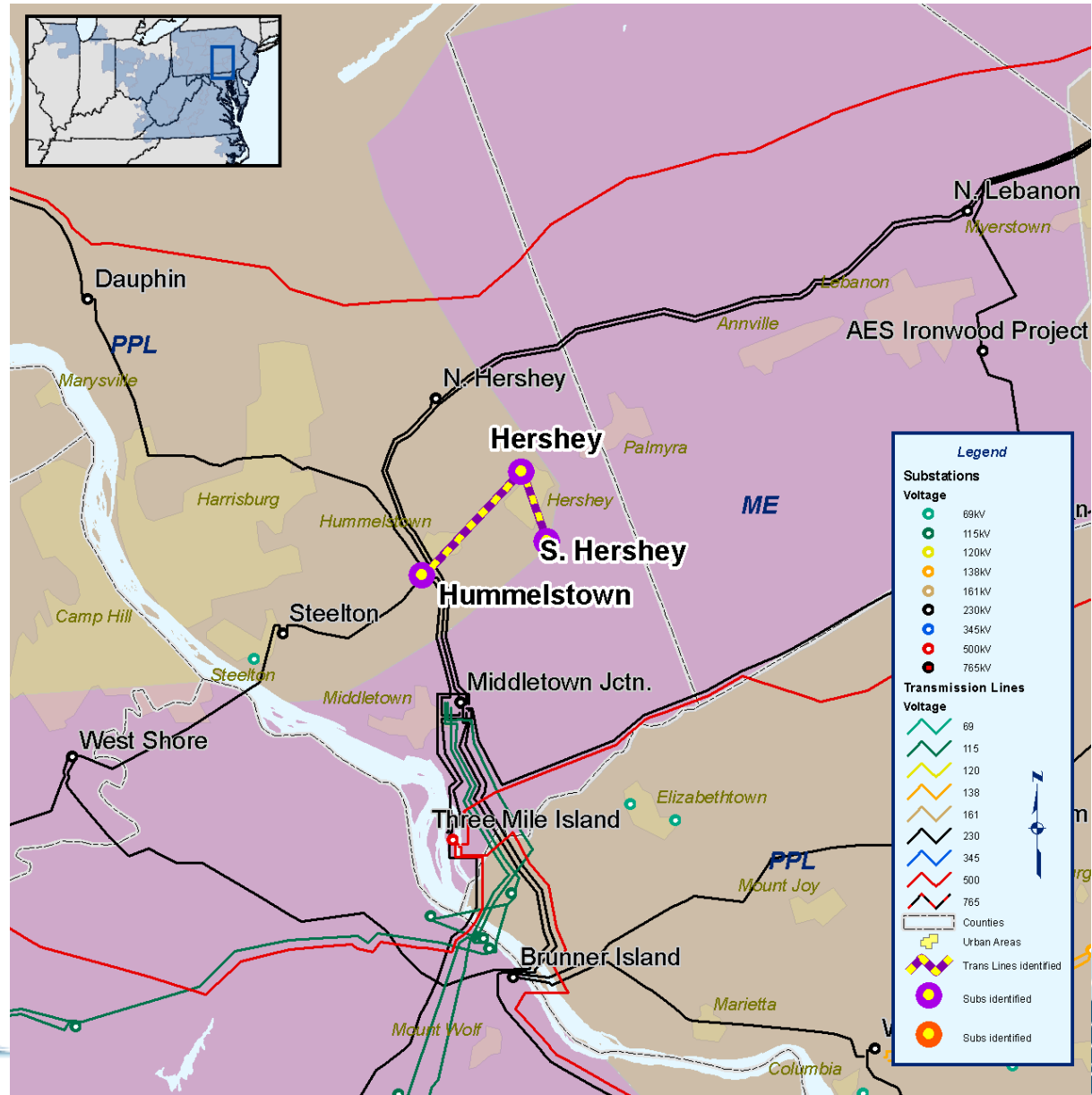
- More than 30 MW load loss / loss of the Lake Naomi 69 kV Tap
- Exceeds PPL guidelines for maximum allowable load loss
- New Double Circuit 69 kV Line from Jackson to Lake Naomi Tap
- Estimated Project Cost: \$7.33 M
- Expected IS Date: 11/01/2013



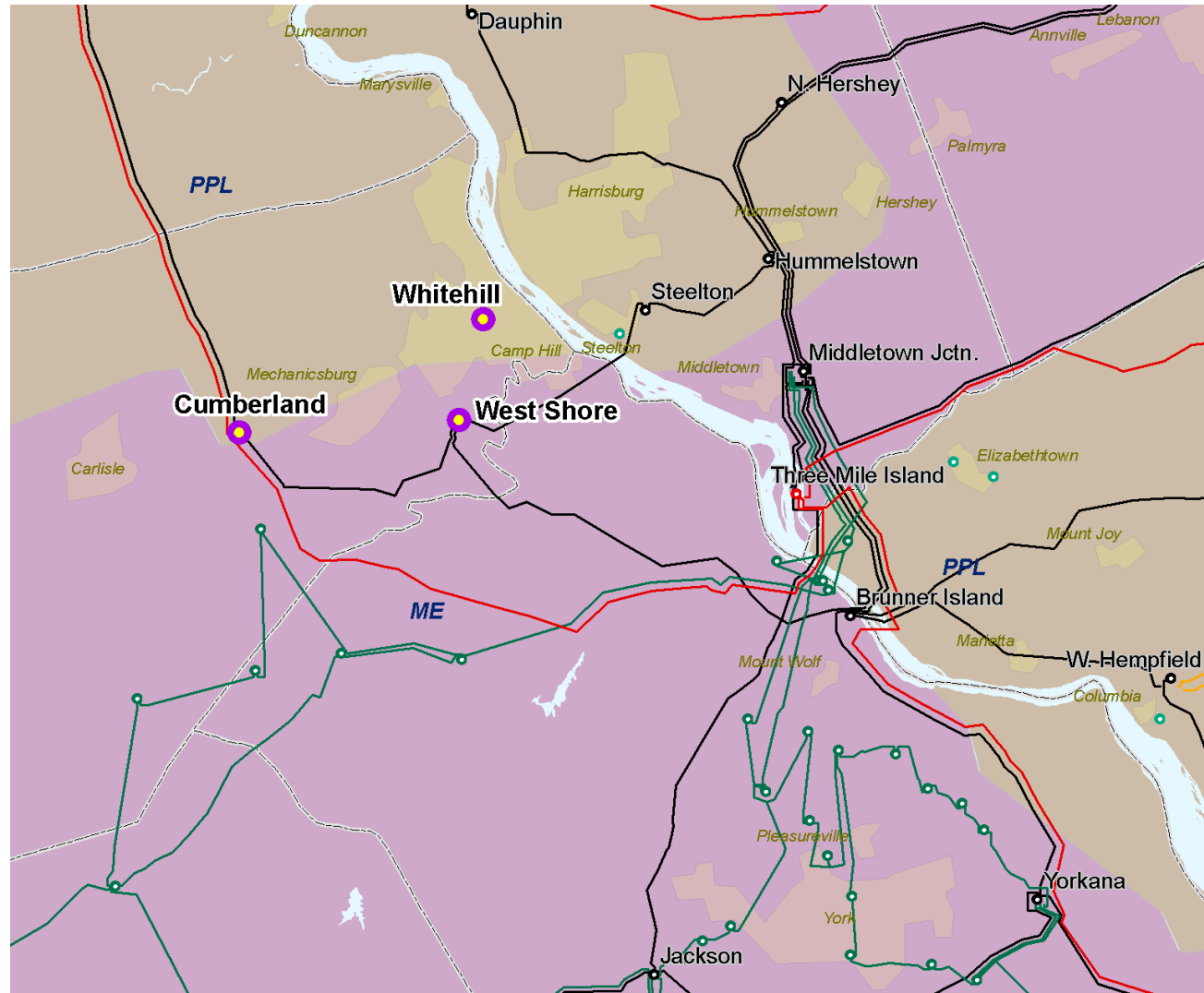
- More than 45 MW load loss / loss of double circuit Cumberland-West Carlisle #1 and #2 69 kV lines
- Exceeds PPL guidelines for maximum allowable load loss
- Install New Double Circuit 69 kV Line between Carlisle and West Carlisle Substations
- Estimated Project Cost: \$8.11 M
- Expected IS Date: 11/01/2012



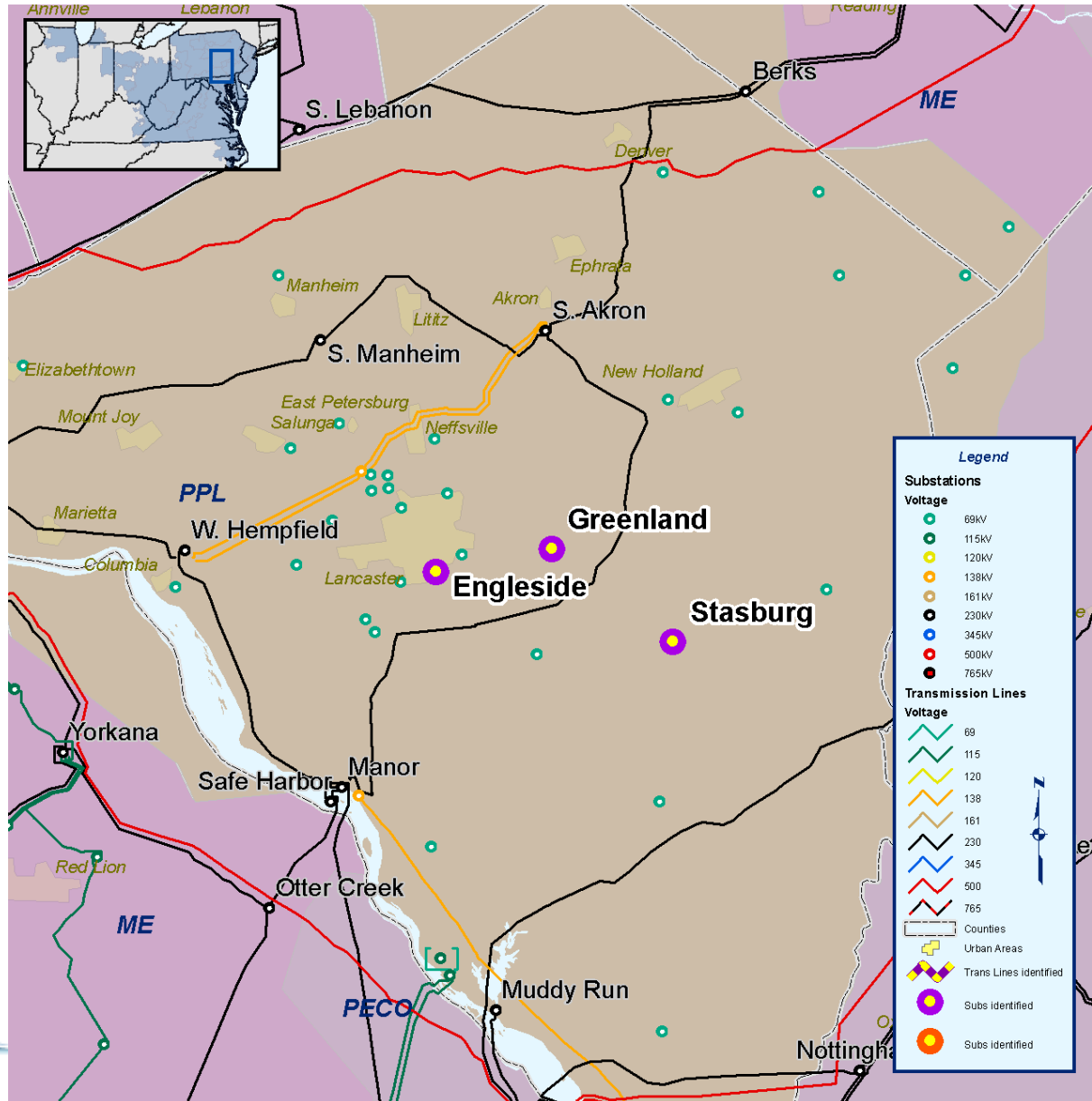
- More than 45 MW load loss / loss of double circuit Hummelstown-Hershey and South Hershey-Hershey 69 kV lines
- Exceeds PPL guidelines for maximum allowable load loss
- Install 3rd 69 kV Line from Reese's Tap to Hershey Substation
- Estimated Project Cost: \$9.75 M
- Expected IS Date: 5/01/2012



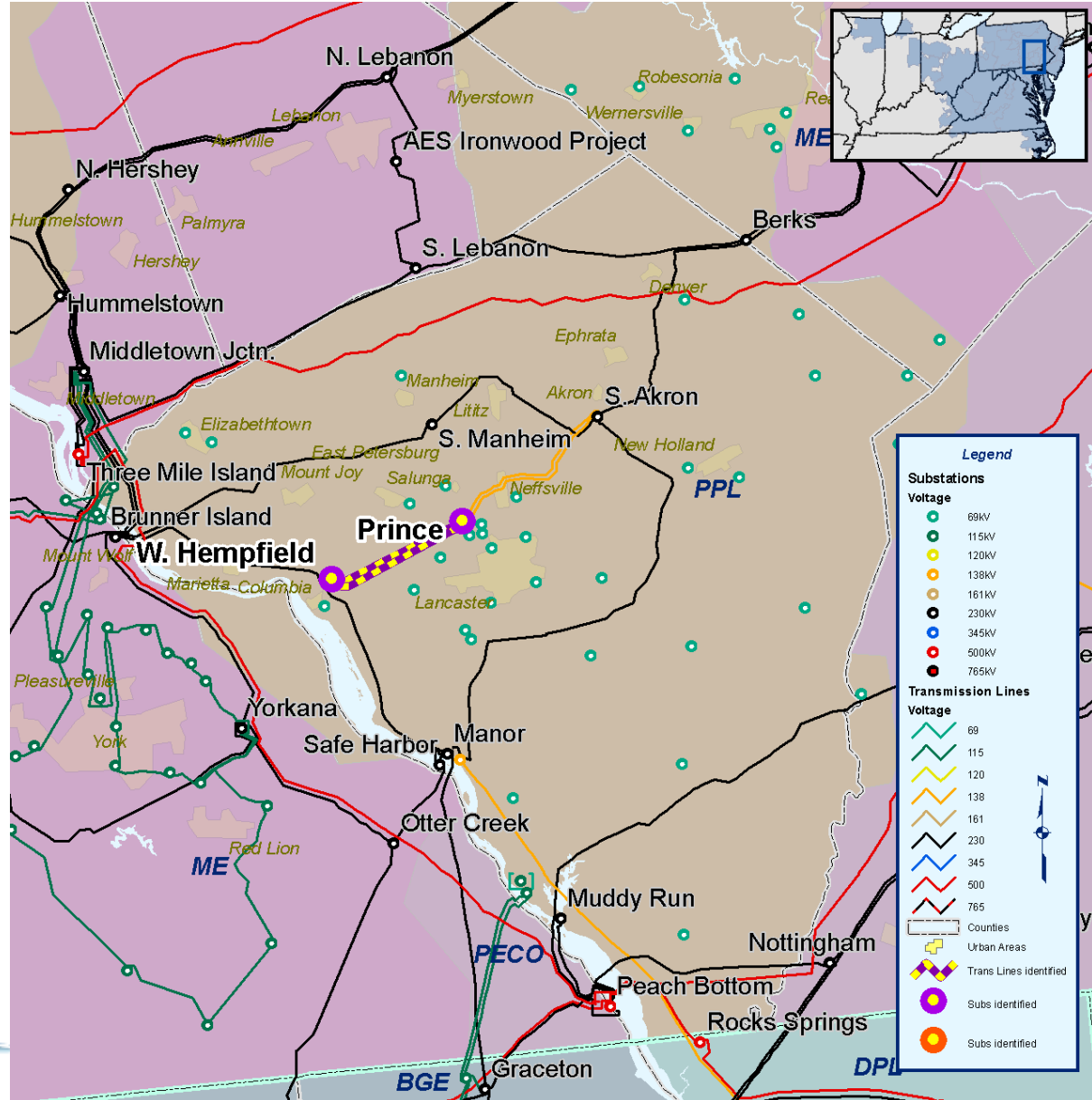
- More than 45 MW load loss / loss of double circuit outage of the Whitehill 69 kV Taps
- Exceeds PPL guidelines for maximum allowable load loss
- New 69 kV Line: from a tap of the West Shore-Cumberland #1 69 kV Line to Whitehill Substation
- Estimated Project Cost: \$3.49 M
- Expected IS Date: 11/01/2013



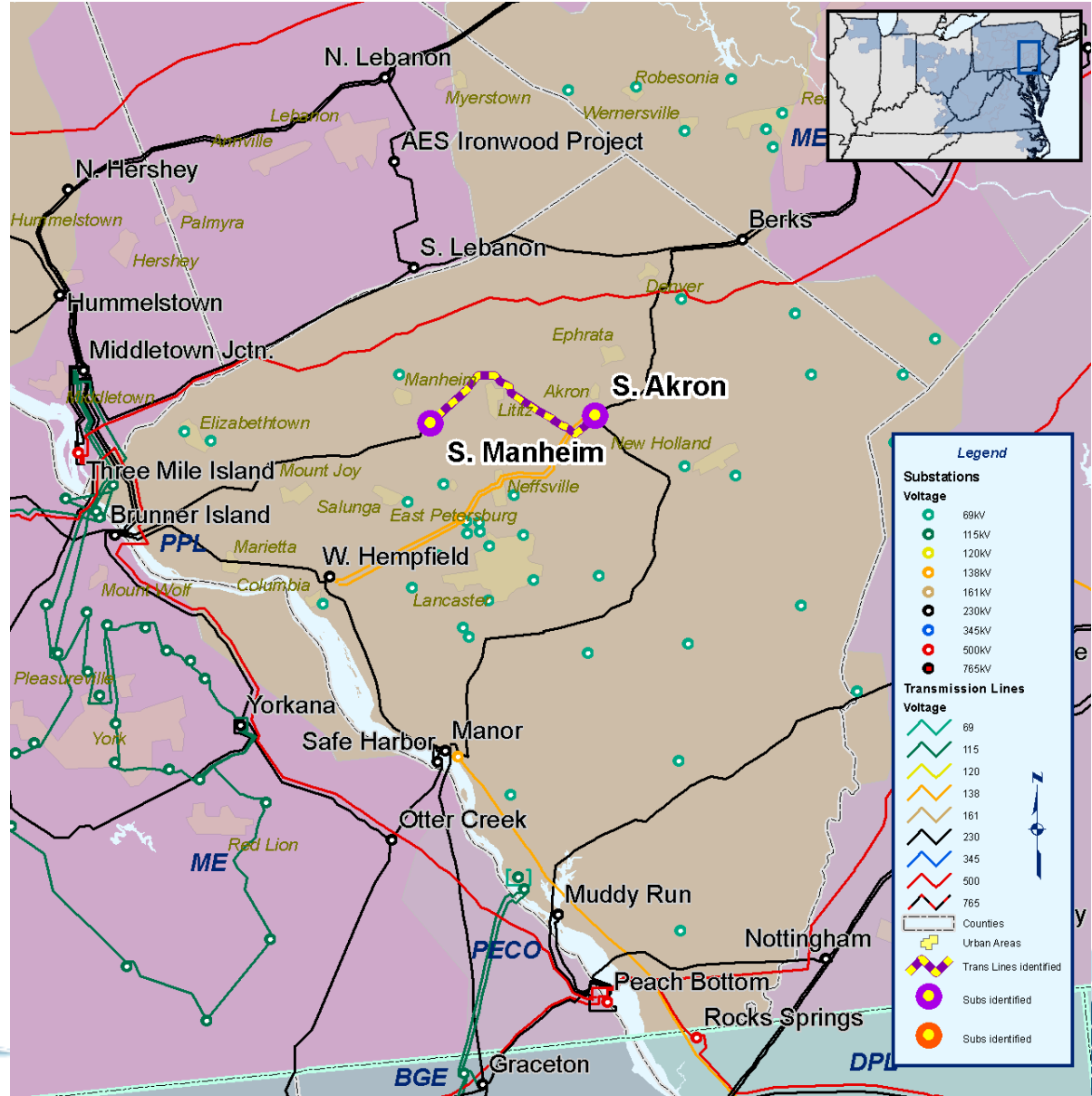
- More than 50 MW load loss / double-circuit outage on the 69kV Greenland Tap
- Exceeds PPL guidelines for maximum allowable load loss
- Construct a 69 kV Line Between Strassburg Tap and the Millwood-Engleside #1 69kV Line
- Estimated Project Cost: \$1.32 M
- Expected IS Date: 11/01/2009



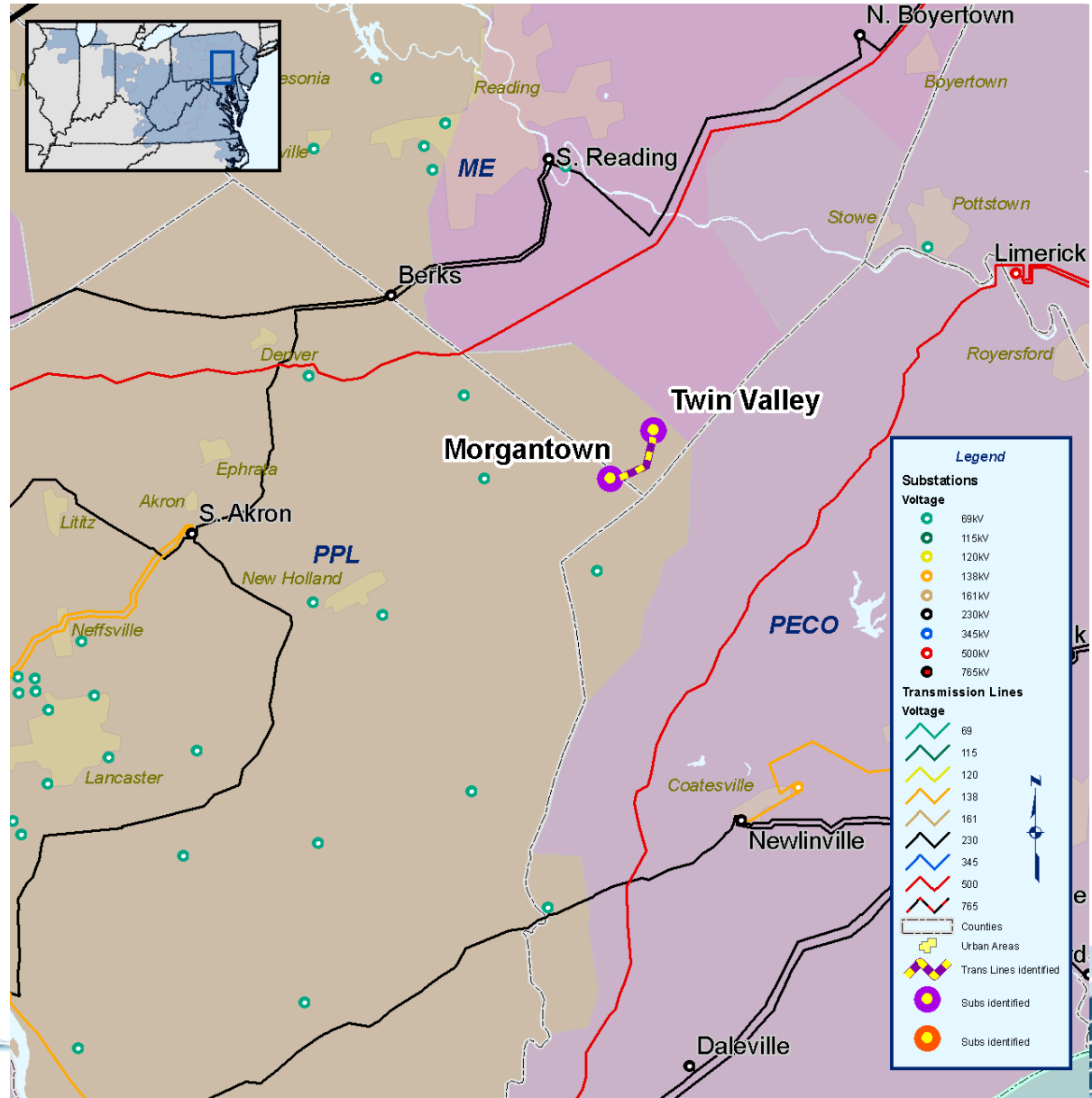
- More than 70 MW load loss / double-circuit outage on the 69kV Dillersville Tap
- Exceeds PPL guidelines for maximum allowable load loss
- Construct a new 138kV Double Circuit Line between Dillersville Tap and the West Hempfield - Prince 138kV Line
- Estimated Project Cost: \$0.545 M
- Expected IS Date: 5/01/2010
- Prepare Roseville Tap for 138 kV Conversion
- Estimated Project Cost: \$0.107 M
- Expected IS Date: 11/01/2010



- More than 70 MW load loss / double-circuit outage on the 69kV Dillersville Tap
- Exceeds PPL guidelines for maximum allowable load loss
- Transfer South Akron-South Manheim #1 & #2 lines from the South Akron 69kV Yard to the South Akron 138 kV Yard
- Estimated Project Cost: \$3.01 M
- Expected IS Date: 11/01/2012
- Install Switches on South Akron-South Manheim #1 & #2 138 kV Lines
- Estimated Project Cost: \$2.04 M
- Expected IS Date: 11/01/2013



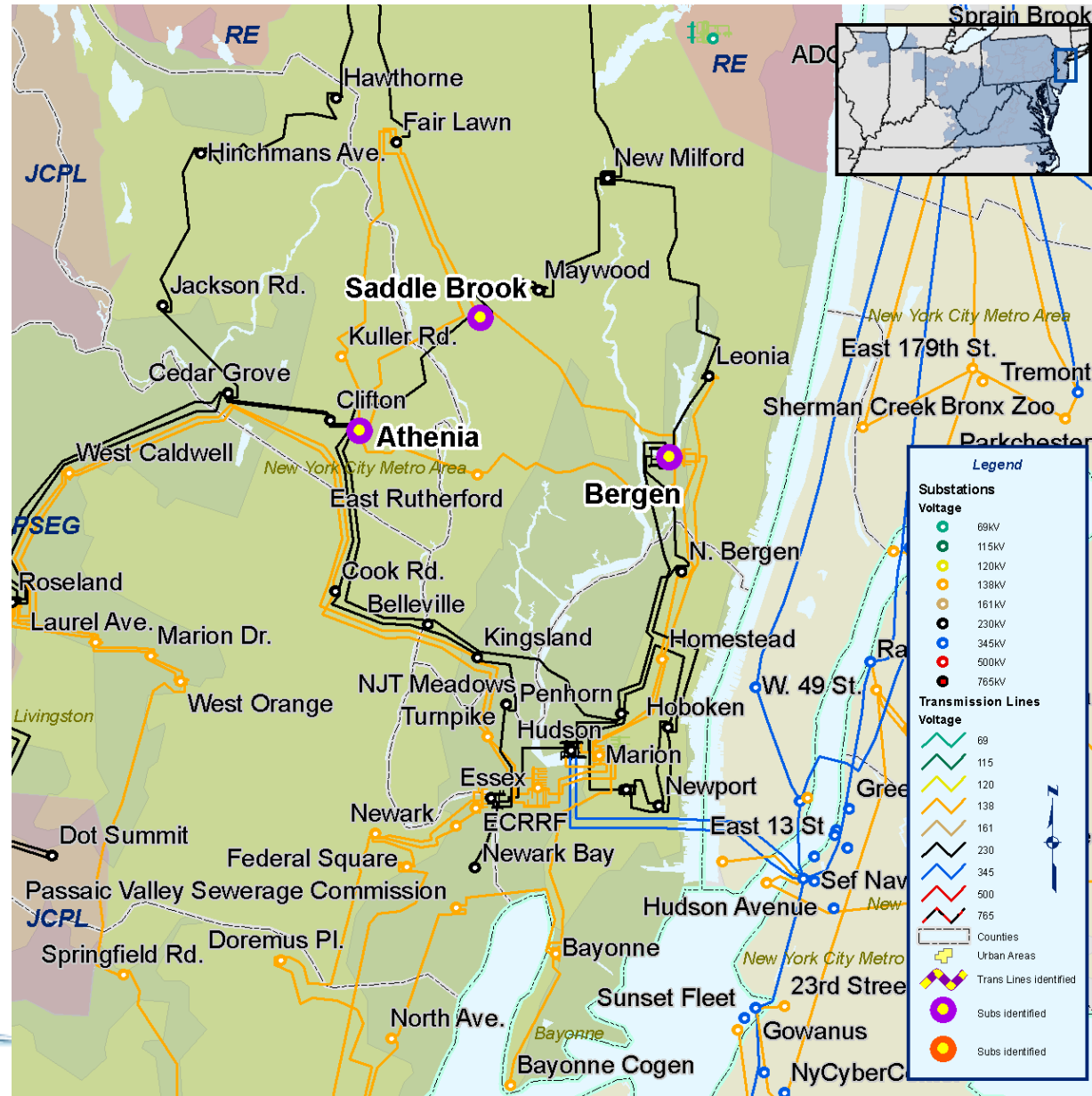
- 33 MVA load loss / loss of the Morgantown-Twin Valley 69 kV line
- Exceeds PPL guidelines for maximum allowable load loss
- Add 2nd 69 kV Circuit from Morgantown to Twin Valley
- Estimated Project Cost: \$0.731 M
- Expected IS Date: 11/01/2009



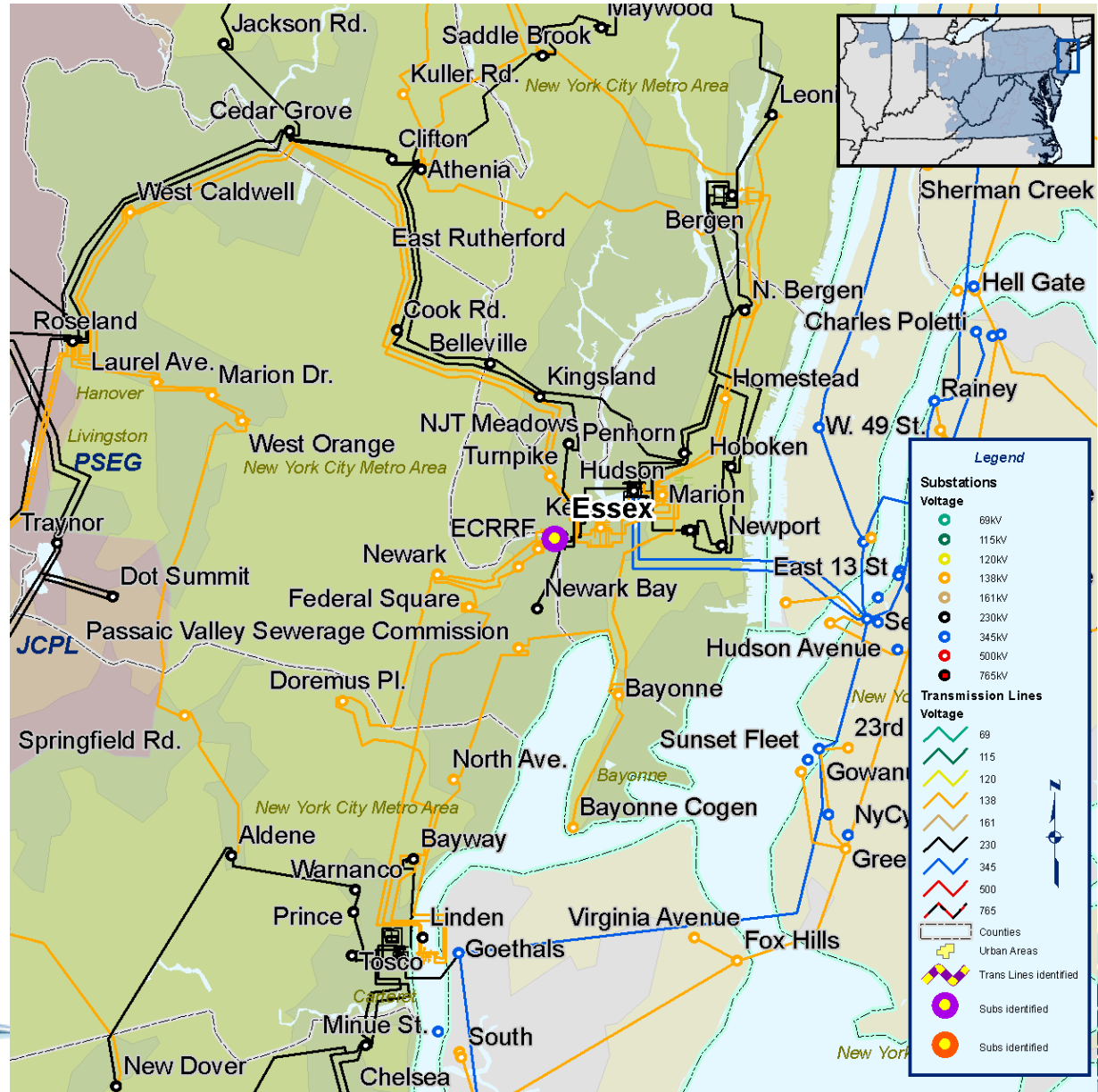


PSE&G Baseline Upgrades

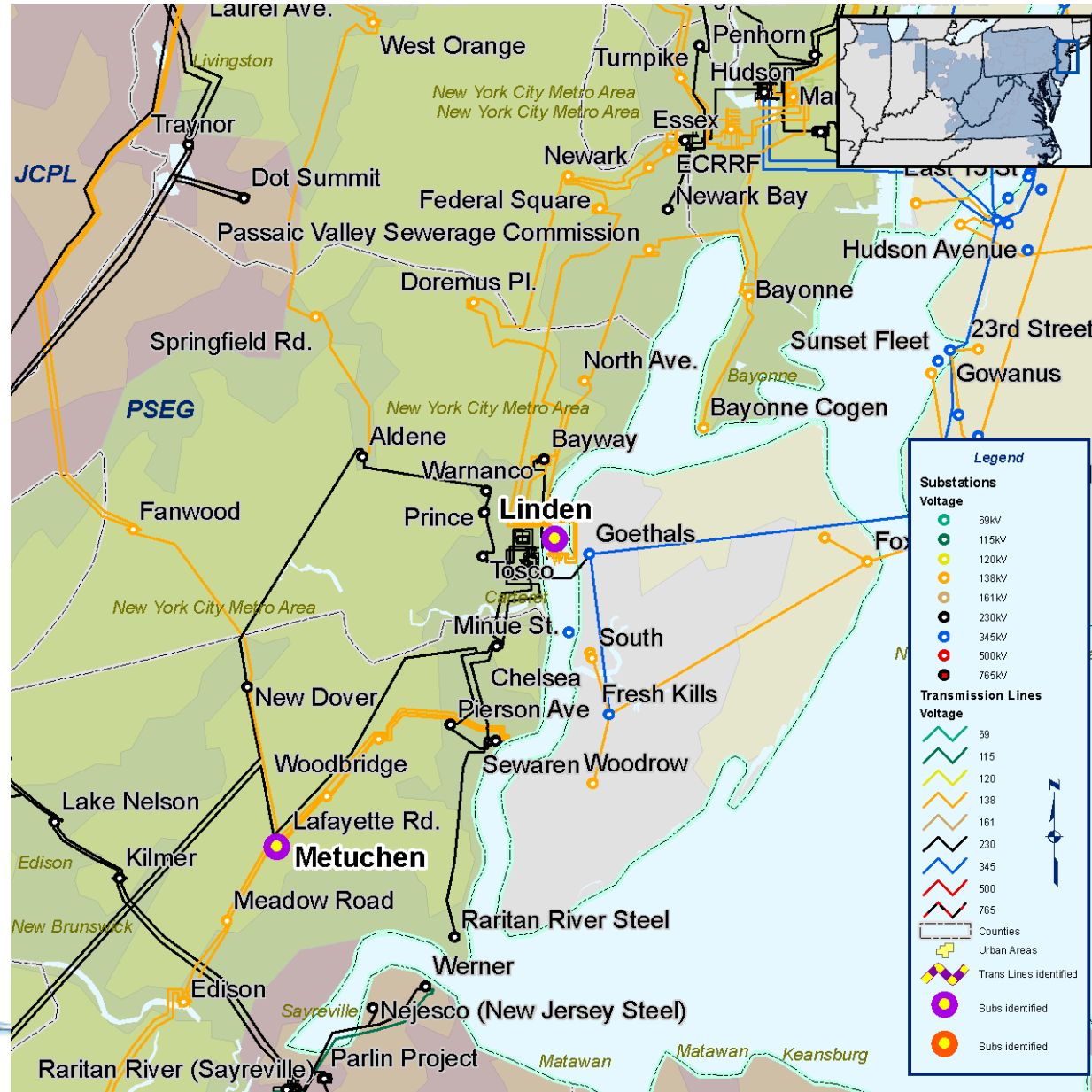
- Driver: Short Circuit Violation
- Replace Athenia 230 kV breaker 31H due to Short Circuit
- Estimated Project Cost: \$ 0.4 M
- IS Date: 6/1/2012
- Replace Bergen 230 kV breaker 10H due to Short Circuit
- Estimated Project Cost: \$ 0.4 M
- IS Date: 6/1/2012
- Replace Saddlebrook 230 kV breaker 21P due to Short Circuit
- Estimated Project Cost: \$ 0.4 M
- IS Date: 6/1/2012



- Driver: 2009 Base Conditions
- Replace Essex 138 kV breakers due to Short Circuit
 - 4LM (C1355 line to ECRRF)
 - 1LM (220-1 TX)
 - 1BM (BS1-3 tie)
 - 2BM (BS3-4 tie)
- Estimated Project Cost each: \$ 0.4 M
- IS Date: 6/1/2009



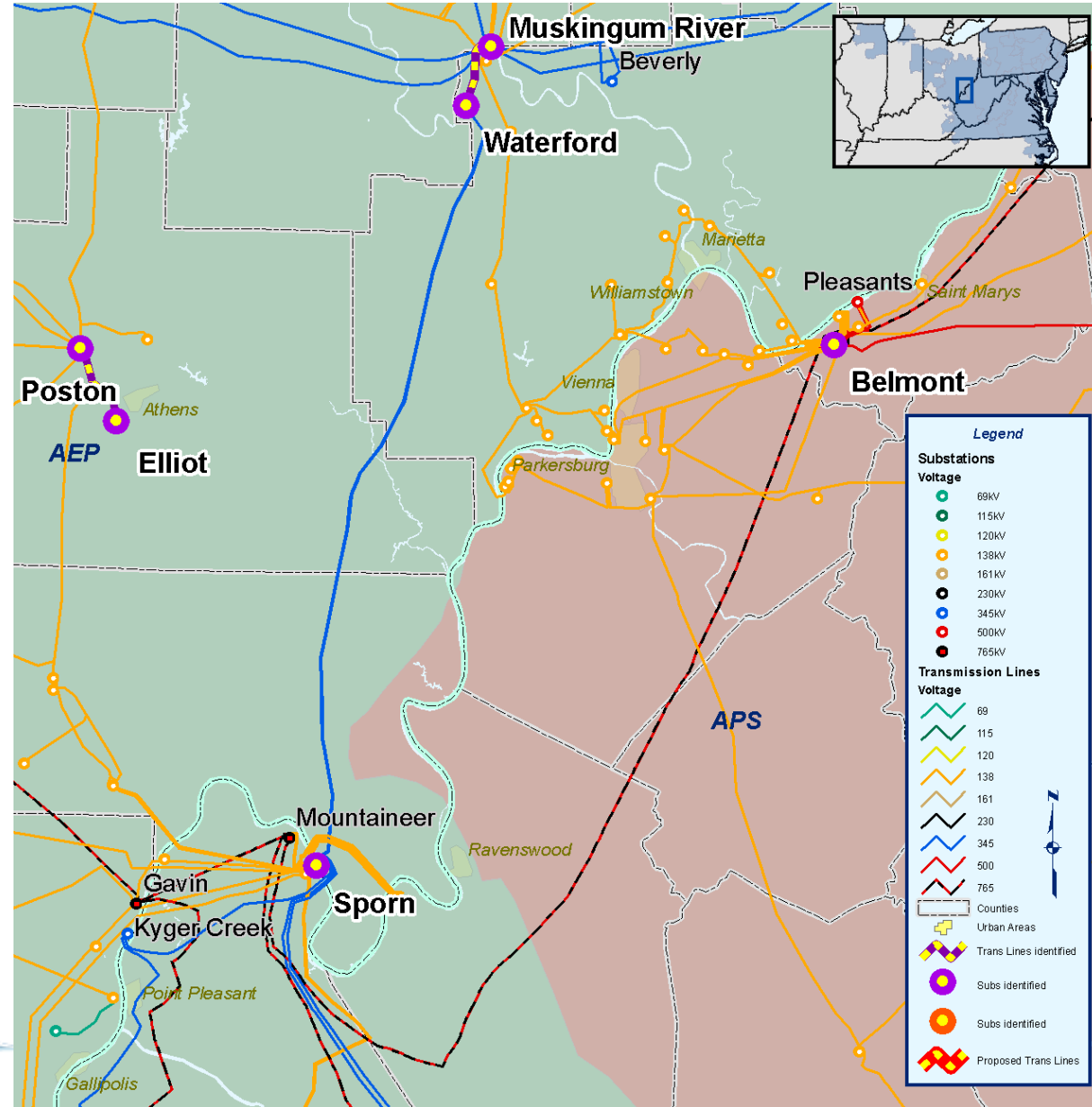
- Driver: 2009 Base Conditions
- Replace Linden 138 kV breaker 3 (132-7 TX) due to Short Circuit
- Estimated Project Cost: \$ 0.4 M
- IS Date: 6/1/2009
- Replace Metuchen 138 kV breaker '2-2 Transfer' due to Short Circuit
- Estimated Project Cost: \$ 0.4 M
- IS Date: 6/1/2009



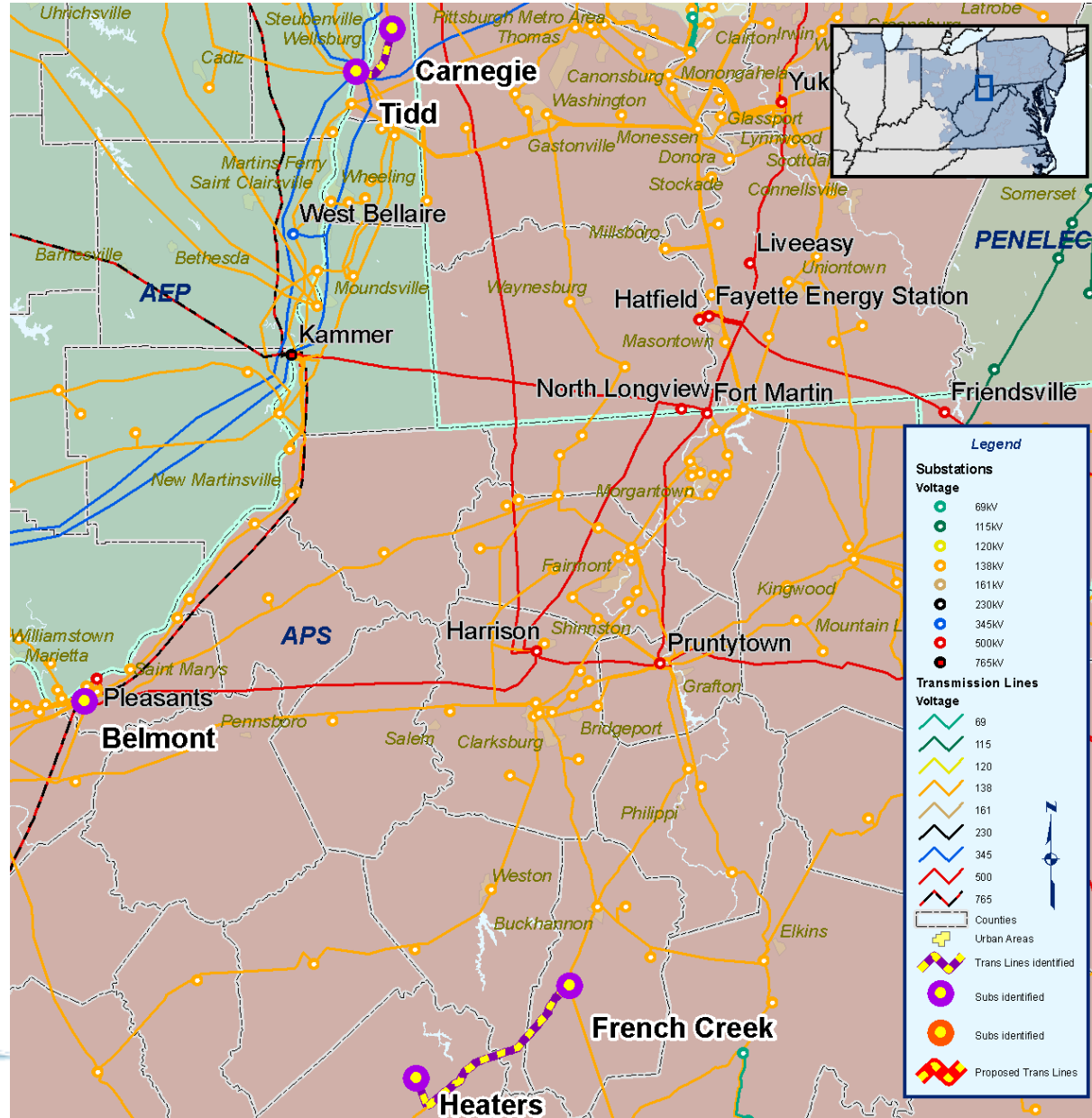


PJM Queued Generation Network Upgrades

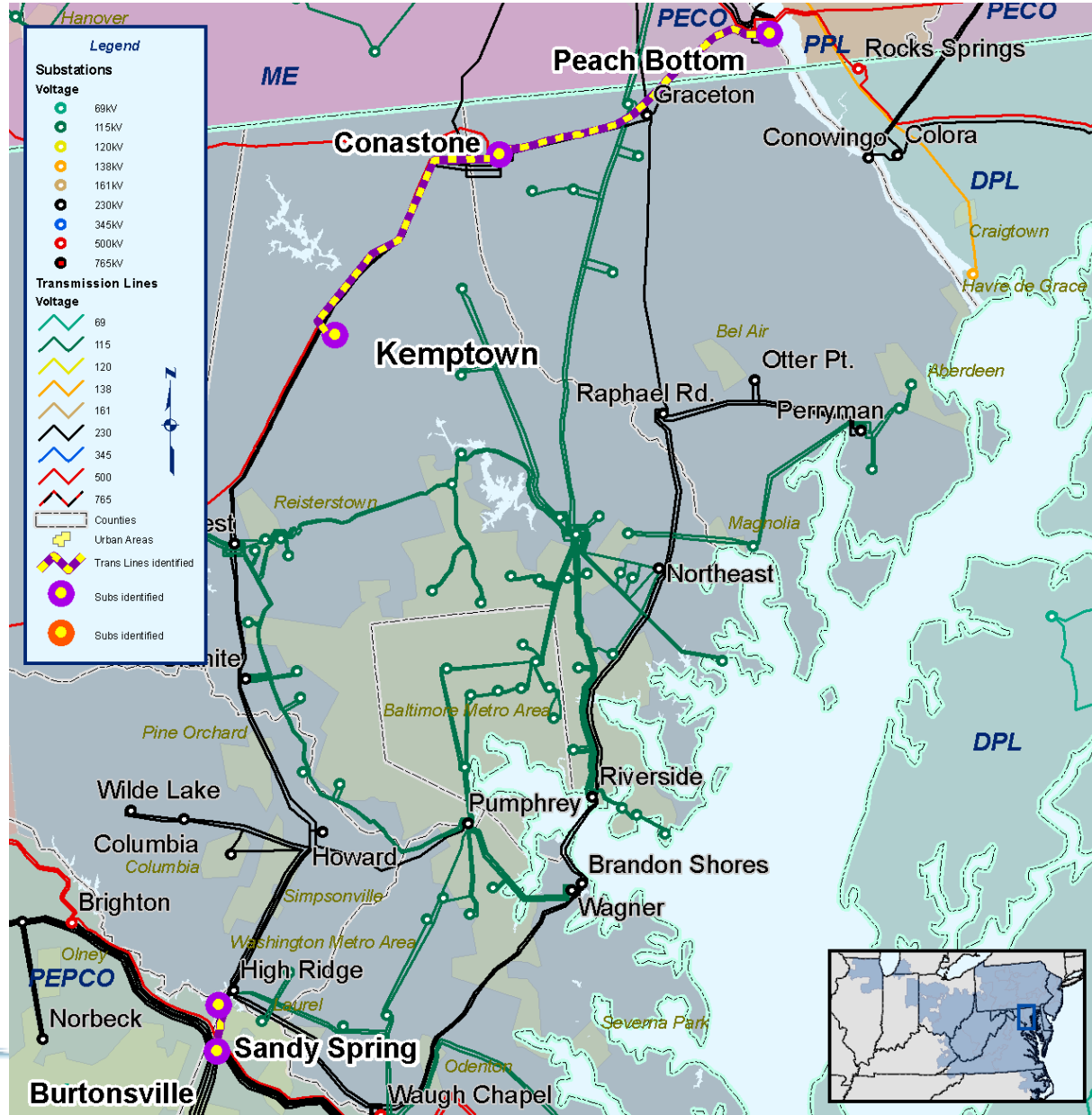
- Poston Station and Elliot Tap - Rebuild approximately 3 miles of 138kV line between the Poston Station and Elliot Tap
 - Estimated Cost: \$3M
- Sporn - Replace risers and switches at Sporn station and rebuild approx. 4 miles of the 34.5kV line between Sporn station and the new P54 Interconnection Station
 - Estimated Cost: \$13.4M
- Muskingum River - Waterford - Rebuild approximately 4 miles of the 345kV line between Muskingum River and Waterford Station
 - Estimated Cost: \$10.7M
- Sporn - Replace the "CC" 345kV circuit breaker
 - Estimated Cost: \$1.9M
- Sporn - Replace the "CC1" 345kV circuit breaker
 - Estimated Cost: \$1.9M
- Waterford - Replace the "52-A" 345kV circuit breaker
 - Estimated Cost: \$2M
- Waterford - Replace the "52-B" 345kV circuit breaker
 - Estimated Cost: \$2M
- Waterford - Replace the "52-C" 345kV circuit breaker
 - Estimated Cost: \$2M
- Muskingum River - Replace the "SD" 345kV circuit breaker
 - Estimated Cost: \$1.7M
- Muskingum River - Replace the "SE" 345kV circuit breaker
 - Estimated Cost: \$1.7M
- Muskingum River - Replace the "SD" 345kV circuit breaker
 - Estimated Cost: \$1.7M



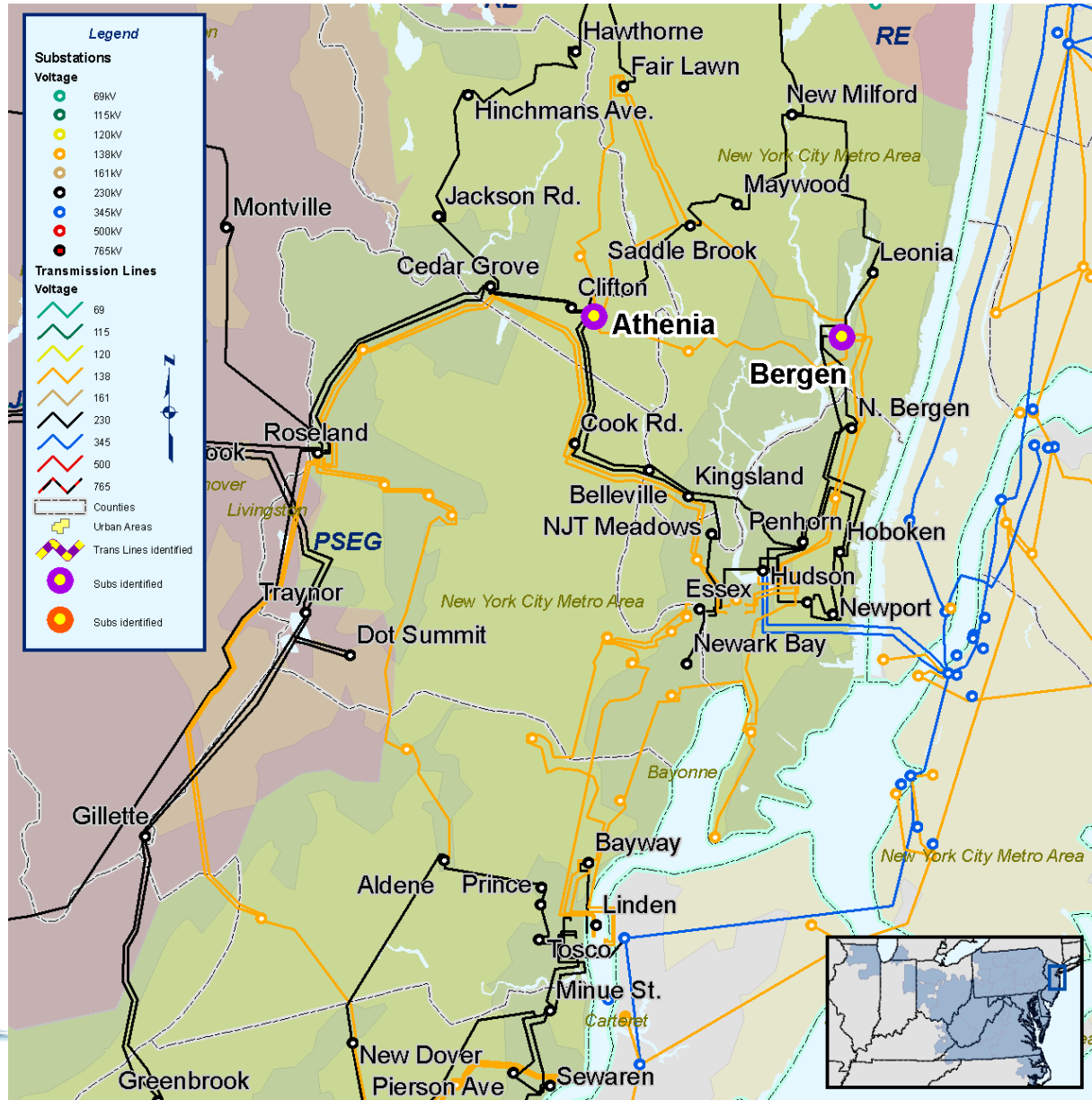
- Tidd - Carnegie - 138kV line section 1.21 miles of 556 ACSR with 954 ACSR conductor
 - Estimated Cost: \$0.32M
- French Creek - Heaters Tap - 138kV line section - reconductor 25.11 mile line section with 954 ACSR conductor
 - Estimated Cost: \$9.5M
- Belmont - Install a third breaker in the Harrison - Belmont line cross bus
 - Estimated Cost: \$0.385M



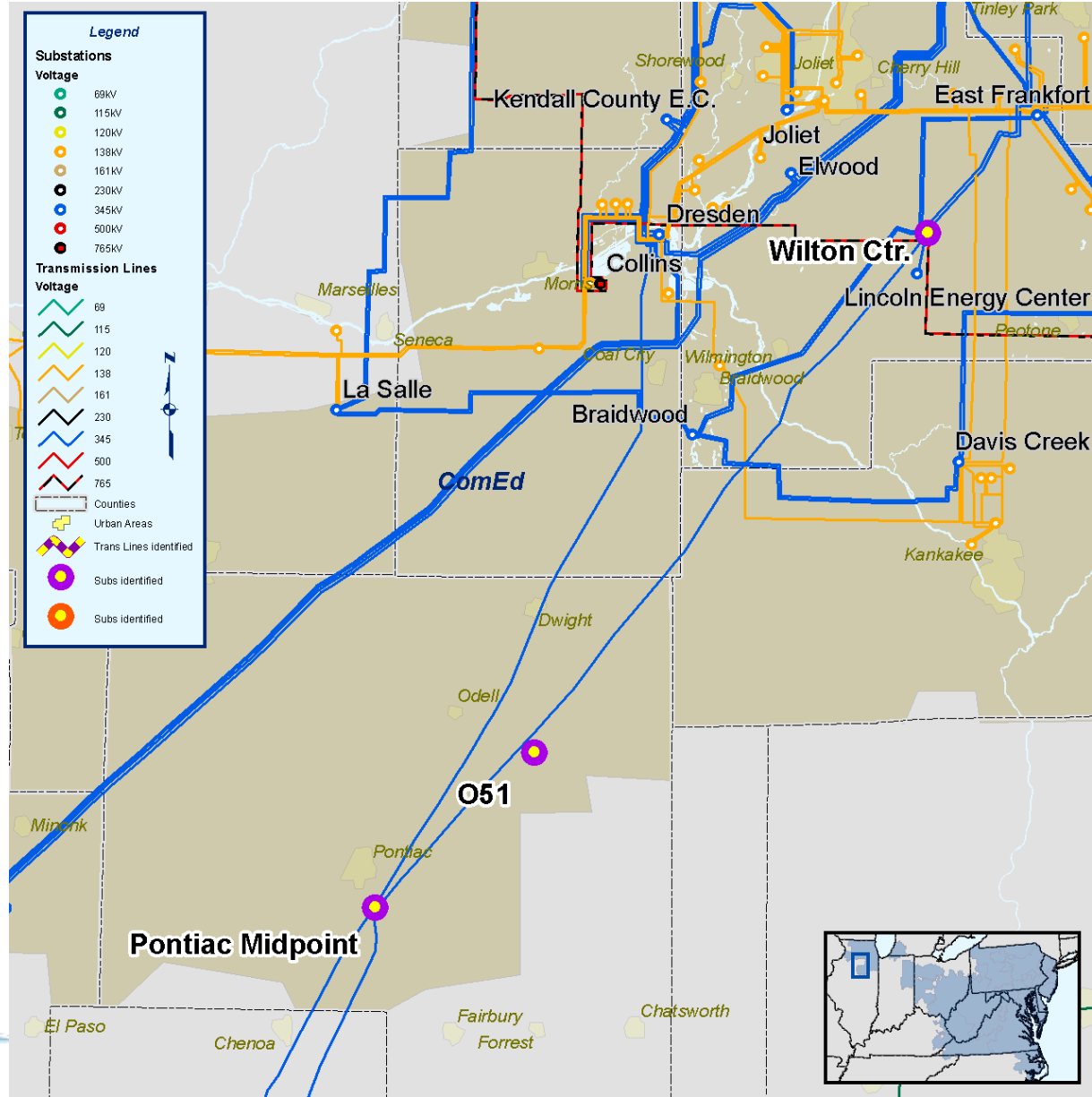
- Burtonsville - Sandy Springs - Rebuild existing line using double bundle 1033 ACSR. Double circuit 2314/2334 Time dependent on High Ridge to Sany Springs
 - Estimated Cost: \$0.5M
- Kemptown - Conastone - Replace 500kV Breaker Disconnects
 - Estimated Cost: \$0.5M
- Conastone - Peach Bottom - Replace 500kV line two circuit breakers, est. time 30 months
 - Estimated Cost: \$1.3M



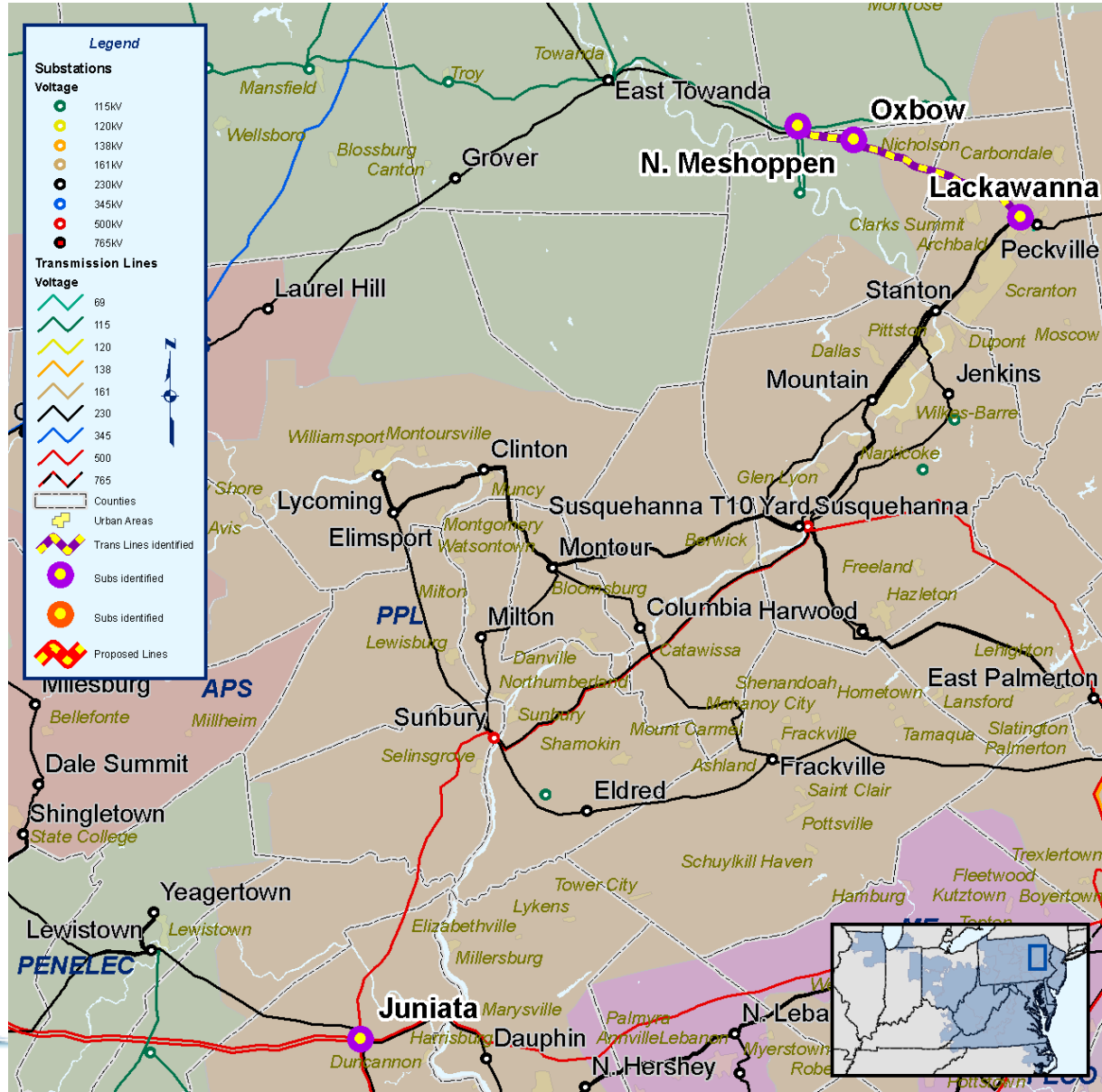
- Bergen 230 kV breaker
12H
 - Estimated Cost: \$0.4M
- Athenia 230 kV breaker
21H
 - Estimated Cost: \$0.4M
- Athenia 230 kV breaker
11H
 - Estimated Cost: \$0.4M
- Athenia 230 kV breaker
51H
 - Estimated Cost: \$0.4M
- Athenia 138 kV breaker
2BH
 - Estimated Cost: \$0.4M



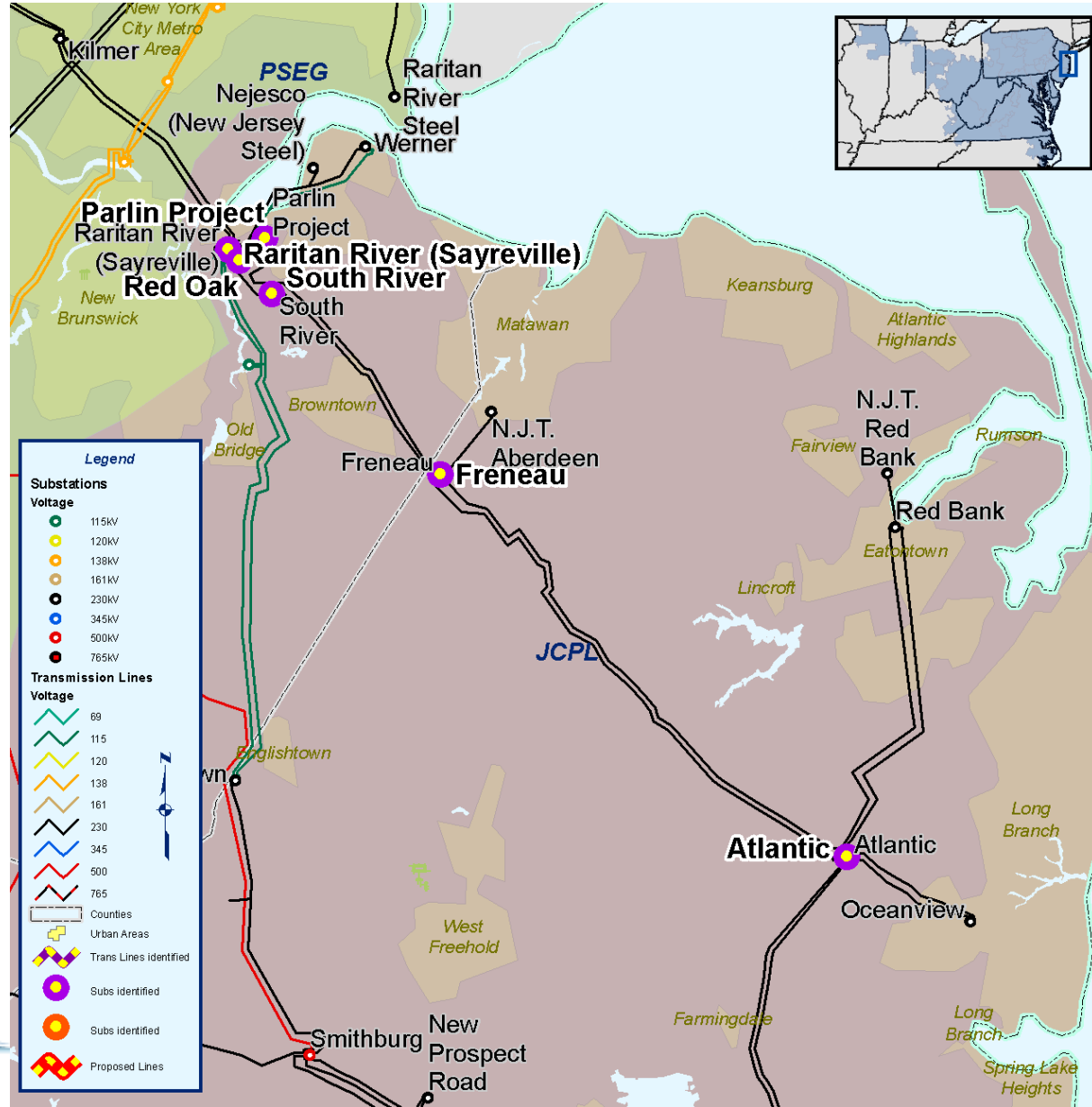
- TSS 112 Wilton Center - Upgrade existing 8012 line relaying to be compatible with new line 11212 terminal at TSS 976 Cayuga Ridge South
 - Estimated Cost: \$0.278M
- TSS 80 Pontiac Midpoint - Upgrade existing 8012 line relaying to be compatible with new line 8012 terminal at TSS 976 Cayuga Ridge South
 - Estimated Cost: \$0.12M
- TSS 976 Cayuga Ridge South - Erect new interconnection substation for Queue position O51
 - Estimated Cost: \$0.47M
- TSS 80 Pontiac Midpoint - TSS 976 Cayuga Ridge South - TSS 112 Wilton Center - Install digital microwave communication for addition of new Livingston 2 ring bus
 - Estimated Cost: \$1.677M
- TSS 976 Cayuga Ridge South - TSS 112 Wilton Center - Reconductor 0.187 miles of line 11212 between TSS 976 Cayuga Ridge South and TSS 112 Wilton Center
 - Estimated Cost: \$0.07M



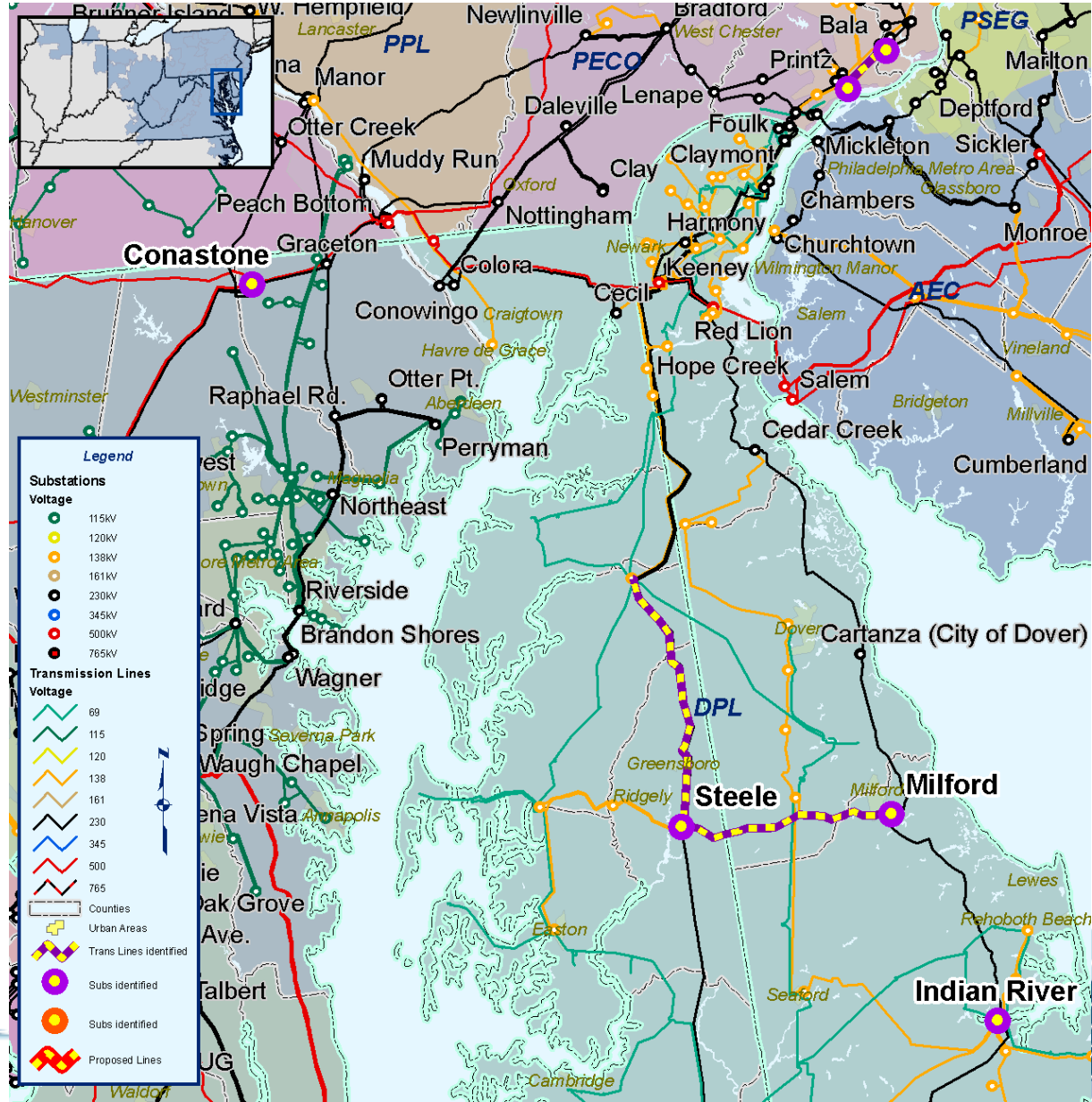
- Lackawanna - Oxbow - Rebuild approximately 16.33 miles of transmission line to support bundled conductor
 - Estimated Cost: \$19.596M
- Lackawanna - Oxbow - Upgrade disconnect switch at Oxbow substation
 - Estimated Cost: \$0.1M
- Oxbow - N. Meshoppen - Rebuild approximately 10.6 miles of transmission line to support bundled conductor, North Meshoppen Substation upgrade/replace two CT circuits and replace substation conductor
 - Estimated Cost: \$12.597M
- North Meshoppen - Add two 230kV circuit breakers, reconfigure 230kV bus into ring bus
 - Estimated Cost: \$1.5M
- Lackawanna - Upgrade terminal equipment at 230kV substation, replace substation conductor and replace disconnect switch
 - Estimated Cost: \$0.125M
- Juniata - Replace 500/230kV transformer #2
 - Estimated Cost: \$10M
- Lackawanna - Upgrade terminal equipment at the 230kV substation
 - Estimated Cost: \$0.7M



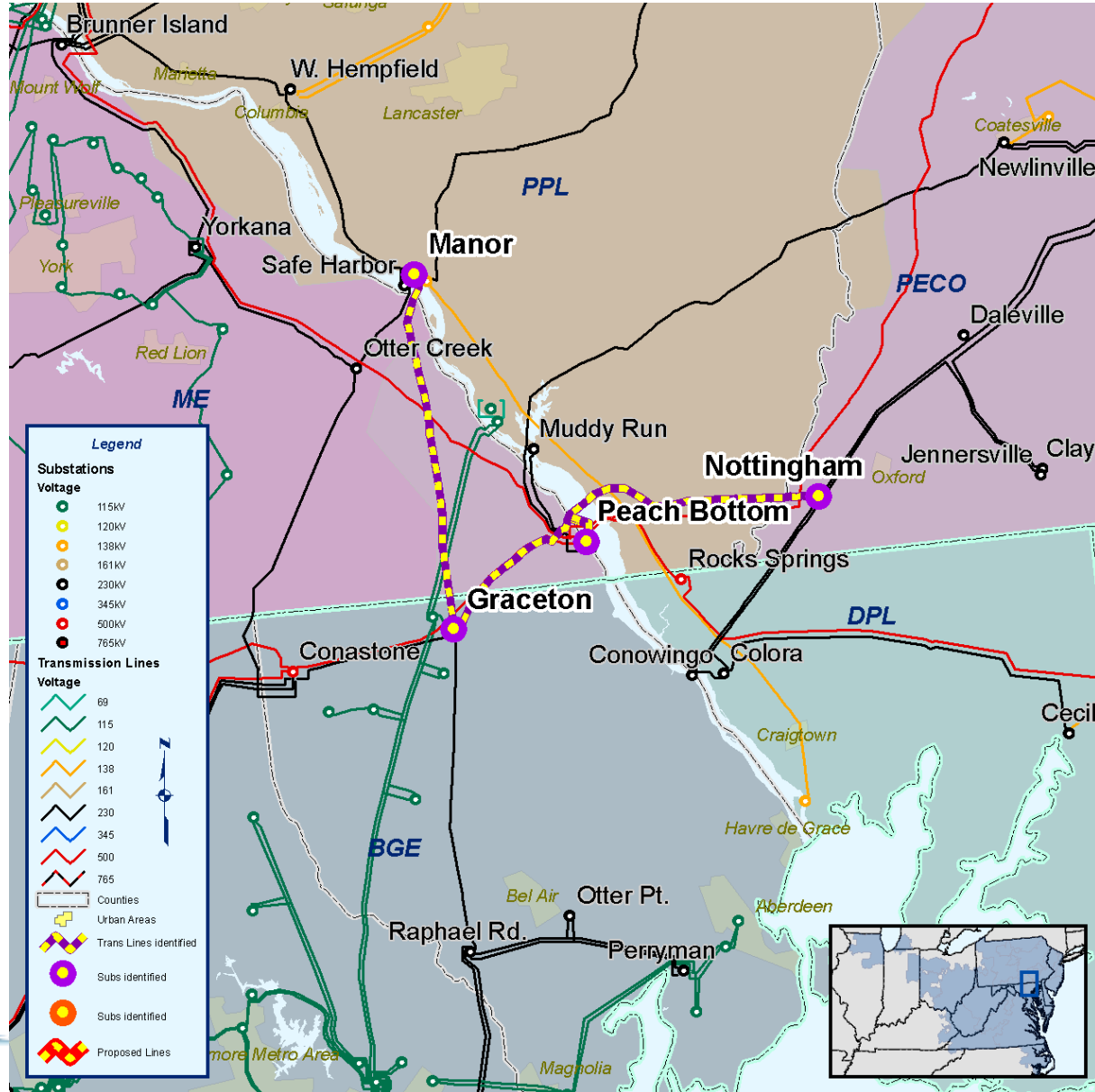
- Raritan River - Red Oak A Mitigation Upgrade, Drop Loop/Bus Conductor (Bundled)
 - Estimated Cost: \$8.331M
- Williams - Freneau Mitigation Upgrade, Drop Loop/Bus Conductor (Bundled)
 - Estimated Cost: \$4.845M
- Parlin - Williams Mitigation Upgrade, Drop Loop/Bus Conductor (Bundled)
 - Estimated Cost: \$1.937M
- South River - Atlantic 230kV line, Mitigation Upgrade, Drop Loop/Bus Conductor (Bundled)
 - Estimated Cost: \$11.057M
- South River - Atlantic 230kV line (G1047), Mitigation Upgrade, Drop Loop/Bus Conductor (Bundled)
 - Estimated Cost: \$0.878M



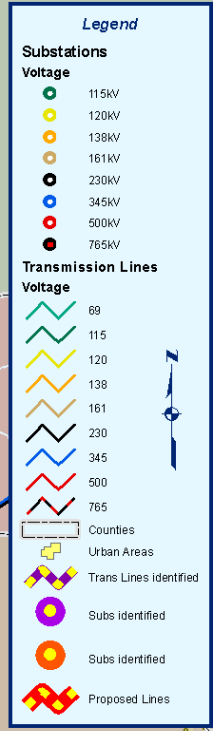
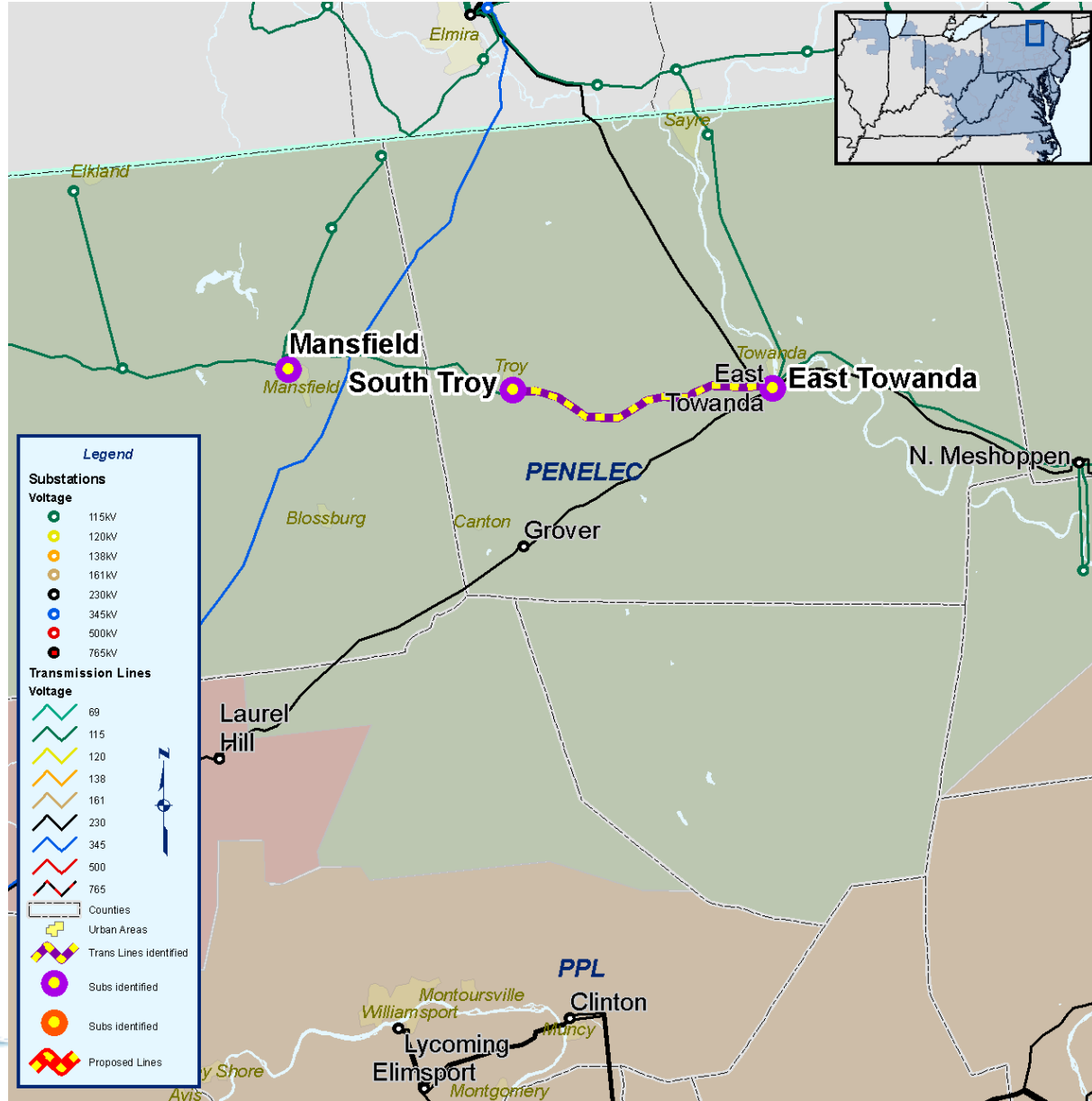
- Conastone - Relocate 500kV 501 line into a new two breaker bay
 - Estimated Cost: \$7M
- Eddystone 3 - Island Road 6 - Replace metering equipment
 - Estimated Cost: \$0.2M
- Milford - Steele - Reconductor 230kV line
 - Estimated Cost: \$10.225M
- Steele - Oil City - Upgrade the temperature rating on the 138kV line
 - Estimated Cost: \$0.25M



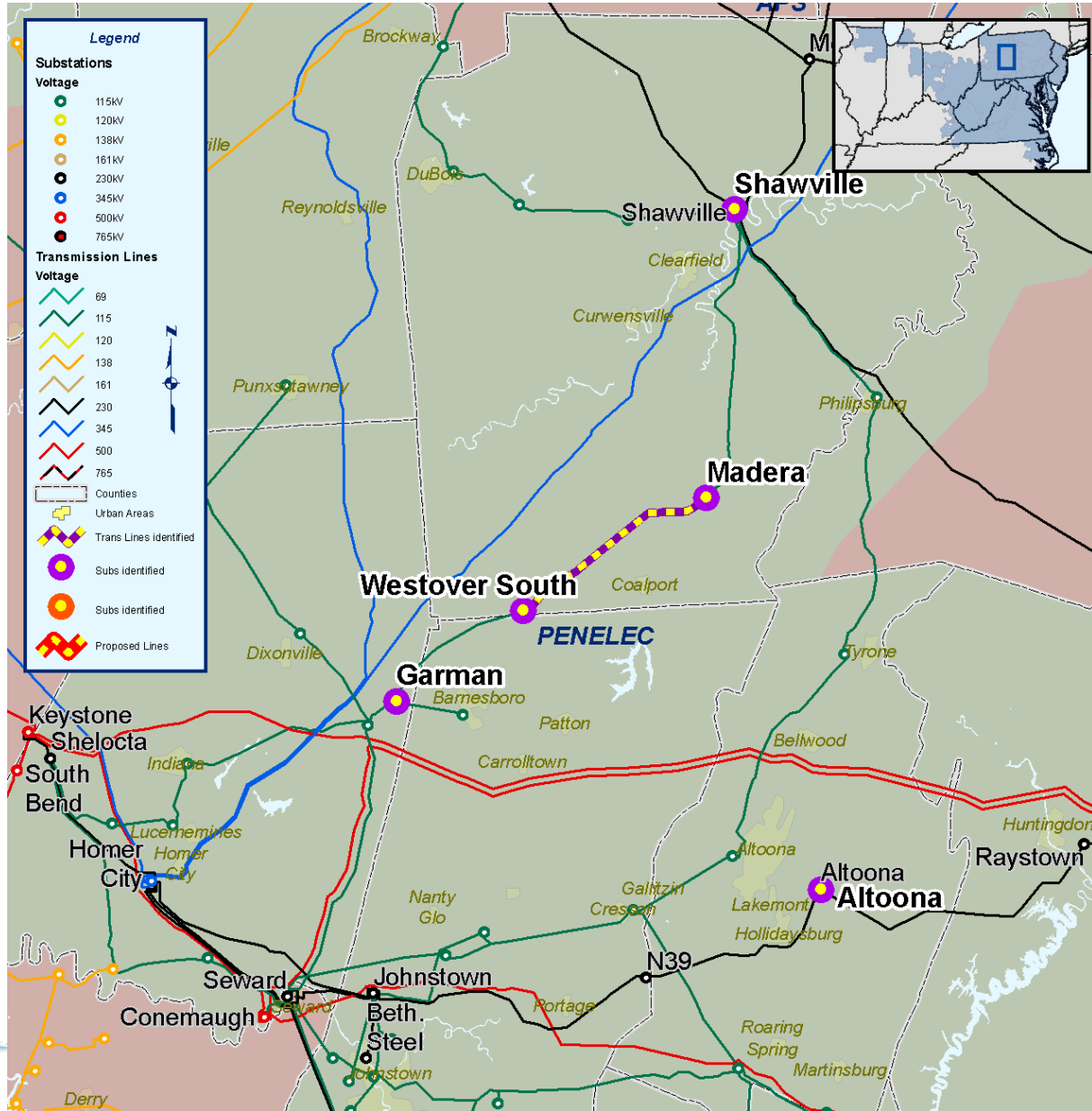
- Manor - Graceton - 230kV line upgrade terminal equipment
 - Estimated Cost: \$37M
- Nottreach-Peach Bottom - Reconductor 230kV line 220-08-p, estm new rating 724 MVAe
 - Estimated Cost: \$29M
- Peach Bottom - Graceton - Reconductor 230kV line 22008
 - Estimated Cost: \$5.085M
- Red OakA - (T1034) 230kV line - Mitigation upgrade, Drop Loop/Bus Conductor (Bundled)
 - Estimated Cost: \$0.14M
- Red OakB - (G1047) 230kV line - Mitigation upgrade, Drop Loop/Bus Conductor (Bundled)
 - Estimated Cost: \$0.14M
- Atlantic - 230kV Disconnect Switch replacement Estimated Cost: \$0.085M
- Nottingham-Nottreac - 230kV line replace line reactor 220-01Reac
 - Estimated Cost: \$0.2M



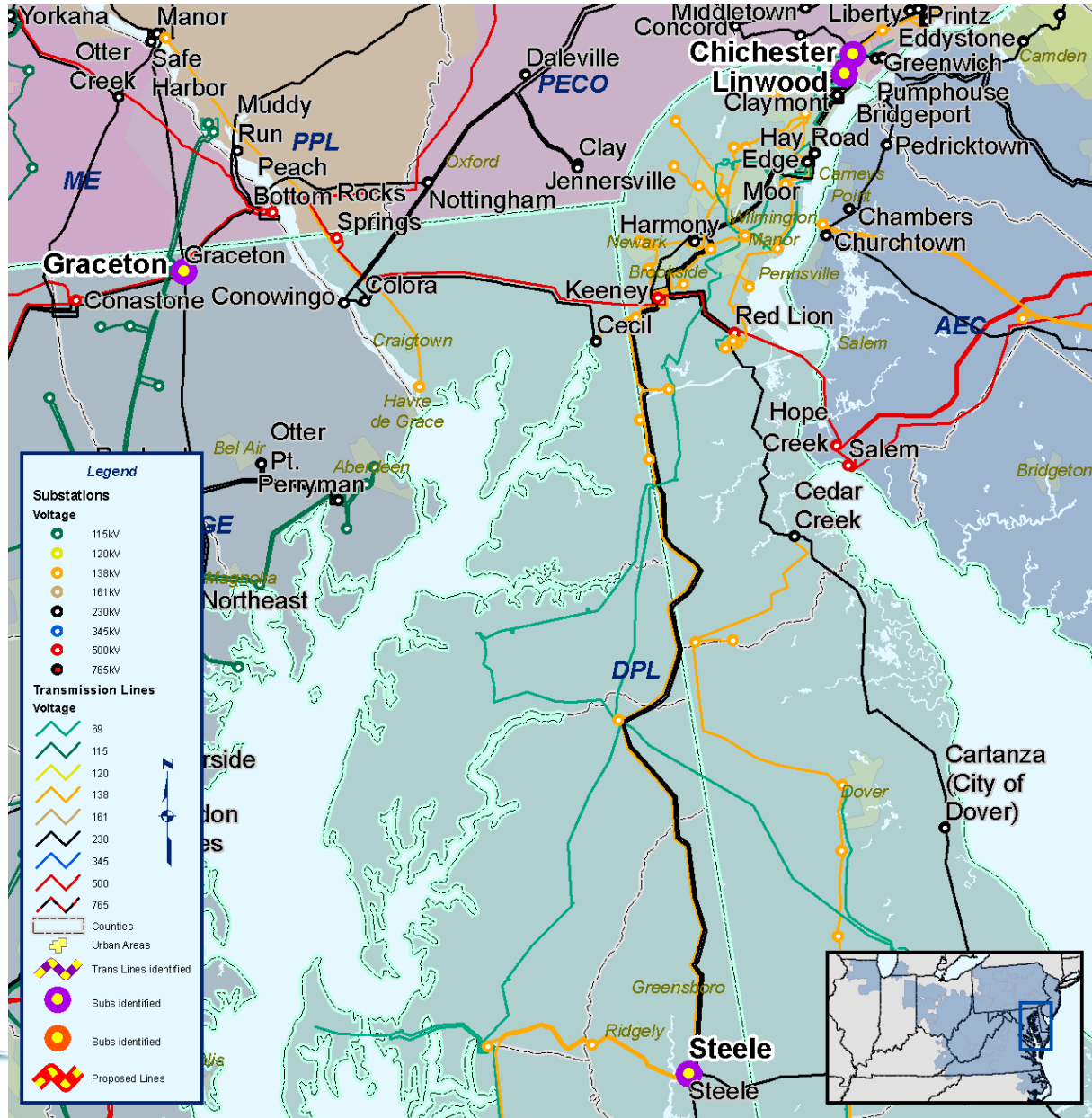
- Aaron to supply name - Install new 115kV 3 breaker ring bus substation approx. 15.46 miles east of Mansfield 115kV substation (disconnect switches, bus structures and a control house)
 - Estimated Cost: \$2.763M
- South Troy - East Towanda - New 115kV structure extending from the Mansfield - South Troy 115kV line to interconnection substation
 - Estimated Cost: \$0.25M
- Mansfield - Relay and control work at 115kV substation. Includes relays, carrier set, line trap and tuner
 - Estimated Cost: \$0.25M
- East Towanda - Realy and control work at 115kV substation. Includes relays, carrier set, line trap and tuner
 - Estimated Cost: \$0.25M
- South Troy - East Towanda - Reconductor 19.54 miles of the South Troy - East Towanda 115kV transmission line
 - Estimated Cost: \$5.373M
- South Troy - Replace two disconnect switches at the 115kV substation (One on East Towanda line, second on Mansfield line)
 - Estimated Cost: \$0.16M
- East Towanda - Replace two CT circuits at the 115kV substation
 - Estimated Cost: \$0.25M
- Mansfield - Relpace a CT circuit and disconnect switch at the 115kV substation
 - Estimated Cost: \$0.33M



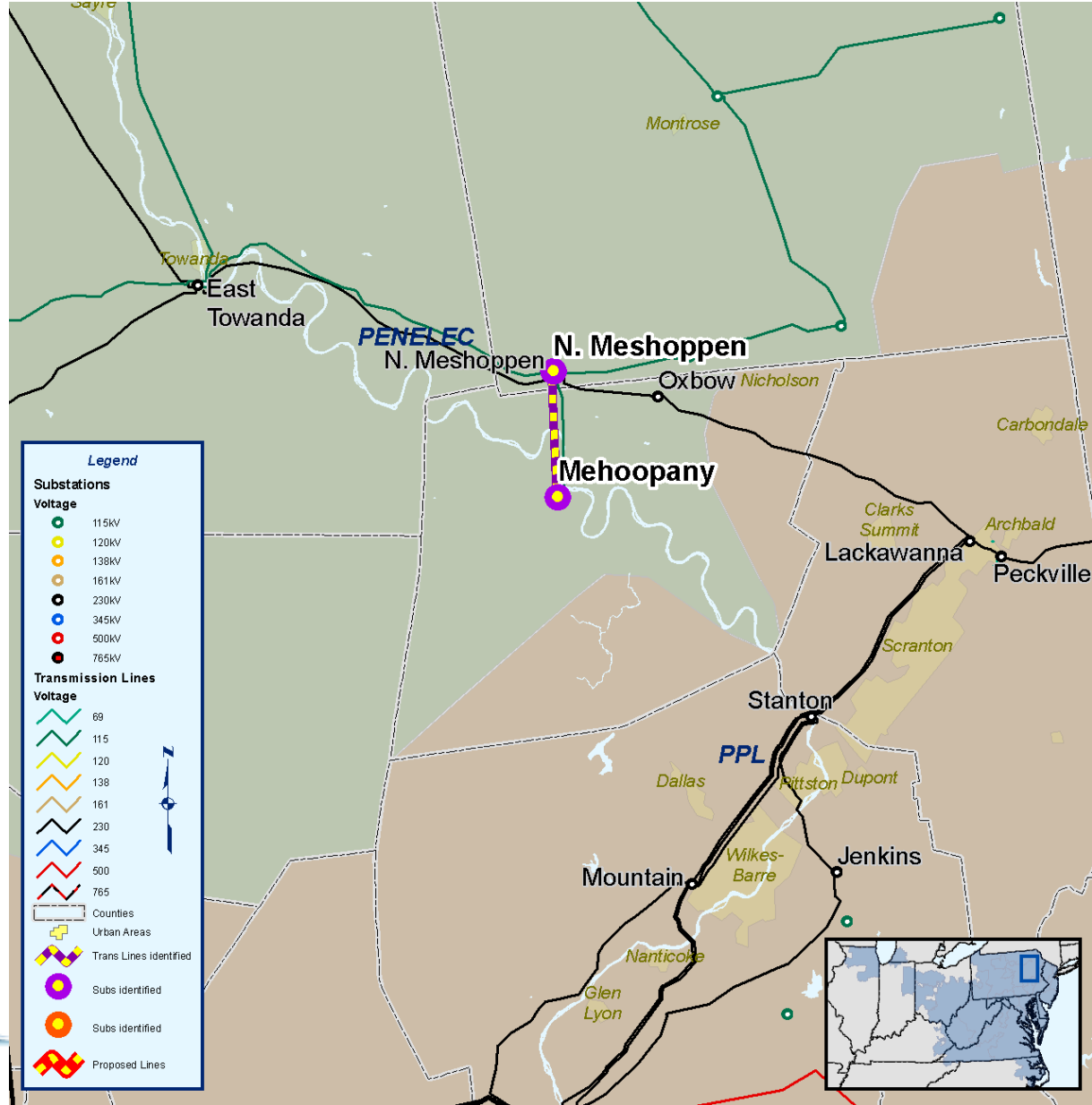
- Waiting for name from Aaron
 - 115kV 3 breaker ring bus
 - Estimated Cost: \$2.763M
- Waiting for name from Aaron
 - Install line tap structure from existing Westover South-Madera 115kV line to new network substation
 - Estimated Cost: \$0.25M
- Garman - Perform relay and control work at 115kV Substation
 - Estimated Cost: \$0.25M
- Shawville - Perform relay and control work on 115kV Substation
 - Estimated Cost: \$0.25M
- Altoona - Replace 230kV line trap at substation (Altoona - Raystown)
 - Estimated Cost: \$0.125M



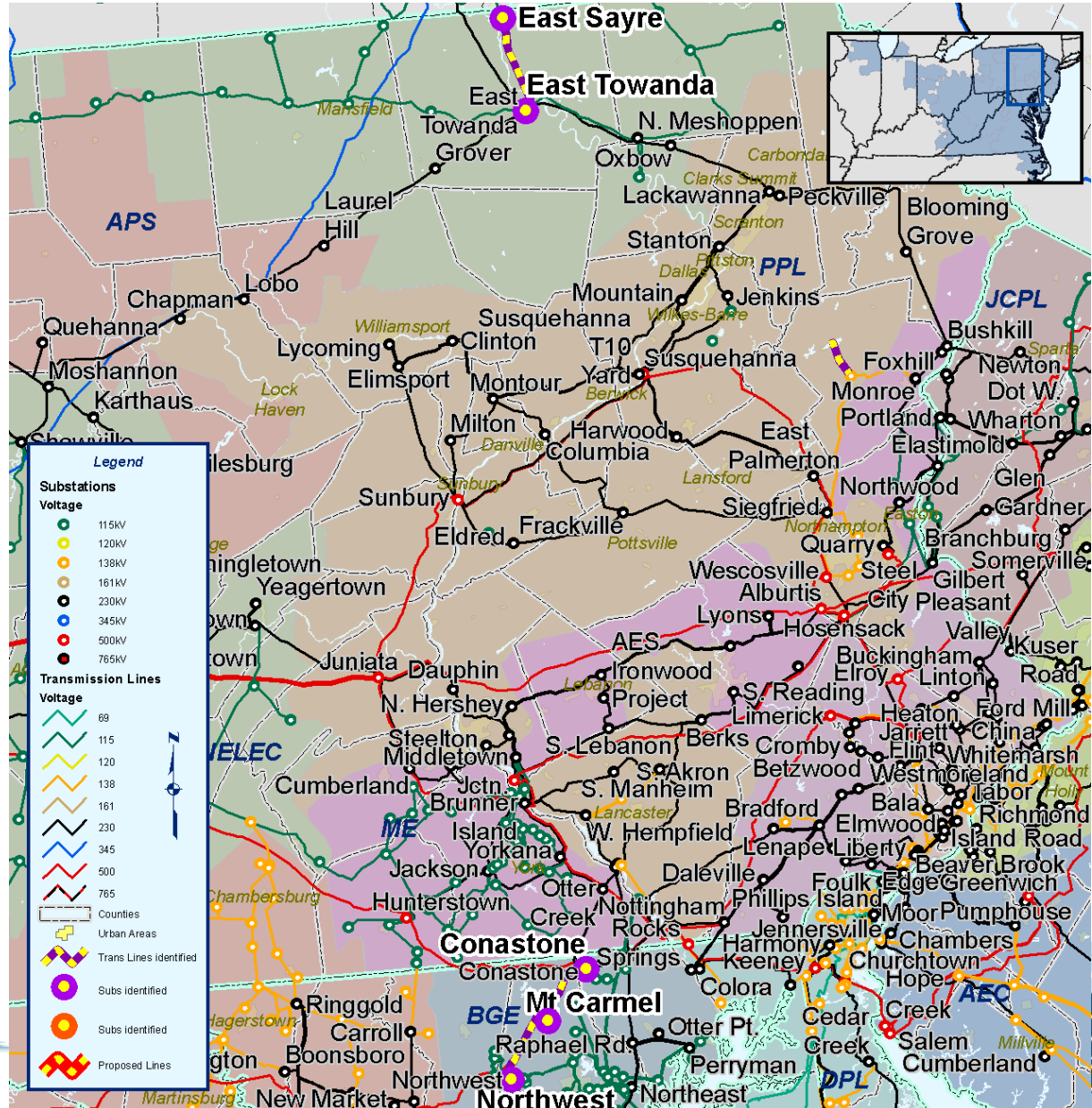
- Steele - 230/138kV replace the 220 MVA unit with a 300 MVA unit
 - Estimated Cost: \$4.3M
- Loretto - Piney Grove - Upgrade 9.51 miles of 477ACSR at 80 degrees C to 125 degrees C
 - Estimated Cost: \$0.5M
- Linwood - Chichester (Circuit 1) - Reconductor line and upgrade substation equipment Linwood to Chichester 220-39 line.
 - Estimated Cost: \$8M
- Linwood - Chichester (Circuit 2) - Reconductor line and upgrade substation equipment Linwood to Chichester 220-43 line.
 - Estimated Cost: \$8M



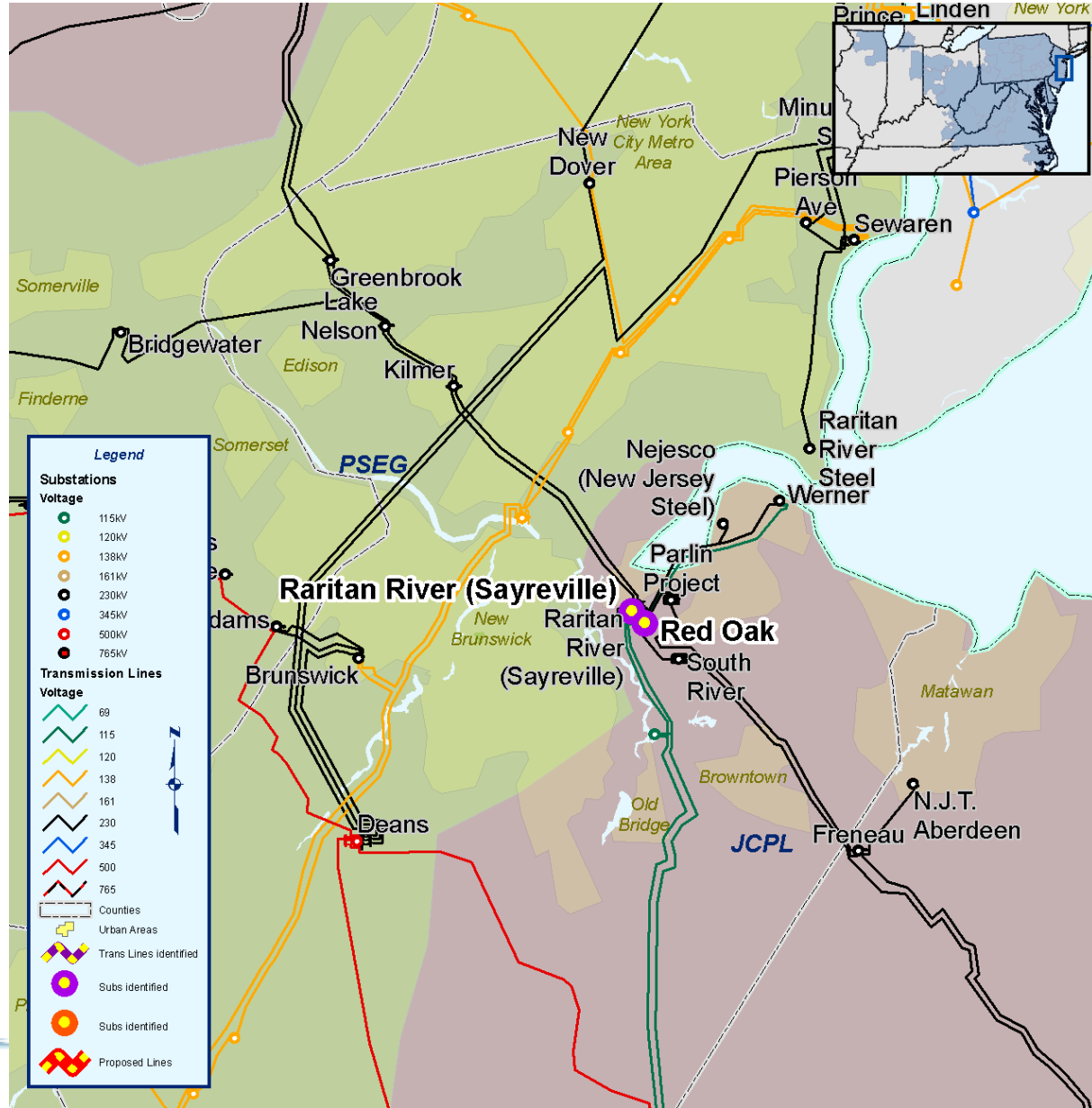
- Mehoopany - Install 4 new 115kV breakers at the substation, Install Disconnect Switches and Bus Structures
 - Estimated Cost: \$1.5M
- Mehoopany - Install new tap structure at the 115kV Substation
 - Estimated Cost: \$0.25M
- North Meshoppen - Perform relay and control work at 115kV Substation
 - Estimated Cost: \$0.36M
- Mehoopany - Perform relay and control work at 115kV Substation
 - Estimated Cost: \$0.36M
- Mehoopany - North Meshoppen - Install approximately 6.56 miles of fiber optic cable between Substations
 - Estimated Cost: \$0.656M



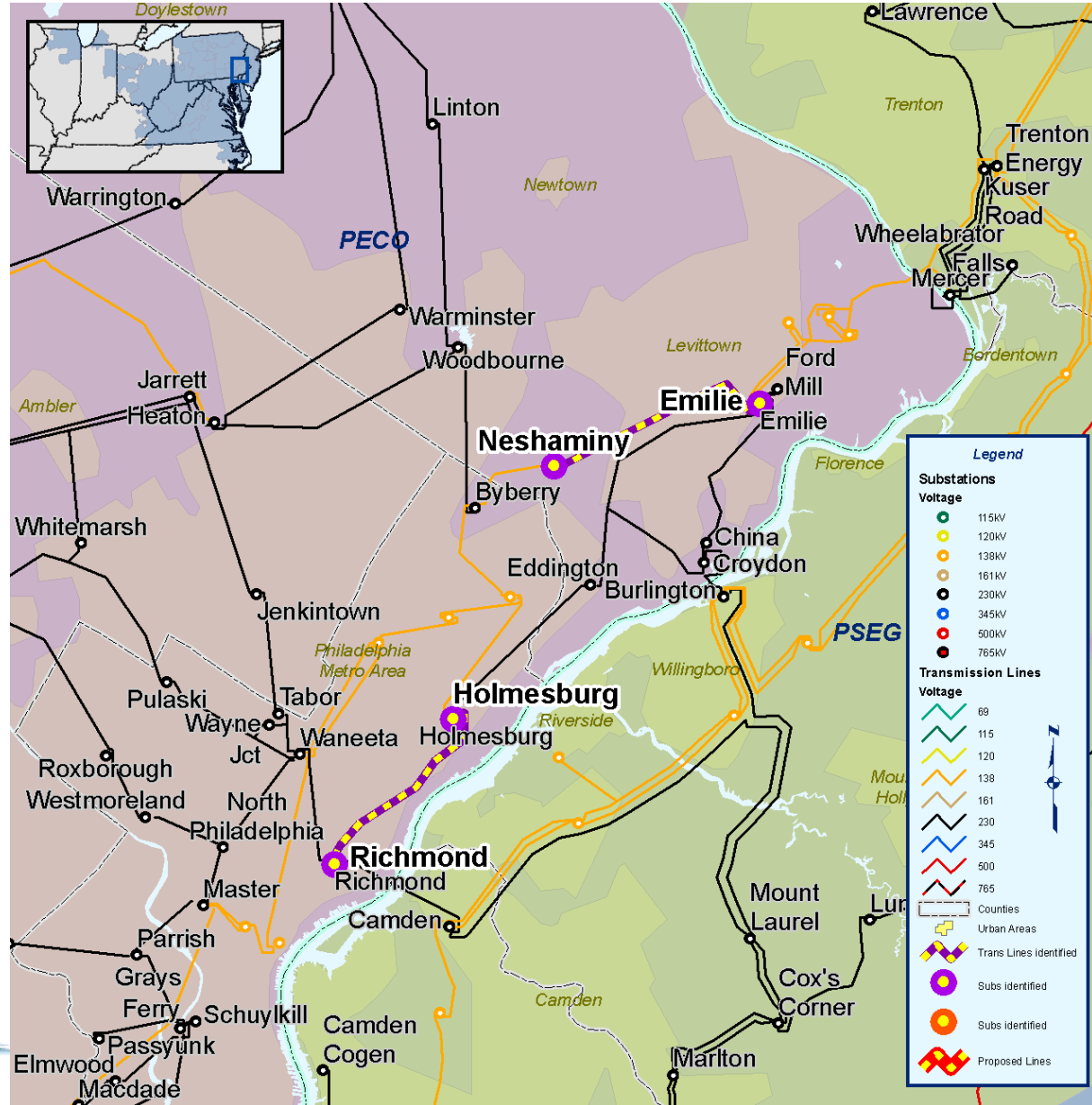
- Constone - Mt. Carmel - 230kV Line 2322 with 1590 kcmil ACSR (160 C design) to match the ratings of adjacent 230kV circuit 2310
 - Estimated Cost: \$4.63M
- Constone - Northwest - Reconductor 230kV line 2322 with 1,590kcmil (160 C design) to match the ratings of adjacent 230kV circuit 2310
 - Estimated Cost: \$5M
- E. Towanda - E. Sayreville - upgrade/replace CT 115kV circuit at East Sayreville
 - Estimated Cost: \$0.125M
- Constone - Mt Carmel - 230kV install 2 500/230kV xfmrs, 4-500kV bkr., 7-230kV bkr.
 - Estimated Cost: \$70M



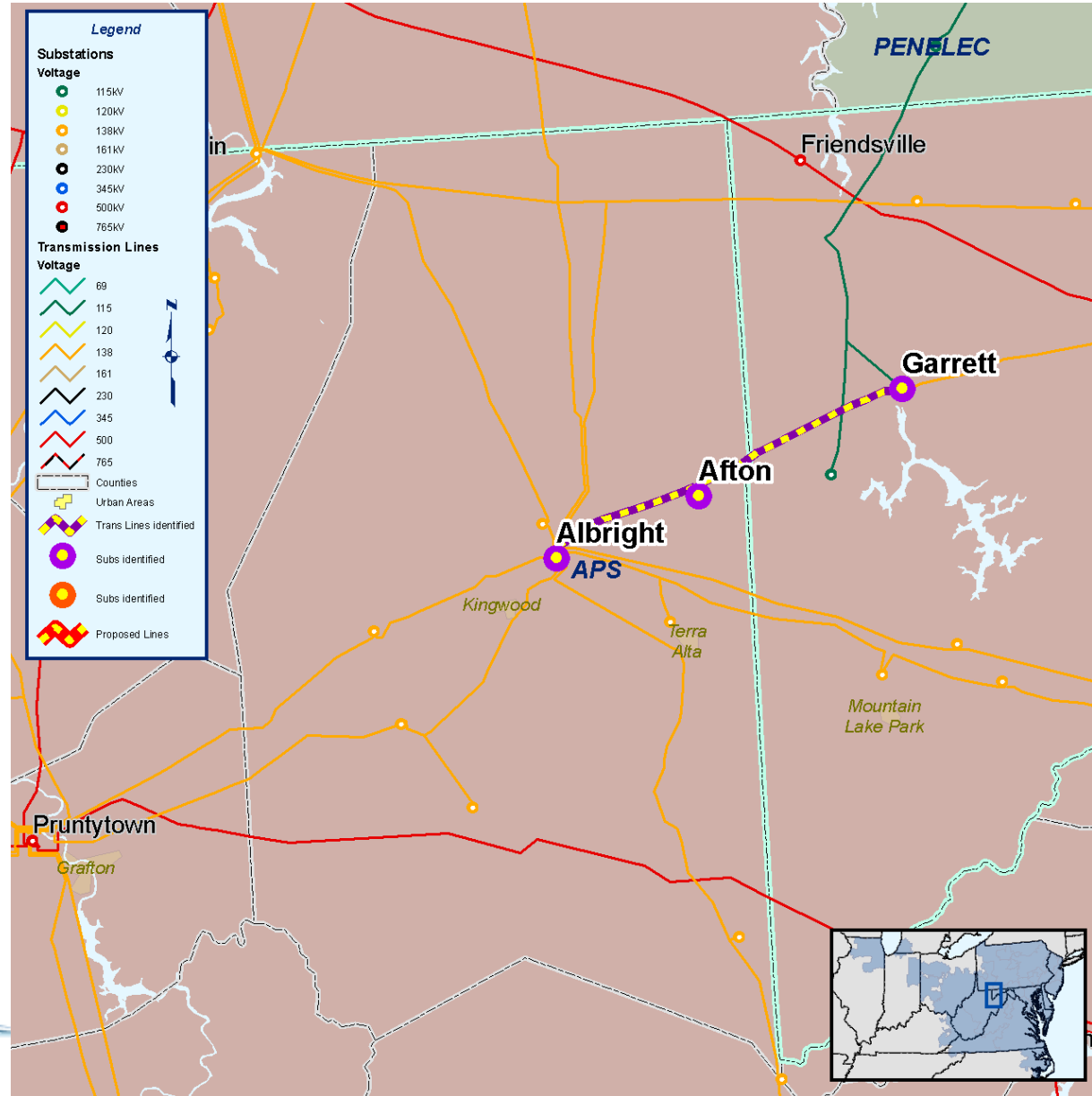
- Red Oak - Modify 230kV substation to connect a 5 breaker ring bus to Raritan River - Parlin and Raritan River - South River 230kV lines
 - Estimated Cost: \$7.9M
- Raritan River - Install 230kV breaker, two 230kV switches and reroute existing control cabling at the 230kV substation
 - Estimated Cost: \$1.115M
- Red Oak - Install 230kV breaker, two 230kV switches and control work at substation
 - Estimated Cost: \$1M



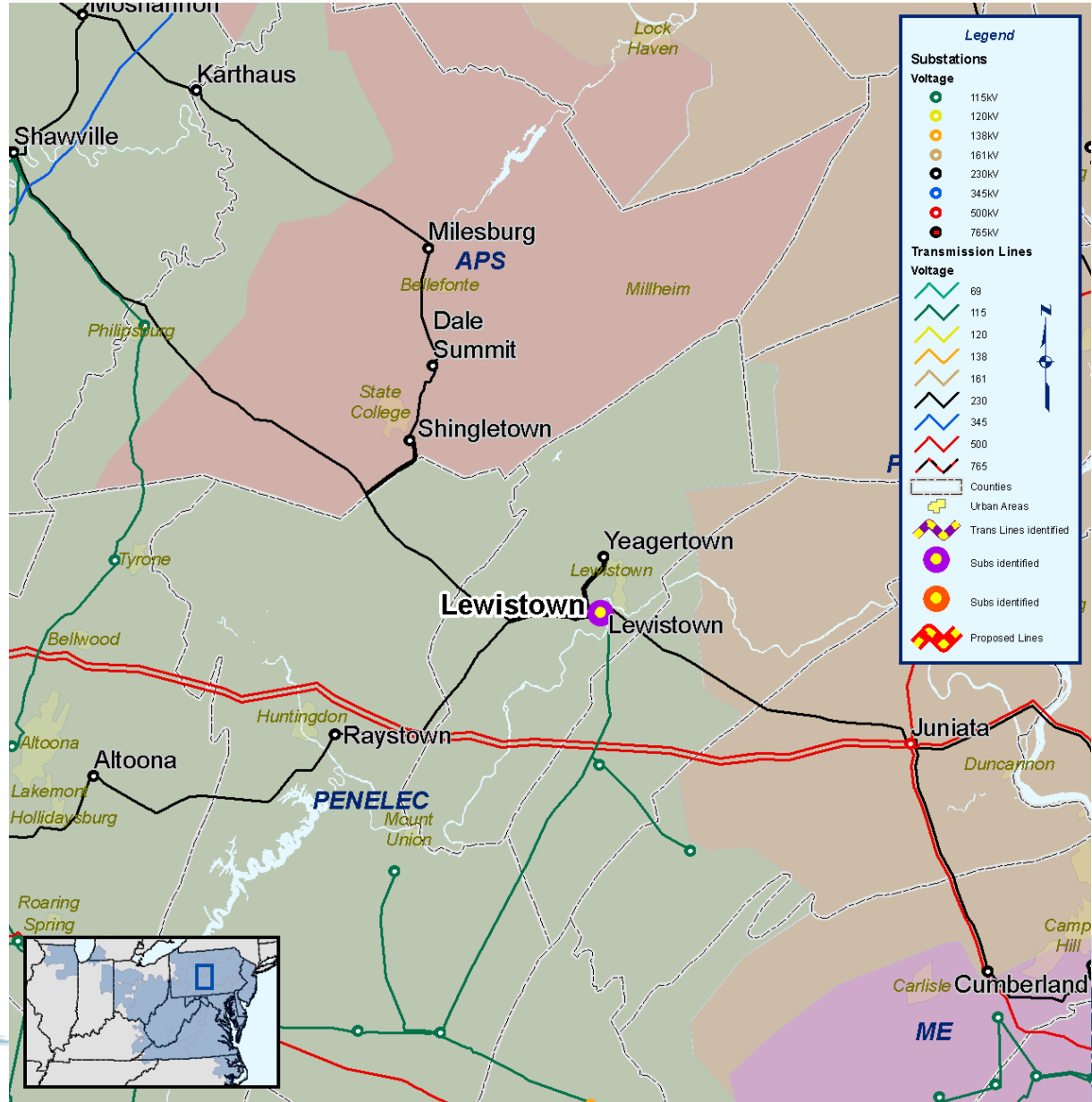
- Richmond - Richmond - Replace line reactors
est. time 18 months
 - Estimated Cost: \$0.2M
- Homesburg-Richmond - Replace terminal equip 230 kV line est time 30 months, est new rating 457/574 MVA
 - Estimated Cost: \$4M
- Emilie-Neshaminy - Replace terminal equip 230kV line
 - Estimated Cost: \$0.5M



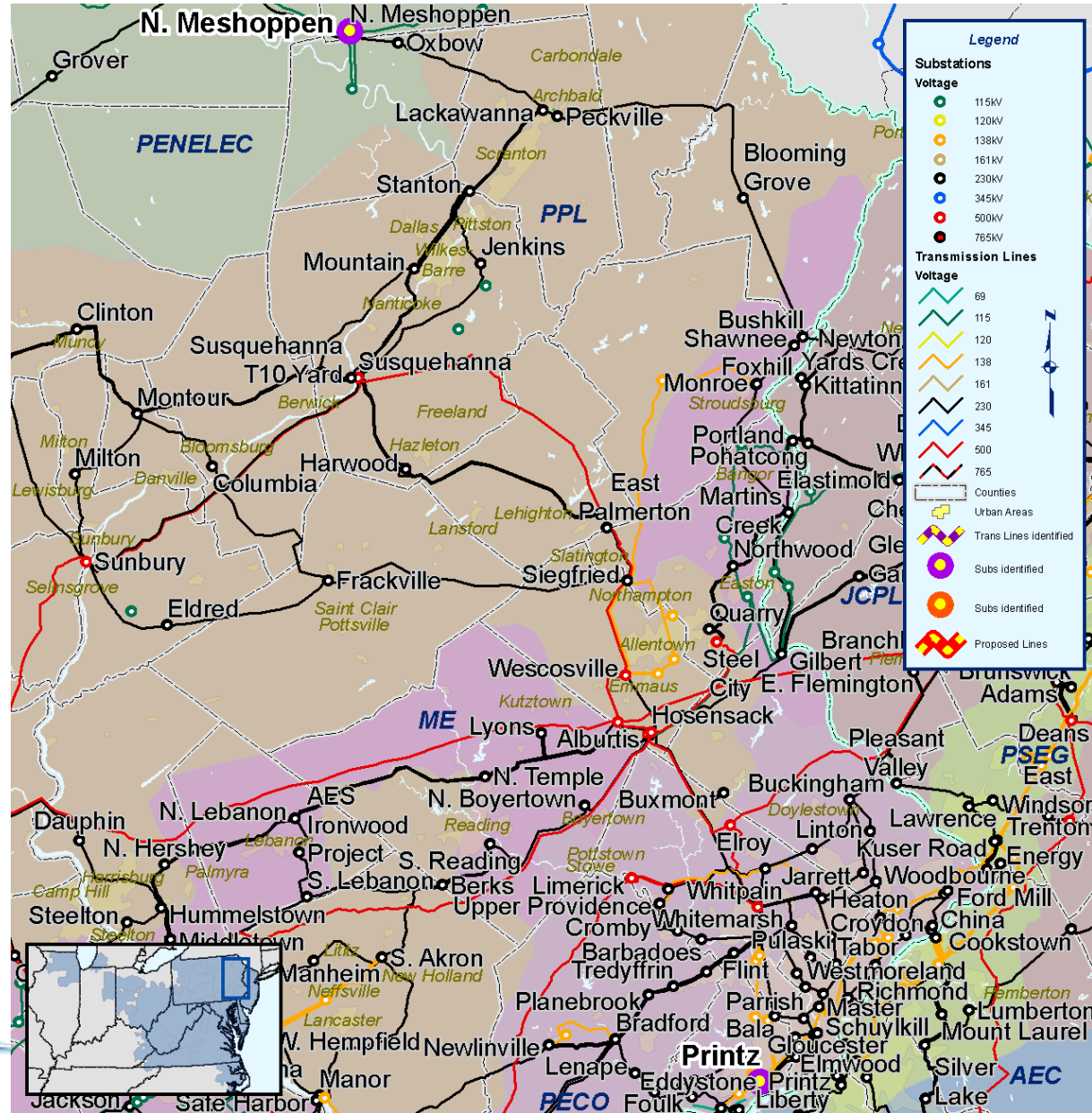
- Albright - Install 138kV relaying at the Albright Substation for the Afton circuit
 - Estimated Cost: \$0.189M
- Garrett - Install 138kV relaying at the Garrett substation for the Afton circuit
 - Estimated Cost: \$0.197M
- Afton - Loop Albright-Garrett 138kV circuit into new Afton substation. Perform relay setting/adjustment at the new Afton substation
 - Estimated Cost: \$0.185M



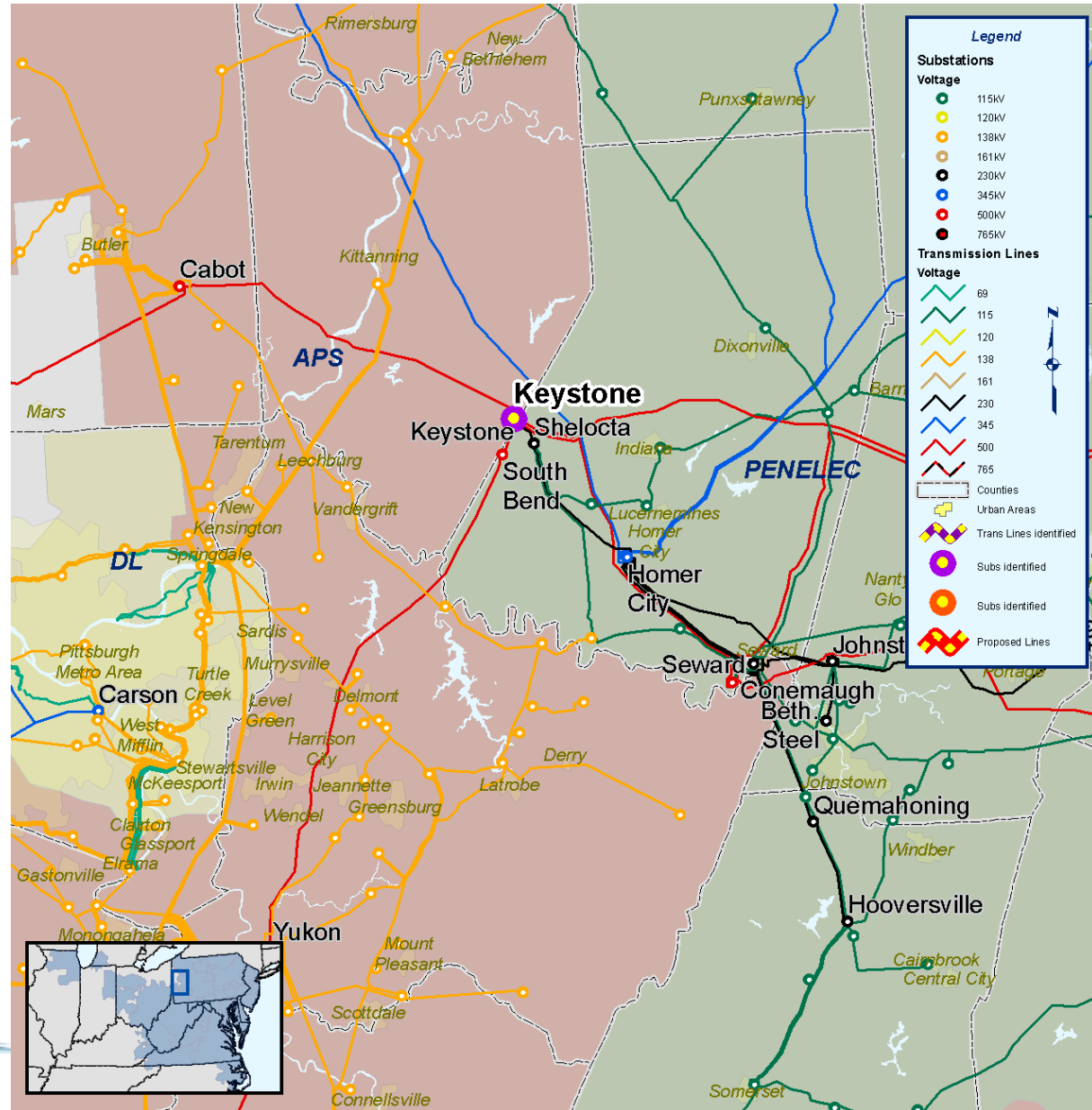
- Bear Rock -
Inspect/Upgrade
grounding grid at
existing 230kV
Substation
 - Estimated Cost:
\$0.02M
- Lewistown - Replace
linetrap at the 230kV
substation
 - Estimated Cost:
\$0.117M
- Lewistown - Replace
CT circuit at the 230kV
Substation
 - Estimated Cost:
\$0.14M



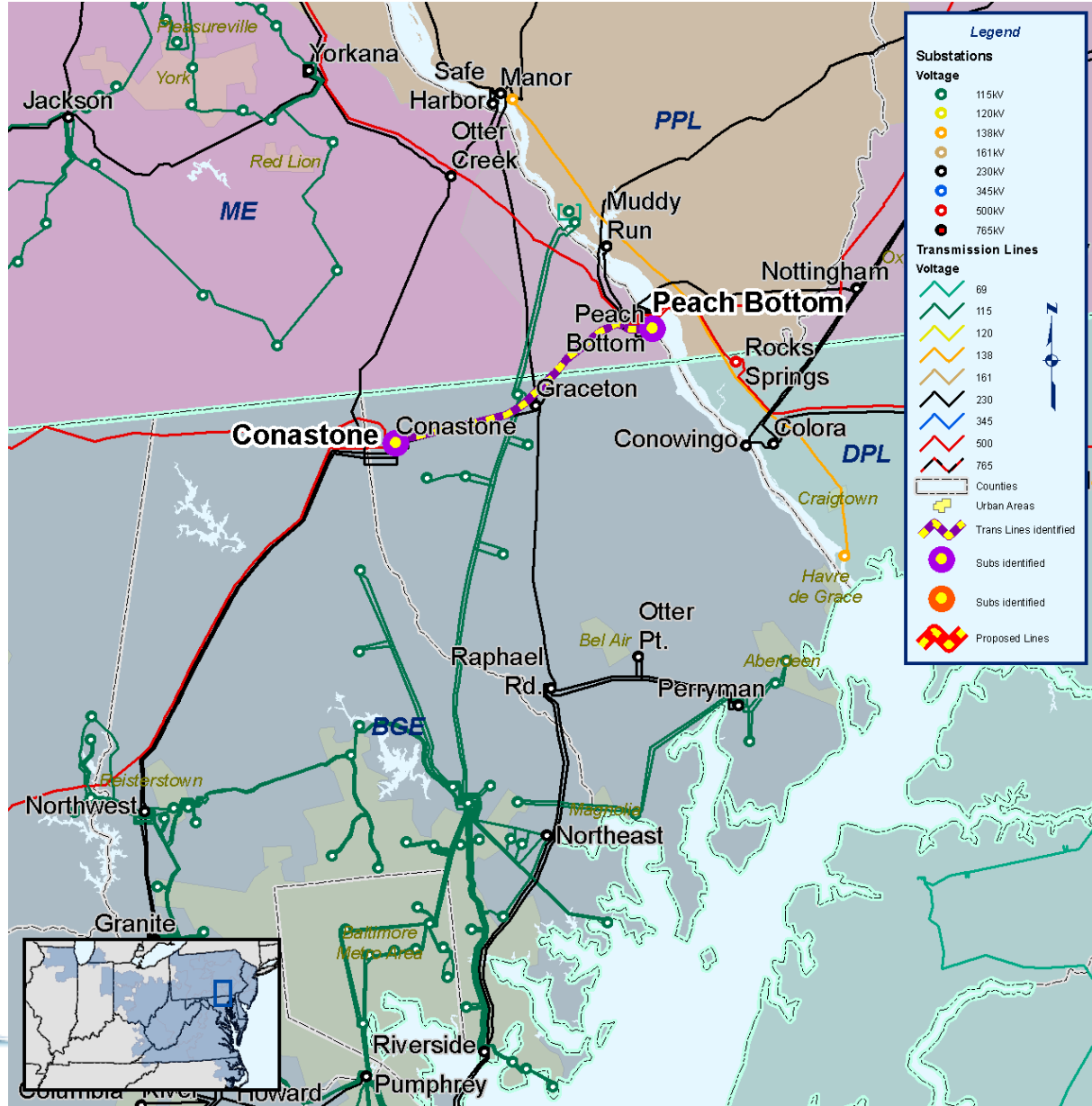
- Printz - Replace 2 circuit breakers 230kV line
 - Estimated Cost: \$0.6M
- N. Meshoppen - 230/115kV addition of two 230kV breakers, reconfigure ring bus
 - Estimated Cost: \$1.5M



- Keystone - Replace #3 500/230kV Transformer
 - Estimated Cost: \$5.5M
- Keystone - Replace #4 500/230kV Transformer
 - Estimated Cost: \$5.5M

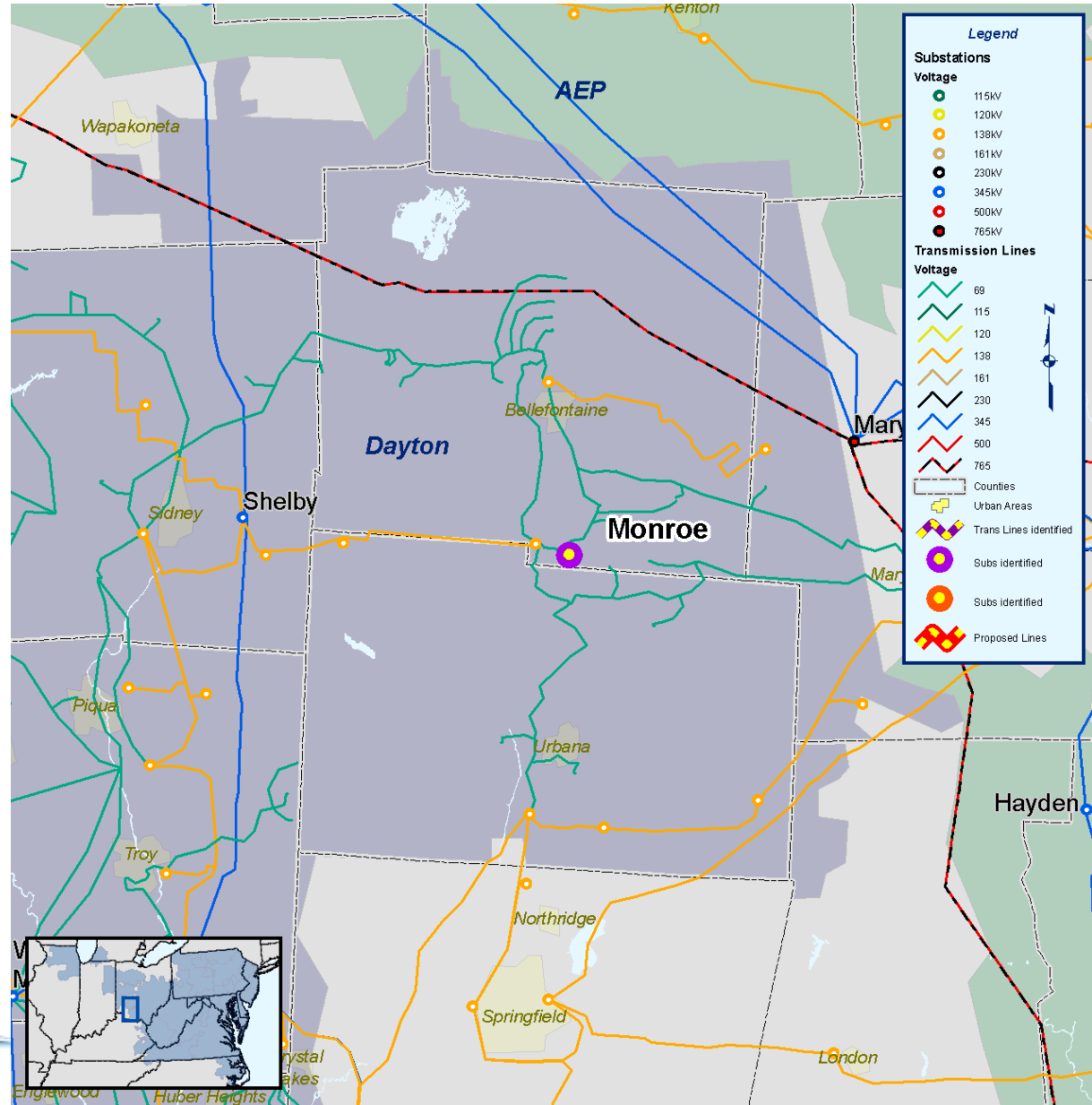


- Conastone-Peach Bottom - Build 500kV line, Conastone end (BGE portion of line)
 - Estimated Cost: \$1.5M
- Conastone-Peach Bottom - Replace 500kV line metering equip 5012 (Peach Bottom to Conastone - PECO only)
 - Estimated Cost: \$0.1M

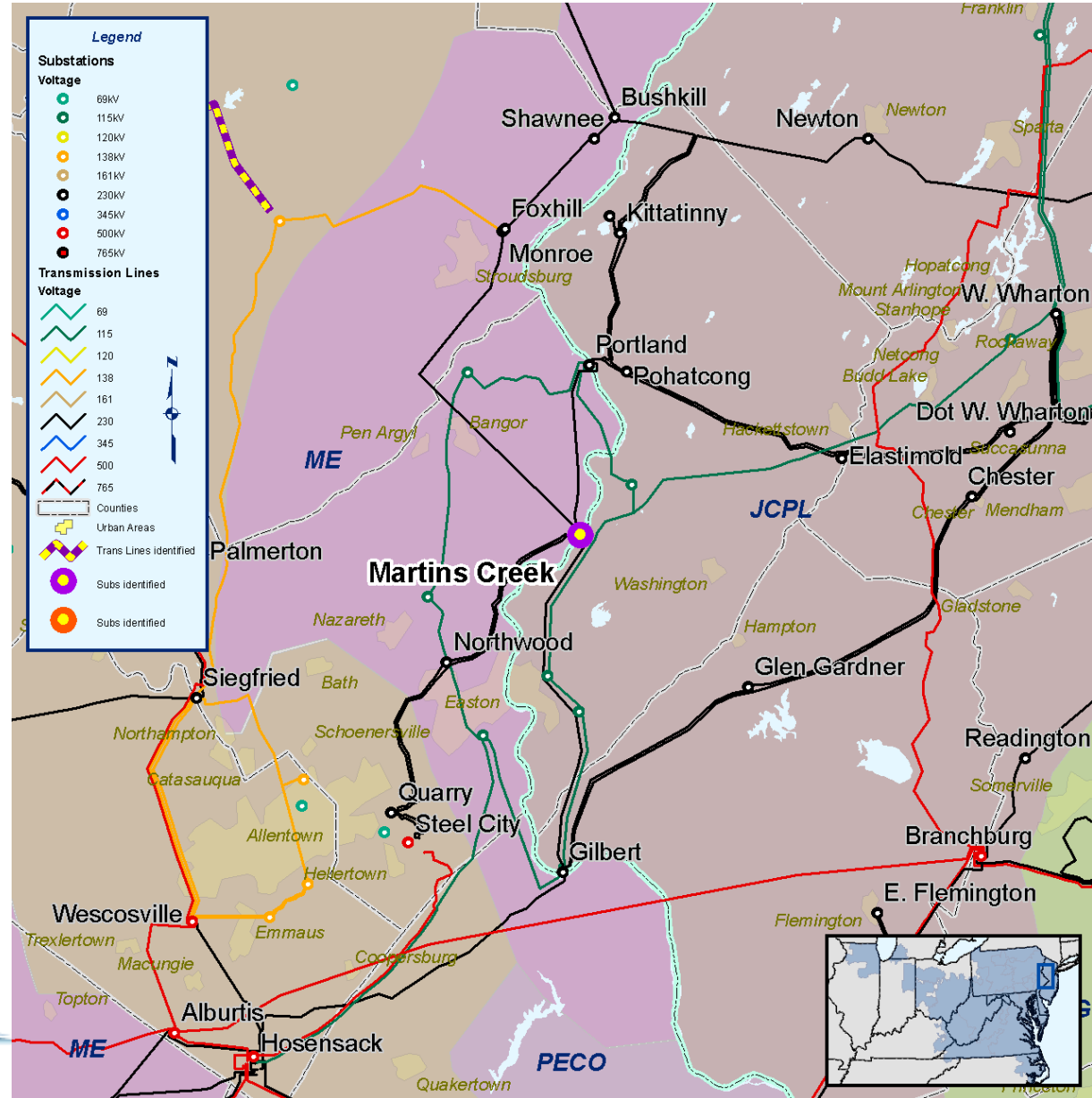


- Monroe - Construct new Interconnection Switching Station T Bus and set remote relays

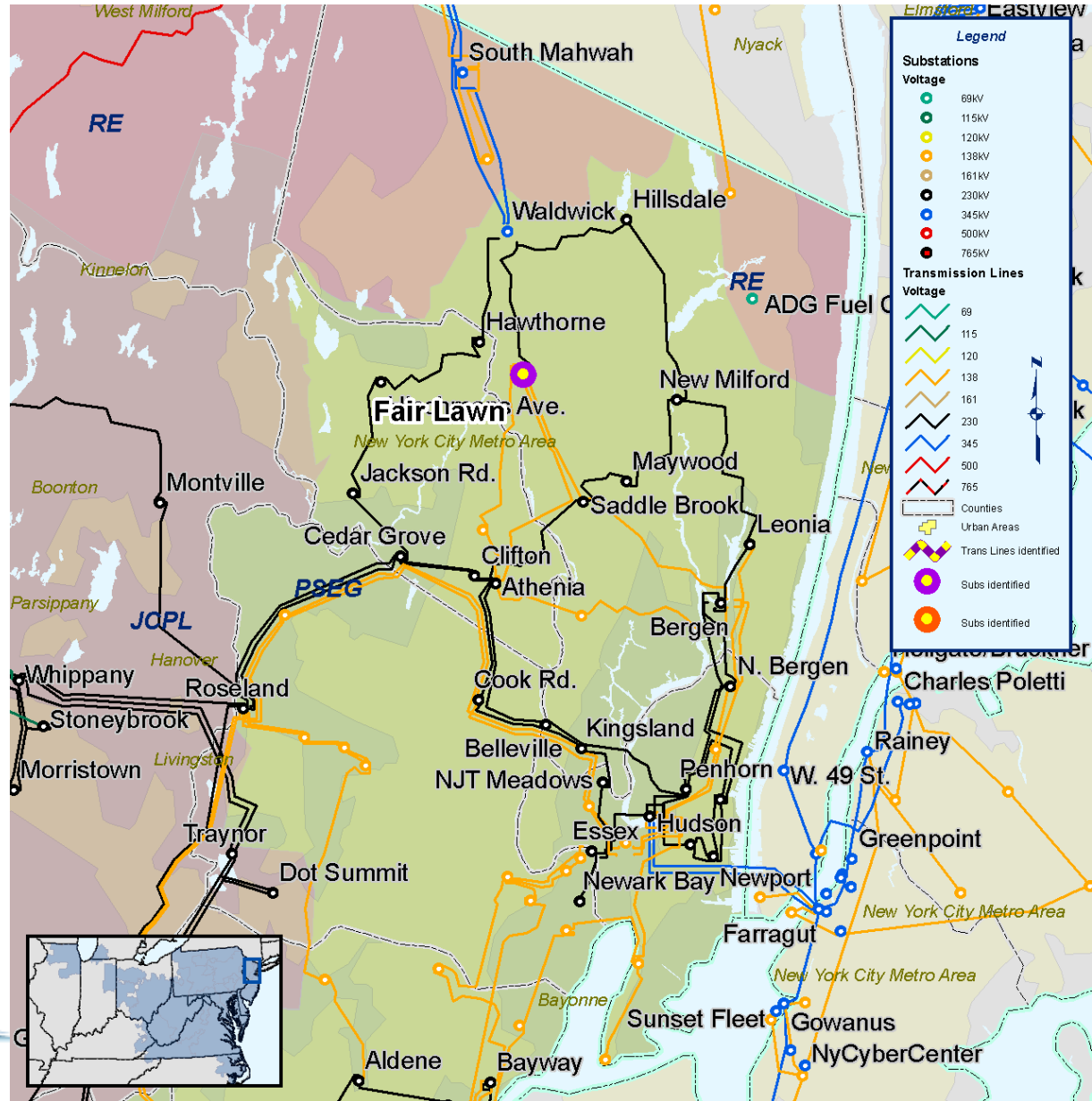
- Estimated Cost: \$1.6M



- Martins Creek -
Install automatic
relay and control
scheme to existing
disconnect
switches 230kV
 - Estimated Cost:
\$0.1M



- Fair Lawn - Upgrade the Z-598 circuit to a summer normal rating of 73MVA
 - Estimated Cost: \$0.5M



Next Steps

- Develop upgrades to address the common mode failure reactive issues
- Finalize upgrades for global reactive issues
- Northern New Jersey Upgrades
- 2012 Retool

Board Approval

- Expect to take the baseline upgrades reviewed today to the PJM Board of Managers for approval on October 15, 2008.
- Comments on the material presented today can be sent to: RTEP@pjm.com