



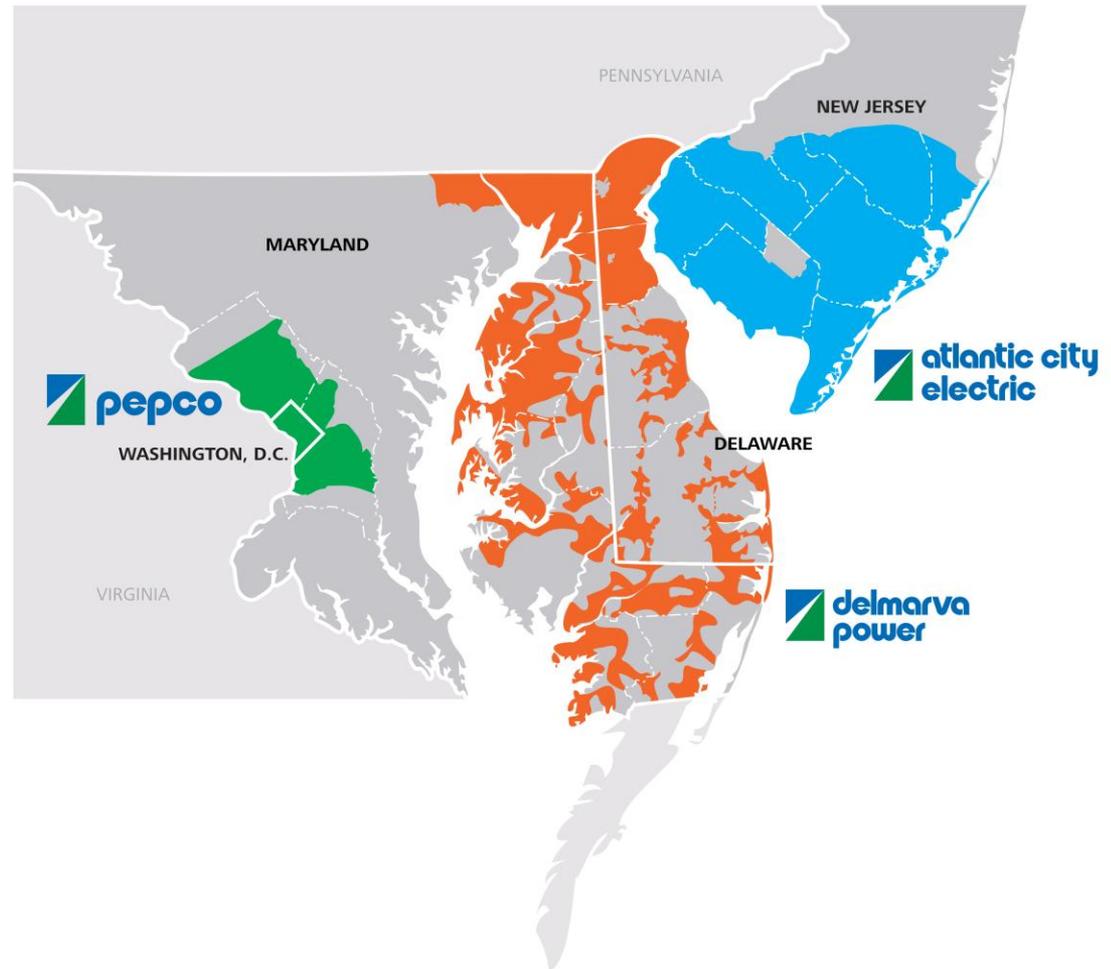
Challenges Impacting Critical Electrical Infrastructure in the Floodplain and Flood Prone Areas due to Storm Events and Sea-level Rise



Chuck Reed
September 19, 2013

Pepco Holdings Quick Facts

- Incorporated in 2002
- Service territory:
8,340 square miles
- Customers served
 - Atlantic City Electric:
 - 545,000 – electric
 - Delmarva Power:
 - 503,000 – electric
 - 125,000 – natural gas
 - Pepco:
 - 793,000 – electric
- Total population served:
5.6 million



In general, what are the issues with sea-level rise?

- Higher and more frequent flooding of wetlands and adjacent shores
- Expanded flooding during severe storms and high tides



In general, what are the issues with sea-level rise?

- Increased wave energy in the near-shore area
- Upward and land-ward migration of beaches
- Accelerated coastal retreat and erosion



In general, what are the issues with sea-level rise?

- Damage to coastal infrastructure
- Overall impacts on the coastal economy



What Challenges do Utilities face due to sea-level rise?

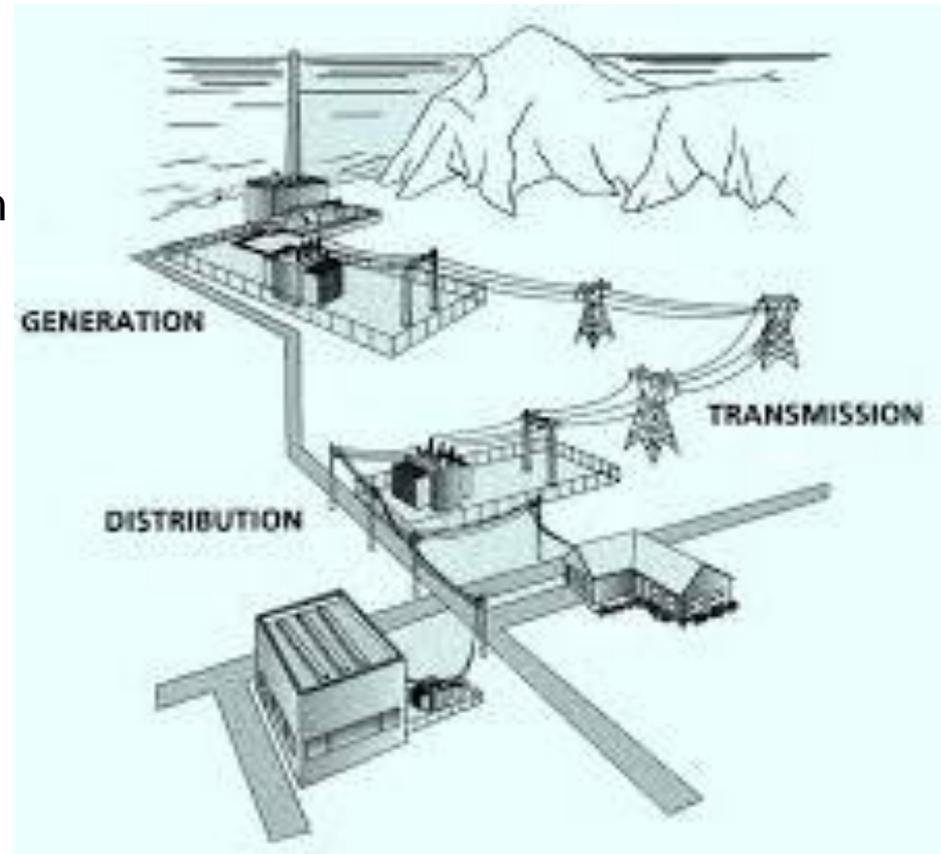
- Limited access for routine maintenance and storm restoration
- Vulnerability of our utility infrastructure to flood damage
- Changing drainage patterns affecting infrastructure stability
- Maintaining reliable service due to the affects of sea-level rise



What are we doing to address sea-level rise?

We are focusing on two critical parts of our infrastructure....

- Transmission Circuits
 - Transmission circuits are the power lines that transport high voltage electricity from the generating stations to the substations.
- Substations
 - Substation are fed by transmission circuits and transform the high voltage energy to low voltage energy that energize communities.



Transmission Circuit Hardening

Description: Upgrade 40 to 45 of the Atlantic City Electric (ACE) 69kV and 138kV transmission circuits, (approximately 375 to 425 pole-line miles), and related assets to appropriate design standards. The intent of this work is to address 1.) hardening pole line infrastructure to a steel and concrete solution to accommodate extreme wind conditions, 2.) correcting foundation stability problems in tidal wetlands and flood plains for pole lines, and, 3.) placing entire circuits or portions there of underground in especially sensitive areas. It will better position these assets to withstand extreme wind forces and storm surges by replacing vulnerable wood poles with steel, installing steel caisson foundations (as necessary), installing storm guying, and / or by using submarine cable or underground cable in conduit as conditions require.

Justification: During Hurricane Sandy, 23 transmission circuit interruptions caused wide spread outages due to downed poles and downed conductors. This included circuits that serve the Barrier Islands (including for example, Long Beach Island and Ocean City)

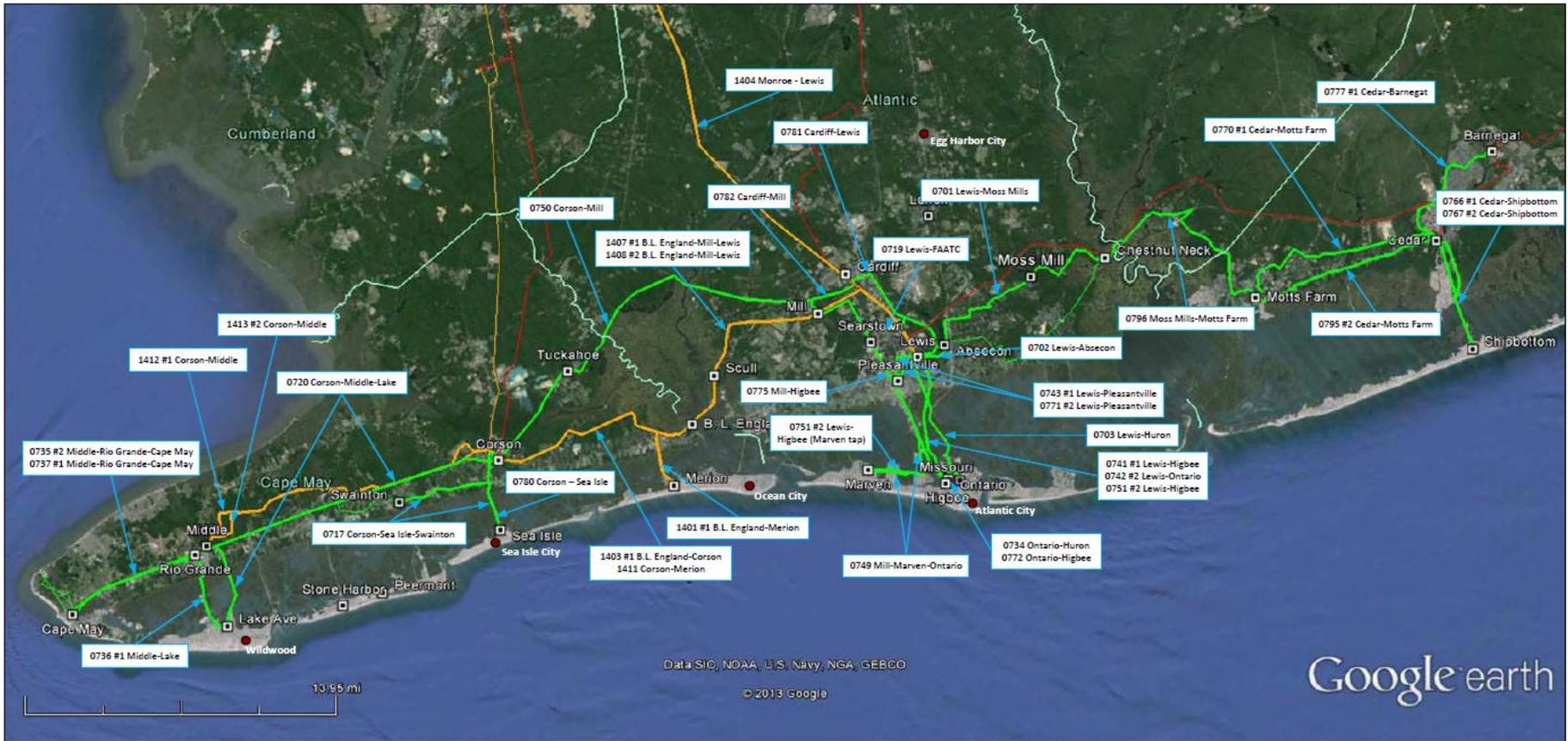
Potential Benefits:

- Improved customer reliability due to reduced transmission line outages resulting from storm wind and surge impacted transmission poles and lines.
- Improved restoration times due to reduced exposure of transmission line assets to storm wind and surge.
- Improved aesthetics from fewer poles with more compact construction.
- Lessened environmental impact due to improved placement of transmission assets.

Note That:

- 5 Coastal Circuits and 11 circuits feeding Barrier Islands were out during Hurricane Sandy

Transmission Circuit Hardening



LEGEND

	Denotes transmission circuits that are candidates for rebuild		230 kV circuit		City
	69 kV candidate for rebuild		69 kV circuit		ACE substation
	138 kV candidate for rebuild		138 kV circuit		

Atlantic City Electric
Southern New Jersey Transmission Circuit Hardening Candidates
Barrier Island and Coastal Transmission Circuits



Transmission Circuit Hardening



Transmission Circuit Hardening



Substation Storm Surge Prevention

Project Description: Upgrade substations to mitigate those with reported flooding and those in the FEMA – ABFE 1% (Advisory Base Flood Elevation – 1% annual chance of being equaled) flood plain and coastal impact areas. These will continue to be a problem due to a rise in sea level caused by global climate change. The upgrades include (a) installing new equipment at a higher elevation and in more secure buildings (b) elevating switchgear, transformers and control houses, (c) installing GIS (Gas Insulated Substation) equipment to replace air insulated equipment (d) installing protective walls and (e) weather proofed enclosure/buildings for substation switchgear and controls.

Resiliency Justification: There were 16 substations that had reported some degree of flooding in the ACE region during the last two major hurricanes (Irene and Sandy). ACE has 13 substations within the Federal Emergency Management Agency's Advisory Based Flood Elevation (ABFE) 1% flood zone. The overlap of these two, yield 20 substations that are on the Atlantic City Electric's flood prone substation list as reported and further detailed in the BPU-58 and BPU-59 compliance items found in the Board's Order Accepting Consultant's Report and Additional Staff Recommendations and Requiring Electric Utilities to Implement Recommendations, dated January 23, 2013 (BPU Docket No, EO11090543)

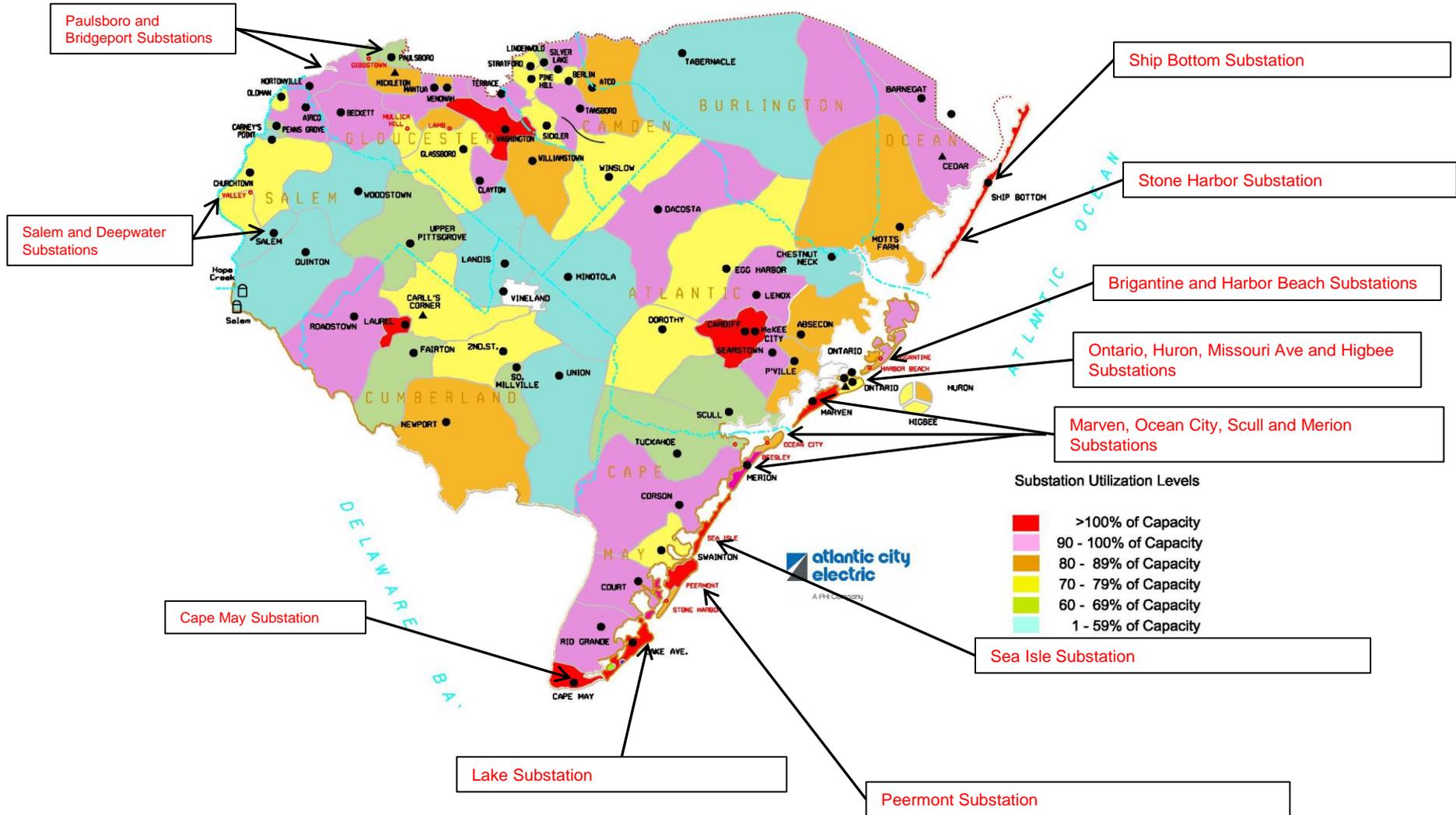
Potential Benefits:

- Prevention of water damage to the critical substation buildings and equipment that occurs due to storm surges
- Elimination of potential catastrophic equipment failure
- Reduced equipment failures and outages due to flying debris by enclosing equipment in buildings or steel enclosures
- Reduced customer outages due to less substation asset damage resulting from storm surges
- Lessened environmental impact due to improved critical infrastructure protection
- Extended life of substations with new equipment replacements and increased capacity

Notes:

- Substations are on coastal and river surge areas
- GIS site buildings
- Switchgear replacement
- Control Building replacement
- Raise Transformers

Substation Storm Surge Prevention (Map)



Substation Storm Surge Prevention (Photos)



Existing Peermont Substation



Substation Storm Surge Prevention (Photos)



New Peermont Substation



Substation Storm Surge Prevention (Photos)



Substation Firming

Project Description: Upgrade existing and build new substations as required to serve all customers from substations having 100% redundant transformer capacity.

Resiliency Justification: Substation Firming eliminates the need to transport a mobile transformer to the site of a failed substation transformer to restore customers out due to the failure of that substation transformer.

Potential Benefits:

- Improved customer reliability due to the minimization of sustained outages related to substation transformer and/or transmission supply failures.
- When paired with “Create Additional Tie Points”, provides additional substation capacity for use in restoring feeders from adjacent substations.

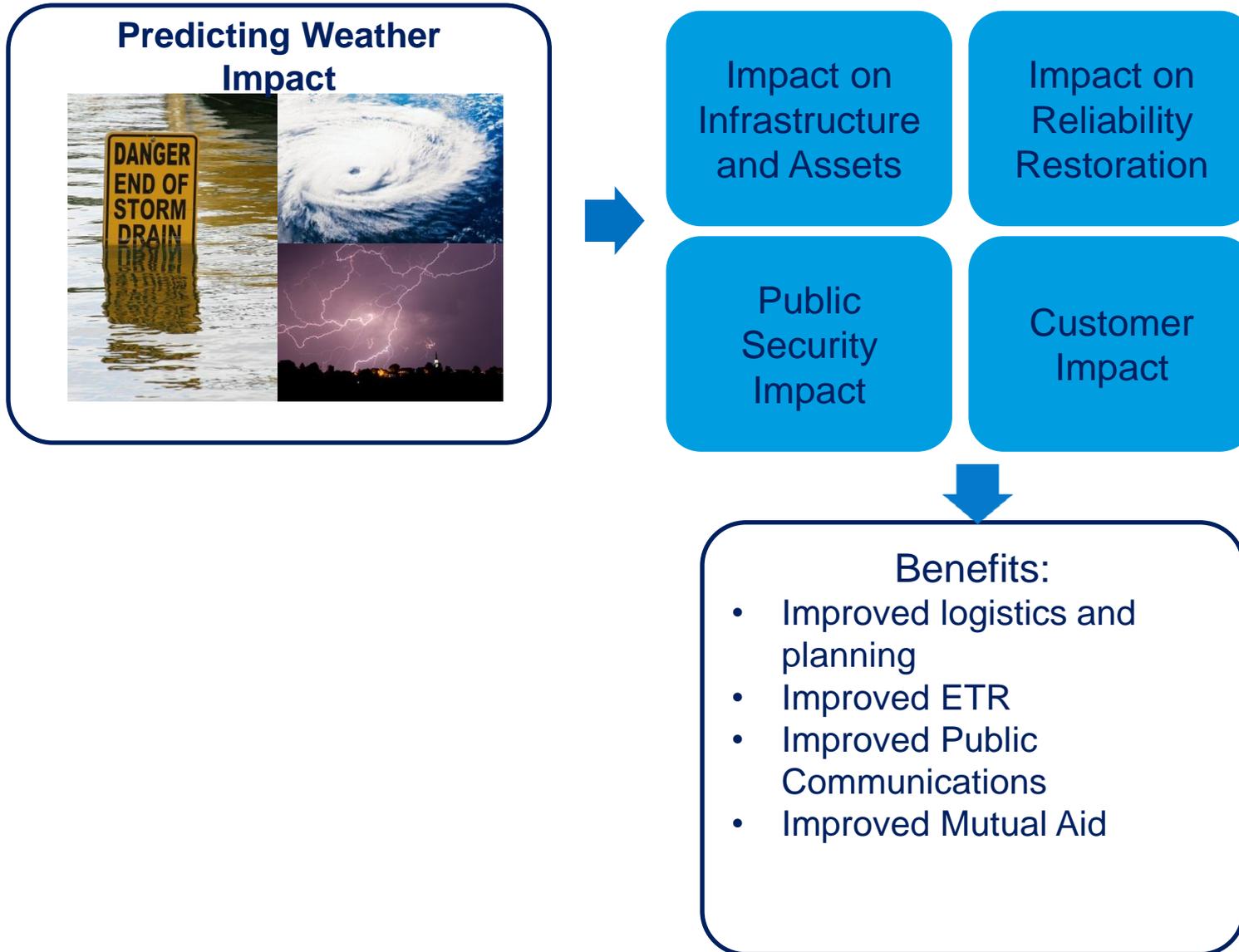
Vulnerability Assessment



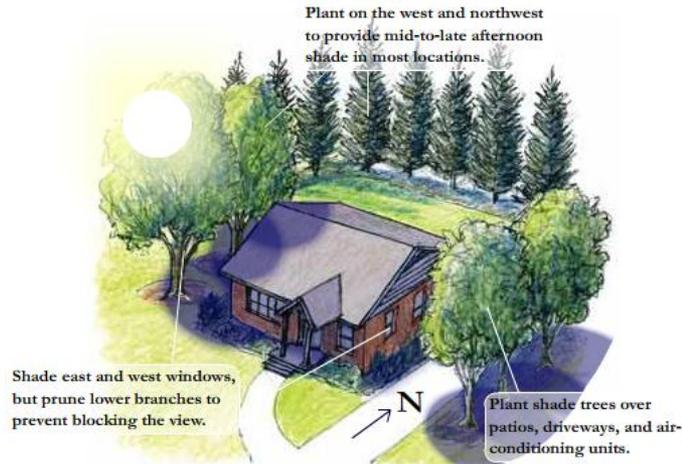
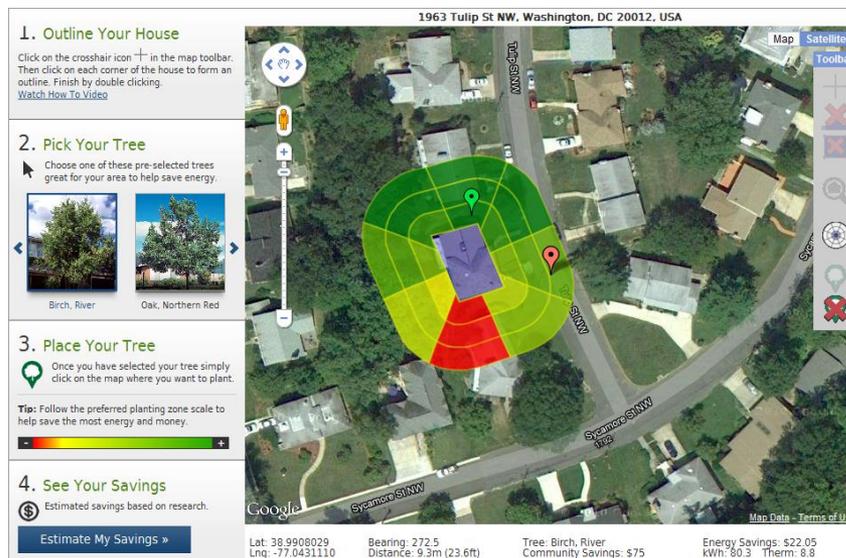
Vulnerability Assessment



Integrated Damage Prediction Model



- Two free trees per customer for energy saving benefits
- Partnership with Arbor Day Foundation since 2011
- Online mapping tool indicating best place to plant for most energy savings
- Also improves air quality, storm water, carbon sequestration
- To date, 3,900 trees in DPL (20,300 across territory)

1963 Tulip St NW, Washington, DC 20012, USA

- 1. Outline Your House**
Click on the crosshair icon  in the map toolbar. Then click on each corner of the house to form an outline. Finish by double clicking. [Watch How To Video](#)
- 2. Pick Your Tree**
Choose one of these pre-selected trees great for your area to help save energy.
 Birch, River
 Oak, Northern Red
- 3. Place Your Tree**
Once you have selected your tree simply click on the map where you want to plant.
Tip: Follow the preferred planting zone scale to help save the most energy and money.

- 4. See Your Savings**
Estimated savings based on research.
[Estimate My Savings](#)

Map toolbar: Map, Satellite, Toolbar

Map Data - Terms of Use

Lat: 38.9908029 Bearing: 272.5 Tree: Birch, River Energy Savings: \$22.05
 Lng: -77.0431110 Distance: 9.3m (23.6ft) Community Savings: \$75 kWh: 80.3 Therm: 8.8

Habitat Restoration Addressing Sea Level Rise Impacts: Eastern Tiger Salamander, Cape May, NJ

- Habitat creation to address habitat loss due to sea level rise
- Creation of vernal pools on ACE ROW
- ACE, USFWS, Conserve Wildlife, NJ DEP ENSP, Cape May County Zoo
- Federal funding to address sea level rise impacts on habitat



Habitat Restoration Addressing Sea Level Rise Impacts: Nanticoke River Wetland Restoration, Vienna, MD

- 260+ PHI-owned acres targeted for restoration of native wetland vegetation
- Reintroduce structural diversity – improved habitat and wetland health
- MD DNR, USFWS, multiple adjacent landowners
- Landscape scale effort
- Photo: 1 yr after 1st treatment

