2014 RTEP Update
• Initial 2019 Summer base case and corresponding machine list update complete
• PJM staff has been reviewing and checking the 2019 base case
• Validating the modeling of RTEP upgrades in the case with the TOs
  – Each TO was sent an itemized list of upgrades to verify modeling
• Currently running benchmarking simulations
• Targeting the week of March 17, 2014 to begin initial RTEP simulations
• RTEP proposal window communication to follow
• Winter study case out to TOs for review and topology update
• Similar to the PJM Light Load Reliability Criterion, PJM currently gathering data for:
  – Generation Dispatch
    • Generation capacity factors
  – Area interchange
    • Historical metered data
• Other considerations
• Analysis to begin late March 2014
Reliability Analysis Update
• Over 100 sag studies in progress
• On schedule to have remediation completed by second quarter of 2015 for all Sag Studies with a need date of June 2015 or sooner.
• Majority of the remediation include upgrades of limited scope
  – Transmission Structure modification
  – Replacement of a few spans
  – Relocation of distribution or third party underbuilds
  – Conductor hardware remediation
• Project Cancellation

• B1852.1: Upgrade five 345 kV circuit breakers (L1223, L11124, L14321, BT2-3 and BT3-4) at Electric Junction

• B1852.2: Modify reclosing on 138 kV line (L11103) at TSS 111 Electric Junction

• B0661, which will be in service this year, will operate the Plano 345 kV red-blue bus tie normally closed. It will relieve the overload on the Electric Junction 345/138/34.5kV transformer #83, which is the original driver for B1852.1 and b1852.2. Due to B0661, B1852.1 and b1852.2 are no longer needed.

• Original required IS Date: 6/1/2016
• NERC Category B:  (DVP critical system condition)
  • In 2018, the outage of Gordonsville 230-115 kV Tx#1 overloads Gordonsville 230-115 kV Tx#3 in Front Royal Stress Case (Front Royal Generation off)

• NERC Category C:
  • In 2018, multiple N-1-1 Contingencies result in Non-Convergent Cases and overloads of Line #2 Mt. Run to Oak Green 115 kV, Line #70 Mt. Run to Remington 115 kV, Line #198 Oak Green to Chancelor 115 kV & Gordonsville 230-115 kV Tx #1 & #3.
  • Contingencies include outages of:
    • Line #255 North Anna to South Anna 230 kV & Line #2054/2135 Charlottesville to Hollymeade to Gordonsville 230 kV
    • Line #573 North Anna to Spotsylvania 500 kV & Line # 575 North Anna to Ladysmith 500 kV
    • Line #553 Cunningham to Elmont 500 kV & Line #255 North Anna to South Anna 230 kV
    • Line #575 North Anna to Ladysmith 500 kV & Line #594 Morrisville to Spotsylvania 500 kV
  • Operational Performance Issues
    • Pratts & Sperryville loads on radial transmission lines
    • Real time outages resulting in transmission line overloads

Continued on the next slide…
Continued from the previous slide:

Proposed Solution:
- Convert 17 mile Gordonsville to Pratts 115 kV line to 230 kV
- Construct approximately 23 mile long 115 or 138 kV line from Pratts to Sperryville
- Additional 115/138kV transformer needed at Sperryville if 115kV line constructed between Pratts & Sperryville
- Construct approximately 38 mile long 230 kV line from Remington to Pratts and install 230 kV ring bus at Remington
- Install 230 kV Switching Station and 230/115 or 138 kV* autotransformer at Pratts
- Install 230 kV breakers at Gordonsville

- Estimated project cost: $200 M
- Projected IS Date: June 2018
- Proposed solution provides good long term support to the 115 kV system in the Gordonsville - Culpeper - Remington corridor while offering improved reliability in the Pratts and Sperryville area by networking radial lines.
B2234 Scope Change:

Existing Scope:
Install 260 MVAR reactor at West Wharton 230 kV.

New Proposed Scope:
Install -260/+40 MVAR SVC at West Wharton 230 kV substation.
- The SVC will have the ability to control an existing 350 MVAR capacitors at West Wharton. It replaces the loss of dynamic reactive reserve due to generator retirements in the area. It will mitigate any potential voltage collapse due to an excessive number of capacitor switching steps required.

Estimated Project Cost:
Existing → $8.6 M
New → $41.4 M

Expected IS Date:
4/1/2015
• **Light Load Reliability Analysis**

  • The South Troy – East Towanda 115kV line is overloaded due to various single contingencies

  • Proposed Solution: Rebuild and Reconductor 115 kV line from East Towanda to S. Troy & upgrade terminal equipment at East Towanda, Tennessee Gas & South Troy. (b2463)

  • Estimated Project Cost: $40 M

  • Required IS Date: 3/1/2016
Short Circuit Upgrades
• The Hunterstown 115 kV breaker ‘96192’ is overstressed

• Significant Driver: Install 2nd Hunterstown 230/115kV transformer (b2452)

• Proposed Solution: Replace the Hunterstown 115 kV breaker ‘96192’ with 40kA rated breaker (b2452.3)

• Estimated Project Cost: $285 K

• Required IS Date: 6/1/2017
Generation Deactivation Update
<table>
<thead>
<tr>
<th>Unit(s)</th>
<th>Transmission Zone</th>
<th>Requested Deactivation Date</th>
<th>PJM Reliability Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Sandy Unit 2 (800MW)</td>
<td>AEP</td>
<td>6/1/2015</td>
<td>Reliability analysis complete. Impacts identified and upgrade expected to be completed 2nd quarter 2016. Interim operating measures will be utilized in interim period. Unit expected to deactivate as scheduled.</td>
</tr>
<tr>
<td>McKee Units 1 &amp; 2 (17MWs each)</td>
<td>DPL</td>
<td>5/31/2017</td>
<td>Reliability analysis underway.</td>
</tr>
</tbody>
</table>


Deactivation Update: Deactivation Notifications

- Big Sandy Unit 2
  - AEP Transmission Zone
  - 800 MW
  - Deactivation date: 06/01/2015
• Generation Deliverability Violation
• Hazard 161/138 kV transformer is overloaded for the tower contingency loss of Dorton – Lock Haven – Clinch River 138 kV line and Beaver Creek – Freemont 138 kV line, Freemont 138/69 kV transformer (‘408_2’)
• Baseline upgrade (b2462): The reinforcement is to add two 138 kV circuit breakers at Fremont station to fix the tower contingency ‘408_2’.
• Cost estimate: $1.2 M
• Required IS Date: 6/1/2015
• Projected IS Date: 6/1/2016
• Interim Solution will be implemented for the one year
• Continue to coordinate discussion of Carrier Relay with the PJM Planning Committee (PC) and Relay Subcommittee (RS)
• SVC modeling during the transient timeframe
  – EPRI feedback
• PSS/e version benchmarking
Artificial Island
Constructability Overview
Southern Delaware Crossing Lines

- Submarine or aerial line over the Delaware
- New or expansion of existing substation in Delaware
- Proposing Entities:
  - LS Power – Proposal 5A
  - Transource – Proposal 2A, 2B
  - Dominion (VEPCO) – Proposal 1B
# Constructability Review – Preliminary Findings

## Rights of Way and Land Acquisition

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• No additional land for expansion of the existing Salem substation in New Jersey</td>
<td>• Availability of land proposed to be utilized in New Jersey is in question</td>
<td>• Availability of land proposed to be utilized in New Jersey is in question</td>
<td>• No additional land for expansion of the existing Salem substation in New Jersey</td>
<td>• No additional land for expansion of the existing Salem substation in New Jersey</td>
</tr>
<tr>
<td></td>
<td>• Land required for a 500/230kV substation in Delaware</td>
<td>• Expansion of the existing Cedar Creek substation in Delaware</td>
<td>• Land required for new switching station in Delaware</td>
<td>• Has acquired an option on a site for the proposed new switching station in Delaware</td>
<td>• Has acquired an option on a site for the proposed new switching station in Delaware</td>
</tr>
</tbody>
</table>

## Common Factors

- 1.5 to 3 miles of right of way needs to be acquired in Delaware
- All projects that have a new substation in Delaware have a proximity issue with route 9
  - Impact to route 9 depends on substation location
## Constructability Review – Preliminary Findings

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• 3 mile 500kV aerial crossing of the Delaware river has potential impacts to viewshed and shipping channel</td>
<td>• 6 mile submarine crossing of the Delaware river</td>
<td>• 3 mile submarine crossing of the Delaware river</td>
<td>• 3 mile submarine crossing of the Delaware river</td>
<td>• 3 mile 230kV aerial crossing of the Delaware river has potential impacts to viewshed and shipping channel</td>
</tr>
<tr>
<td></td>
<td>• Proposed Line right of way crosses or parallels Delaware state route 9, which is classified as a ‘Scenic and Historic’ highway</td>
<td>• No route 9 crossing</td>
<td>• Proposed Line right of way crosses or parallels Delaware state route 9, which is classified as a ‘Scenic and Historic’ highway</td>
<td>• Proposed Line right of way crosses or parallels Delaware state route 9, which is classified as a ‘Scenic and Historic’ highway</td>
<td>• Proposed Line right of way crosses or parallels Delaware state route 9, which is classified as a ‘Scenic and Historic’ highway</td>
</tr>
</tbody>
</table>

### Common Factors
- All projects have comparable approximate 2 mile transmission right of way to be acquired in Delaware
- All projects need a permit to cross the Delaware state lands on the river coast
## Constructability Review – Preliminary Findings

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>• Salem line attachment not detailed in proposal</td>
<td>• Requires relocation of Salem-New Freedom line into new bay</td>
<td>• Requires relocation of Salem-New Freedom line into new bay</td>
<td>• Auto-transformer located in existing Salem substation</td>
<td>• Auto-transformer located in existing Salem substation</td>
</tr>
<tr>
<td></td>
<td>• River crossing not detailed in proposal</td>
<td>• Longest Delaware river crossing (submarine)</td>
<td>• Submarine cable installation</td>
<td>• Submarine cable installation</td>
<td>• River crossing not detailed in proposal</td>
</tr>
<tr>
<td></td>
<td>• Substantial expansion to the existing Cedar Creek substation</td>
<td></td>
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</tr>
</tbody>
</table>

### Common Factors

- All work in Artificial Island substations will be required to conform to nuclear generation facility work rules
## Constructability Review – Preliminary Findings

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Proposed Schedule</td>
<td>• 93 months (items run concurrent)</td>
<td>• 42 months (items run concurrent)</td>
<td>• 42 months (items run concurrent)</td>
<td>• 42 months (items run concurrent)</td>
<td>• 42 months (items run concurrent)</td>
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<tr>
<td></td>
<td>• Permitting - 24 months</td>
<td>• Permitting - 24 months</td>
<td>• Permitting - 30 months</td>
<td>• Permitting - 30 months</td>
<td>• Permitting - 30 months</td>
</tr>
<tr>
<td></td>
<td>• RoW acquisition – 12 months</td>
<td>• RoW acquisition – 12 months</td>
<td>• RoW acquisition – 9 months</td>
<td>• RoW acquisition – 9 months</td>
<td>• RoW acquisition – 9 months</td>
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<tr>
<td>Proposed Cost Estimate (millions)</td>
<td>• $141</td>
<td>• $164 - $207</td>
<td>• $213 - $269</td>
<td>• $148</td>
<td>• $116</td>
</tr>
<tr>
<td></td>
<td>• No stated contingency</td>
<td>• 15 – 40% stated contingency</td>
<td>• 15 – 40% stated contingency</td>
<td>• 20% stated contingency</td>
<td>• 20% stated contingency</td>
</tr>
<tr>
<td></td>
<td>• Basis of cost was recent RTEP projects of similar scope</td>
<td></td>
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</tr>
</tbody>
</table>
Artificial Island
LS Power – Proposal 5A
Salem Expansion

Proposed 500/230kV
Salem Expansion

Red Lion (5015)
New Freedom (5023)
Hope Creek (5037)
Orchard (5021)

New Freedom (5024)
Artificial Island
Transource – Proposal 2A, 2B
Salem Expansion

Proposed
500/230kV
Salem Expansion
Artificial Island
Dominion (VEPCO)
Proposal 1B
Salem Expansion

Red Lion (5015)
New Freedom (5023)
Hope Creek (5037)
Orchard (5021)

Proposed Salem Attachment

New Freedom (5024)
Proposed Line Routes

230kV Corridor Route 9

Potential Line Paths

Artificial Island

Delaware River

Potential Line Paths
• 17 mile 500kV line
• Parallels 5015
• Proposing Entities:
  LS Power – Proposal 5B
  PSE&G – Proposal 7K
  Dominion (VEPCO) – Proposal 1C
  PHI/Exelon – Proposal 4A
  Transource – Proposal 2C
## Constructability Review – Preliminary Findings

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Transmission line Right of Way would need to be acquired on either side of the existing line</td>
<td>Transmission line to be on Right of Way owned as part of Lower Delaware Valley (LDV) assets in which PSE&amp;G has ownership rights</td>
<td>Transmission line to be on Right of Way owned as part of Lower Delaware Valley (LDV) assets in which PHI and Exelon have ownership rights</td>
<td>Right of Way would need to be acquired for transmission line on south/west side of the existing line.</td>
<td>Right of Way would need to be acquired for transmission line on north/west side of the existing line.</td>
<td>Right of Way for the Salem-Orchard (5021) relocation not addressed</td>
</tr>
<tr>
<td>New Hope Creek – Salem tie within existing Artificial Island facility</td>
<td>New Hope Creek – Salem tie within existing Artificial Island facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Common Factors

- Route is approximately 18 miles and adjacent to existing 5015 line (Red Lion – Hope Creek)
- Minimal line distance in Delaware
- Red Lion, Hope Creek and/or Salem expansions proposed to be within existing property boundaries
### Constructability Review – Preliminary Findings

<table>
<thead>
<tr>
<th>Siting / Permitting</th>
<th>Common Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominion (VEPCO) Proposal 1C</td>
<td>• Delaware River Basin Commission approval required</td>
</tr>
<tr>
<td>PSE&amp;G Proposal 7K</td>
<td>• Delaware and New Jersey CPCNs required</td>
</tr>
<tr>
<td>PHI / Exelon Proposal 4A</td>
<td>• US Army Corp of Engineers Section 404 and 10 authorizations</td>
</tr>
<tr>
<td>LS Power Proposal 5B</td>
<td>• Multiple US Fish and Wildlife permits required</td>
</tr>
<tr>
<td>Transource Proposal 2C</td>
<td>• National Marine Fisheries Service</td>
</tr>
</tbody>
</table>
Constructability Review – Preliminary Findings

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Red Lion expansion will require 5015 outages for construction and attachment of new line</td>
<td>Red Lion expansion is a rebuild requiring multiple outages</td>
<td>Minor Red Lion expansion. New line to use existing 5015 position.</td>
<td>Minor Red Lion expansion. New line to use existing 5015 position.</td>
<td>Minor Red Lion expansion. New line to use existing 5015 position.</td>
<td>Minor Red Lion expansion. Salem expansion within existing substation fence.</td>
</tr>
<tr>
<td>New line will need to cross existing 5015 line</td>
<td>New line will need to cross existing 5015 line</td>
<td>New line will need to cross existing 5015 line</td>
<td>New line will need to cross existing 5015 line</td>
<td>New line will need to cross existing 5015 line</td>
<td>Create a new bay for and move the existing Salem-New Freedom (5024) line.</td>
</tr>
<tr>
<td>Hope Creek expansion outages may be limited to tie in</td>
<td>Hope Creek expansion within existing substation fence</td>
<td>Hope Creek expansion within existing substation fence</td>
<td>Salem expansion within existing substation fence. Reuse of the existing 5037 position.</td>
<td>Relocation of existing Salem - Hope Creek tie (5037) into new Salem bay</td>
<td>Move the Salem-Orchard (5021) line into the 5024 bay and route new line for 1 mile.</td>
</tr>
<tr>
<td>New Hope Creek – Salem aerial tie not detailed</td>
<td>New Hope Creek – Salem gas insulated bus tie within existing Artificial Island facility.</td>
<td>Anticipated to raise 5023, 5021, 5024 near Artificial Island to allow the new line to be installed underneath</td>
<td>Anticipated to raise 5037 into new Salem bay</td>
<td>Anticipated to raise 5015 and 5023 near Artificial Island to allow the new line be installed underneath</td>
<td>New line to use existing 5021 bay and rebuild 1 mile</td>
</tr>
<tr>
<td>Minor Red Lion expansion. New line to use existing 5015 position.</td>
<td>Relocation of existing Salem - Hope Creek tie (5037) at Hope Creek</td>
<td>Minor Red Lion expansion. New line to use existing 5015 position.</td>
<td>Relocation of existing Salem - Hope Creek tie (5037) into new Salem bay</td>
<td>Anticipated to cross the 5023 near Artificial Island</td>
<td></td>
</tr>
</tbody>
</table>

Common Factors
- Route is approximately 18 miles and adjacent to existing 5015 line (Red Lion – Hope Creek)
## Constructability Review – Preliminary Findings

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Proposed Schedule</strong></td>
<td>111 months (items run concurrent)</td>
<td>51 months (items run concurrent)</td>
<td>60 months (items run concurrent)</td>
<td>60 months (items run concurrent)</td>
<td>48 months (items run concurrent)</td>
</tr>
<tr>
<td></td>
<td>Design and construction - 38 months</td>
<td>Design and construction - 48 months</td>
<td>Design and construction - 50 months</td>
<td>Design and construction - 60 months</td>
<td>Design and construction - 30 months</td>
</tr>
<tr>
<td></td>
<td>Permitting - 24 months</td>
<td>Permitting - 48 months</td>
<td>Permitting - 34 months</td>
<td>Permitting - 27 months</td>
<td>Permitting – 27 months</td>
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<tr>
<td></td>
<td>Property Acquisition – 78 months</td>
<td>Property Acquisition – 0 months</td>
<td>Property Acquisition – 0 months</td>
<td>Property Acquisition – 18 months</td>
<td>Property Acquisition – 15 months</td>
</tr>
<tr>
<td><strong>Proposed Cost Estimate (millions)</strong></td>
<td>$199</td>
<td>$297</td>
<td>$157</td>
<td>$171</td>
<td>$123 to $156</td>
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<tr>
<td></td>
<td>No stated contingency</td>
<td>25% stated contingency</td>
<td>No stated contingency</td>
<td>20% stated contingency</td>
<td>15 – 40% stated contingency</td>
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</tbody>
</table>

* Basis of cost was recent RTEP projects of similar scope

PJM TEAC 3/6/2014
Red Lion Substation
Dominion – Proposal 1C

New Hope Creek Circuit
Hope Creek (5015)
Artificial Island
PSE&G – Proposal 7K
Artificial Island Expansion

Proposed
Hope Creek
Attachment

Red Lion (5015)
New Freedom (5023)
Hope Creek (5037)
Orchard (5021)

Proposed
New Station
Tie Line

New Freedom (5024)
Artificial Island
Transource – Proposal 2C
Artificial Island Expansion
Red Lion Substation
Transource – Proposal 2C
Artificial Island
LS Power – Proposal 5B
Artificial Island Expansion

Red Lion (5015)
New Freedom (5023)
Orchard (5021)

Hope Creek (5037)

New Freedom (5024)
Red Lion Substation
LS Power – Proposal 5B
Artificial Island
PHI/Exelon – Proposal 4A
Salem Expansion
Red Lion Substation
LS Power – Proposal 5B

Hope Creek (5015)
New Salem Circuit
• Proposed SVC Locations:
  – New Freedom
  – Orchard
  – Near Artificial Island
## Constructability Review – Preliminary Findings

<table>
<thead>
<tr>
<th></th>
<th>Artificial Island</th>
<th>Orchard</th>
<th>New Freedom</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rights of Way and Land Acquisition</strong></td>
<td>• Availability of land proposed to be utilized in New Jersey is in question</td>
<td>• Land would need to be acquired</td>
<td>• Expansion proposed to be within existing property boundaries</td>
</tr>
<tr>
<td><strong>Siting / Permitting</strong></td>
<td>• Nuclear Regulator Commission coordination required</td>
<td>• Potential noise limit concerns</td>
<td>• Potential noise limit concerns</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Common Siting / Permitting Factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DCA approvals required</td>
<td></td>
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</tr>
<tr>
<td><strong>Project Coordination Complexity</strong></td>
<td>• Multiple challenges with the proposed 500kV underground attachment facilities &lt;br&gt; • Salem and Hope Creek line attachments</td>
<td>• Expand Orchard ring bus</td>
<td>• Create a new bay at New Freedom</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Common Project Coordination Complexity Factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• SVC size limitations</td>
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</table>
# Constructability Review – Preliminary Findings

## Artificial Island Orchard New Freedom

<table>
<thead>
<tr>
<th>Schedule Risks</th>
<th>Artificial Island</th>
<th>Orchard</th>
<th>New Freedom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Property acquisition</td>
<td>• Property acquisition</td>
<td>• Assumption of land availability for expansion</td>
</tr>
<tr>
<td></td>
<td>• NRC approval</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Outage availability at Artificial Island</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 500kV cable lead time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Scheduling Risk Factors</td>
<td>• SVC lead time</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost Estimate Risks</th>
<th>Artificial Island</th>
<th>Orchard</th>
<th>New Freedom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• 500kV cable costs</td>
<td>• No transmission line assumed</td>
<td>• No transmission line assumed</td>
</tr>
<tr>
<td>Common Cost Estimate Risk Factors</td>
<td>• SVC costs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Artificial Island SVC

Red Lion (5015)

New Freedom (5023)

Orchard (5021)

Hope Creek (5037)

SVC Substation

New Freedom (5024)
RTEP Issues Tracking
RTEP Next Steps
• Continue AI Work

• Begin 2014 RTEP Analysis

• Coordinate RTEP Proposal Window

• Continue PJM Winter Study
Questions?

Email: RTEP@pjm.com