Final Report

Independent Engineering Evaluation
Constructability Analysis
of
Pattern BCDC Transmission Project

Prepared for

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To avoid sections being taken out of context, the report should be read in its entirety.
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1.0 Executive Summary

Burns and Roe has performed a constructability analysis of the Pattern BCDC Transmission Project. This Project includes the integration of new facilities for back-to-back (BtB) Voltage Source Converters (VSC) in the vicinity of the Hudson Generating Station in Jersey City, New Jersey. The project name “BCDC Transmission Project” is explained as follows:

- Presently, circuits B-3402 and C-3403 connect PSE&G (Hudson Station) with Con Edison (Farragut Station), at 345kV AC. This proposed project will insert back-to-back High Voltage Direct Current (HVDC) converter stations in both B and C circuits. Hence, the project name “BCDC.”

The development of these facilities involves PJM and NYISO as regional transmission organizations, PSE&G and ConEd as utility companies, Pattern as an independent power company and EIG as a consulting group.

The purpose of the constructability analysis is to identify overall constructability of the project as proposed within the cost and schedule identified.

Burns and Roe’s evaluation was based on information provided by Pattern dated October 2013. This information includes Power Point presentations, single line diagrams, general arrangements of the site, schedule and cost estimates. This review takes into account permitting issues, constructability, schedule, and the construction cost of 1) the VSC systems, 2) the modification activities for connection to the VSC systems and the existing transmission lines. Burns and Roe has identified factors that could potentially affect the implementation of the Pattern BCDC Transmission Project.

As a result, the conclusions drawn in this report are based on past experience and good engineering and construction practices, and the information received from the Pattern BCDC Transmission Project report; and not necessarily on detailed designs or in depth requirements for construction of substation and transmission lines upgrade and/or new construction.

This study does not include an in depth assessment of the modifications that must be made by Con Edison in their 345kV substation.
2.0 Project Overview

The Pattern BCDC Transmission Project consists of installing two (2) back-to-back (BtB) VSC systems and associated inside plant construction activities. There are two existing transmission line connections from PSE&G Hudson to Con Edison Farragut. These two transmission lines are part of the overall “1000MW power wheel” to supply power from PJM to NYISO. Connections at 230kV in PSE&G Hudson Substation supply two existing 230kV to 345kV transformers. The output of these transformers, at 345kV, connects to the two existing (B-circuit and C-circuit) underground (dielectric fluid filled pipe type) transmission lines that run approximately 6.6 miles to Farragut in Brooklyn, NY. At Farragut Substation, these circuits connect to existing Phase-Angle-Regulators (PAR), which control power flow into the Con Edison 345kV system.

Short circuit energy from the Con Edison system is provided to the 230kV PSE&G system via these two transmission lines. Even though the short circuit energy flows through the impedances of the PARs, the transmission line conductors, and the 230kV-345kV transformers at Hudson, the continual energy growth is causing the PSE&G 230kV circuit breakers to reach (and exceed) their rated interrupting capacity.

Pattern’s proposed HVDC project will insert back-to-back HVDC conversion systems, using voltage source conversion (VSC) systems. The AC-DC-AC conversion equipment blocks transmission of short circuit energy and thus will alleviate the increased fault duty imposed on the PSE&G 230kV circuit breakers. In addition, the need for the PARs at Farragut will be eliminated, since the 345kV output vectors from the VSC converter systems can be aligned with the Con Edison system via the control systems inherent in the VSC systems.

2.1 Overall Description of Proposed Project

2.1.1 Scope of Work

Pattern and EIG propose to insert VSC DC converter systems into the existing B-3402 and C-3403 pipe-type underground transmission lines between the PSE&G’s Hudson Substation and ConEd’s Farragut Substation using BtB Converter Stations. The 1000MW Wheel is currently provided through three circuits: A-2253, B-3402 and C-3403 to New York City from the PSE&G system. All three aforementioned circuits are rated for 500MW power transmission providing redundancy in the system.

Pattern has proposed two (2) BtB Voltage-Sourced Converter Stations each rated for 500MW. These new VSC’s will require modifications at Hudson Substation and will
convert to 345kV by bypassing the existing transformers and utilizing back-to-back HVDC converters. Modifications at Farragut to bypass the PARs will also be needed but are not in the scope of this analysis and must be executed by NYISO/ Con Edison.

Scope of work at the PSE&G Hudson Substation:
- Disconnection of existing 230kV circuits at existing 230kV – 345kV transformers at Hudson
- Removal of 230kV – 345kV existing transformers
- Modification of the existing 230kV circuits, with 230kV new extensions of each circuit to connect to input transformers at each VSC system
- Installation of two (2) VSC converter stations, each in a separate building, with adjacent input and output power transformers, consisting of major equipment as follows:
  - Strain buses at 230kV and 345kV, for input and output of VSC systems
  - Transformer banks on each side of each VSC building
  - Station service transformers for auxiliary power
  - Black start diesel generator
  - Spare Transformers
  - Air cooled heat exchangers
  - Utility buildings for maintenance, storage and other utility work for water, fuel, communications and auxiliary power
- Disconnection of existing 345kV circuits connected to the existing 230kV – 345kV transformers at Hudson
- Modification of existing 345kV circuits, with connection from output transformers at each VSC to 345kV existing B-3402 and C-3403 circuits

Scope of work at Con Edison Farragut Substation:
- Disconnection of circuits from 345kV PARs
- Modification of existing 345kV circuits bypassing PARs to connect directly to Farragut’s AIS

Options for the Back-to-Back DC Converter System

Pattern has proposed additional configurations as options for this project:
- Increasing the power flow from Hudson to Farragut from 2 x 500MW to [ ]
Connection of Hudson Generating Station Unit 2 to a new 345kV GIS substation at the HVDC site. These options would classify as Merchant Projects, which would cause this project to have a split classification, with more capacity for energy flow evaluated as an Interconnection Request.

2.1.2 Description of New Facilities

2.1.2.1 Pattern Proposed Facilities

In their proposal, Pattern provided satellite aerial views of the existing switchyard and the proposed location of the new facilities with two (2) VSC buildings and associated switchyard modifications. The new BtB VSC Stations will be rated for 2x500MW transmission capacity. The irregular quadrilateral shaped property is approximately 16 acres with the police shooting range and other buildings currently occupying the property. The property currently belongs to PSEG Power and will be leased for a 99 year duration for this project. The proposed location is situated north of the Hudson Generating Station and currently bounded by the NJ Turnpike, railroad tracks, access roads and the Penhorn Creek. A thirty (30) foot access road will lead to the new facilities. On the property, there are buildings, transmission tower structures and wetlands. A black-start diesel generator, heat exchangers and spare transformers will also be included in the new facility. There are overhead tower structures for existing transmission circuits including the 138kV circuits F-1306 and E-1305, 230kV circuits X-2250 and Y2225 directly adjacent to the proposed property. More importantly, existing overhead transmission circuit A-2227 is directly in the way of the proposed project and will need to be relocated. The police shooting range will also have to be relocated north of the new buildings with a 15 ft. access road connected to the 30 ft. access road.

2.1.2.2 Pattern Transmission Line Modifications

The Hudson Substation is connected to several overhead and underground transmission lines. For this BCDC Transmission Project, there will be several modifications in the existing substation yard including removal of equipment, relocation of towers and installation of new connection points. The transformers for the B-3402 and C-3403 will be removed from service, and the existing 230kV circuits will be extended to supply the VSC facility. Interconnection points will be constructed at both the existing 230kV and 345kV circuits, linking the 230kV feeds to the BtB HVDC stations and taking 345kV back to the existing circuits. 230kV and 345kV solid dielectric underground cables will be used as part of the retrofit connections to the converter stations. From the
interconnection points, these four circuits will have to cross under the railroad tracks using Horizontal Directional Drilling (HDD) to reach the proposed new facilities.

2.1.2.3 Pattern Option

For the option of connecting Hudson Generating Station Unit 2 to the output of the VSC system, a new 345kV GIS substation will be included for this project. Hudson Generating Station Unit 2 output presently connects to the 230kV AIS Hudson substation. This connection to Hudson substation will be removed and the 230kV generating unit output (from its present step-up transformer) will be connected to transformers rated 230kV to 345kV. These transformers will be existing transformers that are presently used for Circuits B-3402 and C-3403, since those transformers will no longer be needed because the output of the VSC systems will be at 345kV. The new 345kV GIS substation for this project will be located in a new GIS building, approximately 125 ft. x 240 ft., located on the VSC site. This 345kV GIS substation will contain seven (7) 345kV circuit breakers, and will connect the outputs of the two VSC systems and Hudson Generating Station Unit 2 to existing 345kV Circuits B-3402 and C-3403.

2.2 Milestone Schedule

The Pattern BCDC Transmission Project schedule indicates PJM Board Approval is required by October 31, 2013, in order to achieve completion by July 31, 2017. The schedule is divided into two (2) major sections, Project Development and Project Execution. Three (3) months of preliminary site engineering precede twelve (12) months of permitting activities. During the permitting process, Pattern will also start EPC contracts and negotiations. A year is assumed for all environmental permitting including federal, state and local approvals.

The second milestone occurs at the completion of Project Development and commencement of Project Execution, with the beginning of the execution activities including site development, EPC execution, interconnection activities at Hudson and Farragut Substations and commissioning. The first part of Project Execution is the site development which is based on obtaining approvals from the major authorities, including environmental permitting. The project will end with the commercial operation of the new facilities and substation modifications, executed in approximately forty-five (45) months from PJM Board Approval.
For the 2 x 500MW base scheme, the total project duration of 45 months appears to cover the time for both VSC systems to be completed and commissioned, allowing both Circuits B-3402 and C-3403 to transmit power to Farragut from the output of the VSC converter systems.

2.3 Overall Estimated Project Cost

Pattern submitted a project cost estimate as part of their conceptual presentation of the 2x500MW Converter Stations. The total estimated cost amounts to approximately $572M which includes 19% contingency. Major elements of the cost estimate are as follows:

1. Site development without contingency: $9M
2. Site acquisition: not included; $6M is an approximate estimated value for purposes of this report.
3. Site preparation with 10% contingency: $47M
4. Converter Stations including EPC contract, risk insurance, sales taxes of approximately 5%, and contingency of 20%: $504.9M
5. 345kV Cable System Cooling: not applicable to this 2x500MW project
6. PSE&G interconnection including 230kV cable, 345kV cable, Hudson Substation integration, and the transmission line relocation with 20% contingency: $10.2M
7. Con Edison Interconnection with 20% contingency: $0.6M
8. NY ISO system upgrade: not applicable
9. PJM system upgrades: not applicable

The above cost estimate includes revisions made in October 2013, with the main increase in the site preparation costs. The largest cost increase comes from the wetland mitigation estimates, and the access road preparation increased to $2.3M, the utilities increased to $3.6M and the site preparation is now estimated at $20.9M, including civil and remediation works and the relocation of the shooting range building.

There is no cost allocated for purchase of land although there are plans to lease the property for an extended period.
The cost of land acquisition for this project estimated at 16 acres is unknown at this time, and must be negotiated with the landowner, PSEG Power. Based on other cost estimates for land acquisition for similar but smaller projects, a viable estimate of at least $6M can be considered. However, since the land will be leased for a long term period of 99 years, the total capitalized cost will likely be higher. Note that this parcel of land is presently unused and PSEG Power may be eager to dispose of it, since it presently is an expense due to taxes without any income being produced, and the site requires remediation before any practical use. Adding the estimated land acquisition cost of $6M will increase the total to $578M.

The next level of the option includes the new 345kV GIS substation and the connection of Hudson Generating Station Unit 2 to the new 345kV system at the VSC project. This adds an estimated cost of $42M, with the majority of this cost being the 345kV GIS substation at $30M. This cost adder is considered reasonable. With the connection of Hudson Unit 2 and the 345kV GIS substation added

2.4 Potential Risks to Successful Project Completion

This HVDC project has risks as described below:

- Land acquisition (99 year lease) is required from PSEG Power. At this time, the cost of this lease is unknown, and discussion with PSEG Power has not been started. The necessary land can likely be obtained, so this is considered a minor risk. The cost of the lease is unknown and not included in the project cost estimate, so the overall project cost estimate is incomplete.

- The project schedule has issues that add duration to the projected in service date, see Par. 4.0 of this report.

- The project cost estimate is incomplete, and some costs may be insufficient, see Par. 5.0 of this report.

- Relocation of the existing overhead transmission lines must be accomplished prior to construction activity. As explained in Par. 4.0 under Schedule Assessment, the time required for PSE&G planning and permitting for a new ROW is not included, and the overall project schedule may be extended while waiting for these transmission lines to be relocated. Furthermore, the ability of PSE&G to actually locate a suitable new ROW is assumed, but this may be time consuming given the crowded nature of the Jersey City area where this project is situated, especially with regard to proximity of other transmission lines and the NJ
Turnpike. This topic needs further investigation and discussion with PSE&G, and PSE&G will need time for finding a suitable alternate route and obtaining permitting for this relocation. The line outage will need to be done during off-peak period (winter)

- On-time procurement of the VSC systems is critical to the project. As a result of schedule risks and potential delays, late award of the VSC systems may require expediting of VSC engineering and fabrication, with associated extra costs. This is a significant risk, however, the extra costs to expedite the equipment should be covered by the contingency in the estimate.

- Installation of underground utilities crossing under existing railroad tracks requires approvals and permitting from multiple authorities. This may delay the project and possibly increase costs.

- The technology for VSC systems is somewhat new, and local installation contractors and testing/commissioning personnel, as well as PSE&G personnel, will need to become familiar with this equipment.

- Present site layout indicates that 230kV and 345kV strain wire buses are located above transformer banks along both sides of each VSC building. The present layouts appear insufficient for proper spacing of AIS high voltage strain wire systems in proximity to the buildings, and locating the strain wire buses above the transformer banks must allow for proper clearances and connections. The site arrangement will likely expand when this topic is examined. This expansion will consume most or all of the anticipated laydown area.

This review does not address risks associated with work with NYISO.

2.5 Executive Summary of Findings

The conceptual descriptions, drawings, cost estimates and schedule for this 2 x 500MW back-to-back HVDC project have been reviewed. The project technical basis is fundamentally sound, using AC – DC – AC conversion systems to mitigate the flow of short circuit energy from Con Edison into the PSE&G 230kV system. In addition, the installation of these conversion systems will eliminate the need for phase angle regulators (PARs), presently needed for the interconnection of PSE&G to Con Edison to regulate power flow.

Other risks include the need to relocate existing PSE&G overhead high voltage transmission line circuit A-2227, which must be completed prior to commencement of construction of the HVDC facilities. The new ROW for this transmission line relocation is unknown and may be difficult to locate, obtain permitting, obtain easements, and construct in a reasonable time duration. This may cause the overall project duration to be increased. In order to proceed with this VSC project, PJM should meet with PSE&G as soon as possible to discuss options for relocation of A-2227 such that the VSC project can proceed in accordance with its schedule.
Land acquisition for this project is needed and a commitment for land acquisition has not been finalized with the landowner (PSEG Power). The site is contaminated and partially is wetlands, making permitting and construction more difficult and possibly adding costs and duration. Acquiring property, whether developed or undeveloped, in northern New Jersey is costly, since the entire area is crowded and filled with commercial, industrial and residential development, except for wetlands and areas such as government-owned tracts (e.g. parks and other municipal, county or state facilities). An estimated cost of $6M for this parcel appears to be reasonable for estimating purposes, since the needed land presently appears to be available without any active use except for the shooting range which will be relocated. This parcel is located in an industrial area and PSEG Power may be eager to dispose of it since it presently does not produce income, and conversely, real estate taxes must be paid, which is an expense. Interaction with the present landowner to obtain the 99 year lease has commenced but full commitment should be obtained in contract as soon as the project is approved.

Other risks and concerns are defined in the various sections of this report, including assessment of costs and schedule.

3.0 Regulatory Risk

A preliminary review of potential environmental and regulatory implications associated with the proposed installation of the Back-to-Back DC substation is presented in this section. The review was based on a desktop assessment, using Google Maps, US Fish and Wildlife Service website for preliminary wetland determination, FAA limitations and FEMA flood data. The results of the review are presented below.

- Wetlands

A review of the U.S. Fish and Wildlife Service (FWS) website indicated the presence of “Riverine” wetlands over small portions of the site, mostly along the southern portions. Although the region surrounding the site has extensive wetlands, the past use of the site for commercial/industrial purposes has resulted in the majority of the site being modified and reclaimed to support such use. The remaining wetlands will be affected, and the need to take any of the wetlands would result in the requirement to offset the loss, unless the project can be designed to avoid the taking of the wetlands. However, avoidance of the wetlands is likely not possible as the entire site has to be raised to a final grade of 10 feet to address flooding issues. It will not be possible to raise the site in such a manner without impacting the on-site wetlands. Still, the amount of wetlands shown on the U.S. FWS website appears minimal. Note that the U.S. FWS tool is for guidance purposes; a proper wetlands delineation would involve a site survey by a wetlands specialist. However, given the recent commercial/industrial use of the site, there exists low probability of extensive wetlands, as well as low possibility of reversion of the site back into a natural state.
(i.e., return to wetlands). Attachment 3 contains two views of wetlands delineation of the site.

• Flooding

The Federal Emergency Management Agency (FEMA) provides flood zone data, which is available from their website. Because of the historical flooding associated with “Superstorm Sandy” in October of 2012, FEMA has been updating their coastal zone flood maps. The specific map for the project site has not yet been updated and, as such, information is not available for that specific grid point. FEMA has published preliminary flood data for the site and the entire property is designated an “AE” zone with a flood height of 9 feet above mean sea level. A review of site topography using Google Earth indicates topography ranging from 4 feet to 21 feet above mean sea level with an estimated average elevation of 8 to 9 feet above mean sea level. Consequently, it is likely that some elevation of the site will be necessary to raise the site above revised flood elevations. It is acknowledged that the site elevation needs to be raised to 10 feet, which is consistent with the preliminary FEMA determination. Attachment 4 contains a preliminary FEMA determination of flood elevation of the site.

• Site Contamination

The project is proposed to be developed on land that has seen past commercial or industrial use (a “brownfield” site). Review of Google images of the site did not indicate recent heavy industrial usages that would increase the potential for contamination. However, historical site usage, from initial re-claim to the most recent use is not known. It is also not known if a Phase I site investigation was ever performed of the site. Further, uses of neighboring sites are not known such that consideration of potential infiltration of contamination from adjacent properties can be made.

On-line databases were checked to determine whether a “hazardous” classification has ever been delineated to the site. Maps showing National Priority List (NPL) “Superfund” sites do not flag the property proposed for project use. The NJDEP maintains a list of contaminated sites within the State of New Jersey. The list is extensive and the contaminated site listing for Hudson County contains hundreds of locations. Without a specific property address, correlation with the NJDEP list is not possible.

The descriptive material for this project describes (PJM notes, Item 5.c.iii) the need to remove 5 feet of soil from the site and replace it with clean fill, as well as raising the site elevation to 10 feet to avoid flooding issues. Consequently, some degree of past contamination has been identified, and is acknowledged. The type and extent of contamination is not known. Any contaminated material removed would need to be
properly disposed of; associated costs will vary depending on the quantity and nature of the contamination.

- Rail Crossing

The project site access road and underground utility lines will cross railroad tracks. The tracks being crossed used to serve a branch of NJ Transit that once carried passenger trains. Freight trains also utilized the tracks during that time. However, the tracks are now out of service as a through route beginning from a point a 0.8 miles northwest of where the tracks adjoin the property. Current use of the in-service track is that of a spur where freight cars are stored by Norfolk Southern Railroad. Underground utilities including multiple high voltage circuits (230kV and 345kV) will be installed beneath the railroad tracks. Obtaining permission to cross beneath the tracks requires multiple approvals from various agencies and the railroad. Obtaining these approvals is time consuming.

3.1 General Path Feasibility

The 16-acre project is located within the Meadowlands Region of Secaucus, approximately 0.6 miles from the Secaucus Junction Rail Transfer Station (See Attachment 1 for two views of the site). A site access road is proposed to run from the southwest corner of the site, cross and then run parallel to an existing railroad track in a southeasterly direction for a distance of 0.5 miles before terminating at the Hudson substation. An underground utility corridor will run parallel to the site access road. Based on the limited project knowledge, several regulatory issues and multiple permitting issues will need to be addressed based on what is known of the location.

3.2 Public Opposition

This project is located in a somewhat inaccessible area without significant visibility from residences or highways, and the project facilities do not include any high structures or other significant improvements. On the contrary, the project will be somewhat inconspicuous within the surrounding multitude of industrial properties. A new shooting range for the Jersey City Police Department will be constructed, and the only significant traffic adjacent to the site will be for that use.

Public opposition for this project is not anticipated to be an issue.
3.3 Permitting and Environmental

3.3.1 Wetlands

The level of effort required to obtain approval for wetland disturbance will depend on the nature of the disturbance. A project with the potential to disturb a larger quantity of wetlands will require a different level of review than for a project with minimal impact. The Back-to-Back DC project is located in an area which has multiple locations of various categories of wetlands in the surrounding properties; however, the project site is located on a parcel of land that has seen previous industrial/commercial use which implies that historical taking of wetlands has been done previously.

Regulatory agencies recognize the unique nature, in terms of environmental impact, of certain project types. Specific to the PJM Constructability project, the Back-to-Back DC option will likely have no impacts associated with the installation of new overhead transmission lines. The Hudson Substation is immediately south of the site and electrical tie-ins will apparently be accomplished via an underground corridor.

NJDEP General Permit 2 or GP-2, covers underground utility lines. GP-2 authorizes activities in freshwater wetlands, transition areas, and/or State open waters, necessary for the construction and/or maintenance of an underground utility line. This could be anything from a gas line to placement of fiber optic telecommunication cable; generally any linear disturbance intended for a utility line. Again, the close proximity of an existing transmission line to the site precludes any large-scale impacts as lines to be constructed to feed the line from the new substation will be minimal in length.

If a utility line is jacked or directionally drilled underground, so that there is no surface disturbance of any freshwater wetlands, transition areas, or State open waters and there is no draining or dewatering of freshwater wetlands, NJDEP approval is not required. Directionally drilled utility lines, if improperly constructed, have the potential to act as "French drains", in essence creating a conduit for water to flow. As such, it is important to implement measures such as anti-seep collars to prevent movement of water. In addition, perched water on which a wetland system may depend could be the result of a "clay lens" which, if punctured by construction of a utility line, can alter a wetland system.

A GP-2 may be combined with other general permits or permits provided the total disturbance of all GP's do not exceed the one acre threshold for multiple general permits.

If such new infrastructure does involve the disturbance of wetlands to accommodate any needed above ground utility lines, permitting can be accomplished via General Permits offered by the NJDEP for the class of projects defined as "Above Ground Utility Lines". Requirements are addressed under “General Permit 21” or GP-21. To be eligible for a GP-21, the temporary disturbance during construction cannot be more than 60 feet wide,
and the permanent disturbance at the conclusion of the project cannot be more than a 1/2 acre or wider than 20 feet.

Activities under this general permit must not interfere with the natural hydrologic characteristics of the freshwater wetland (FWW), transition area (TA), or State Open Water (SOW). If the applicant has to place the utility line on pilings to avoid this issue, than that may be a requirement to satisfy this condition. The main concern here is the inadvertent creation of a "French drain" or other type of structure that would act to drain or otherwise alter the FWW, TA or SOW.

The Permitee is also required to mitigate for all permanent loss and/or disturbance of 0.1 acres or greater of freshwater wetlands and/or State open waters.

In order to determine whether or not an area of freshwater wetlands, transition areas or State open waters may be disturbed by any proposed activity, detailed information about that wetlands and the site must be obtained, and an inspection of the property by a representative of the Department is required. The Department offers a “Letter of Interpretation” (LOI), which is a document that may describe if there are wetlands on the property, and if so, where they are located.

NJDEP freshwater wetlands permitting is required for each project where more than one acre of wetlands will be permanently disturbed as a result of an installation or expansion. In accordance with NJDEP’s “No Net Loss Policy”, wetlands permitting will require creation of 2 acres of wetlands for every one acre of disturbed land. Joint U.S. Environmental Protection Agency (EPA) and U.S. Fish and Wildlife Services (FWS) review will be required if more than five (5) acres are disturbed.

3.3.2 Federal Aviation Administration (FAA)

A Notice of Proposed Construction or Alteration approval from the FAA is required for any structure greater than 200 feet above ground level or for a structure within 20,000 feet of a large airport or seaplane base with a height in excess of the slope criteria, i.e., 1 foot vertical per 100 feet horizontal. The design height of new structures associated with the Back-to-Back DC project is less than 100 ft. per the preliminary project documentation. A substation infrastructure in excess of 200 feet, or infrastructure less than 200 feet in height but within the take-off and approach paths of a nearby airport (Newark Liberty in this case) may trigger FAA filing requirements. The existing transmission towers that bisect the site property line likely already are acknowledged on FAA aviation charts, as such, navigation hazards are not likely to be triggered for the infrastructure associated with this project.
3.3.3 Streams and Rivers


Unless properly controlled, development within flood hazard areas can exacerbate the intensity and frequency of flooding by reducing flood storage, increasing stormwater runoff and obstructing the movement of floodwaters. In addition, structures that are improperly built in flood hazard areas are subject to flood damage and threaten the health, safety and welfare of those who use them. Furthermore, healthy vegetation adjacent to surface waters is essential for maintaining bank stability and water quality. The indiscriminate disturbance of such vegetation can destabilize channels, leading to increased erosion and sedimentation that exacerbates the intensity and frequency of flooding. The loss of vegetation adjacent to surface waters also reduces filtration of stormwater runoff and thus degrades the quality of these waters.

The Flood Hazard Area Control Act rules therefore incorporate stringent standards for development in flood hazard areas and adjacent to surface waters in order to mitigate the adverse impacts to flooding and the environment that can be caused by such development. Attachment 2 contains a copy of the NJDEP Stream Encroachment Administrative Checklist.

A utility line or substation that is proposed in a tidelands area may require a tidelands license if the activities are taking place at or below the mean high water line of a tidal waterway or a tidelands grant if any portion of the activities are taking place in an area that is currently landward of the mean high water line but was, at some point, flowed by the tide.

3.3.4 Other Possible Permits / Requirements

Depending on the nature of the project, additional permits may be required, as noted in the following section.

3.3.4.1 NJDEP Stormwater Discharge Permit

The stormwater discharge permit program is responsible for protecting New Jersey's ground and surface water quality by assuring the proper treatment and discharge of wastewater (and its residuals) and stormwater from various types of facilities and activities. With respect to the expansion or installation of new substations, this permit would cover construction activities (soil erosion control, stockpiling and covering of exposed soil, wetting of roads to suppress dust), as well as discharges during operation (which from a substation, would mostly involve assurance that vessels containing transformer dielectric fluids and lubricants are properly operated, maintained and inspection in terms of minimizing the chance of potential spill). A temporary operation
such as a concrete batch plant to support substation foundation construction would be permitted under a General Permit for Concrete Products Manufacturing (CPM).

3.3.4.2 NJDEP Air Permit

The installation of a temporary concrete batch plant could also trigger a requirement for obtaining a NJDEP air permit for emissions associated with raw and final product material handling. Pollutants of concern would be dust from dry material handling (aggregate, sand, etc.). Use of fabric filter controls during material handling and transfer may need to be applied.

The project includes a diesel generator for back-up power. This generator will be used only during an outage of 230kV power, and also for periodic testing. Obtaining an air permit for this diesel generator is not a risk.

3.3.4.3 Local Noise Requirements

Local or overriding state noise requirements would need to be reviewed in determining acceptable construction practices (i.e., limits on evening construction activities that would generate noise). The remote location of the site precludes any concern over potential negative noise impacts.

3.3.4.4 Spill Prevention Control and Countermeasure (SPCC)

Under 40 CFR 110 & 112, and the legal authority of the Clean Water Act, the Discharge of Oil regulation, more commonly known as the "sheen rule", provides the framework for determining whether an oil spill to inland and coastal waters and/or their adjoining shorelines should be reported to the federal government. In particular, the regulation requires the person in charge of a facility or vessel responsible for discharging oil that may be "harmful to the public health or welfare" to report the spill to the federal government. The regulation establishes the criteria for determining whether an oil spill may be harmful to public health or welfare, thereby triggering the reporting requirements, as follows:

- Discharges that cause a sheen or discoloration on the surface of a body of water;
- Discharges that violate applicable water quality standards; and
- Discharges that cause a sludge or emulsion to be deposited beneath the surface of the water or on adjoining shorelines.

Because the Oil Pollution Act of 1990, which amended the Clean Water Act, broadly defines the term "oil," the sheen rule applies to both petroleum and non-petroleum oils (e.g., vegetable oil).
Dielectric fluid contained within a substation (i.e., transformers) would likely be regulated under the SPCC regulations provided minimum applicability threshold quantities are exceeded (aggregate above ground capacity of 1,320 gallons, including the totals of all material stored in containers greater than 55 gallons in volume. Regardless of applicability, it is recommended that a standard operating procedure governing safe handling of dielectric fluid contained in the underground pipes during cable termination modifications should be developed and implemented to minimize the risk of an accidental spill.

4.0 Schedule Analysis and Assessment

The proposed schedule for the 2 x 500MW Pattern HVDC project is based on PJM approval on Oct. 31, 2013, with completion on July 31, 2017. This is a 45 month schedule and the start date has already passed. If the total duration of 45 months is held constant, and assuming project start (PJM approval) on Dec. 31, 2013, the project will be completed two months late, on Sept. 30, 2017. The main reason for performing this project is to alleviate increased fault duty on the PSE&G 230kV system, with a required date of June, 2015, based on PJM system studies which are predicated on energy growth causing 230kV breakers to be over-dutyed. On this basis, the project will be completed later than needed.

In addition, the overall schedule is considered aggressive, based on the following comments:

- The intended project site has contaminated soil, and approximately five feet of existing soil will be removed and replaced. In addition, a significant amount of imported fill material is required to raise the grade by approximately 10 ft. (actual present grade levels vary, and thus depth of imported fill will also vary). Raising the overall grade is needed to clear the flood level. The project schedule allows only seven (7) months for site development including remediation and preparation; the required effort may take longer, and this effort is scheduled to start while the ground is frozen. This is significant schedule risk.

- The intended site is partially wetlands, and permission to build on wetlands is predicated on purchase of Wetlands Mitigation Credits. Achieving the required approvals and permitting for use of the site may take longer than the 12 months presently shown in the schedule. This is a significant schedule risk.

- The intended site must be leased for 99 years from PSEG Power, and a commitment for land acquisition with the landowner has not been finalized at this time. The required geotechnical investigation will need to be done early in the overall schedule, prior to completion of site remediation. This is another significant risk.
• The project schedule does not include any time for PSE&G to relocate the existing overhead transmission line (circuit A-2227). It is inappropriate to expect that construction activity can commence while this energized transmission line and its structures with foundations are still in place, and PSE&G will need time for planning and permitting to obtain a new ROW to relocate these lines. The duration of planning and permitting by PSE&G will likely coincide with the Pattern permitting effort, leaving no float time for PSE&G to complete the relocation prior to the Pattern scheduled start date of construction activity. This is a significant risk.

• Obtaining permits and approvals for multiple horizontal directional drills for underground high voltage cables, as well as water, sewer, fuel gas, auxiliary power and communications, crossing under active railroad tracks in multiple locations, may require more time than is shown in the schedule for permitting and approvals. This is a further risk to the schedule.

These schedule risks are not quantified in the present level of documentation, but approximate time durations can be estimated as follows:

• Site development: add 6 months due to intended project start during winter
• Wetlands permitting: add 12 months for approval
• Geotechnical information: add 12 months due to wetlands approval
• Relocation of Circuit A-2227: PSE&G construction will likely need 6 months after permitting, and the line outage may be prohibited during summer peak period. The extra time duration will be concurrent with other schedule risks above.
• Railroad approval for underground utility crossings: add 12 months for approval, which will be concurrent with other schedule risks above.

Based on these schedule risks, the overall project duration will likely need an additional 12 – 18 months, causing the completion date to move to mid-to-late 2018.

5.0 Cost Analysis and Assessment

The assessment of the cost estimate for this project includes the following issues:

• The project cost estimate is incomplete. Costs for land acquisition have not been included, and interface with the present landowner (PSEG Power) must be finalized in order to obtain this cost. A value of $6M can be considered at this time to obtain an appropriate total cost for land.
• Cost for relocation of the existing overhead transmission lines has been estimated as $2M. The new ROW is not determined. After PSE&G examines the necessary relocation and performs some conceptual planning, this cost value may increase.

• Costs for modifications at Hudson and Farragut have been estimated without interface with PSE&G and Con Edision. These cost values are at risk until both utilities review and assess the required modifications.

• Costs of Wetlands Mitigation Bank Credits are estimated at $16M. The actual costs for this item are dependent on the availability of wetlands credits that can be purchased. This cost value is at risk.

• Costs of the VSC systems are estimated and will likely increase when actual pricing for procurement is requested. Due to the relatively new technology for VSC systems, inclusion of “type tests” is recommended.

• The cost estimate does not include excavation and removal of existing contaminated topsoil; included in the cost estimate is $750K for installation of a protective membrane over the existing soil prior to placement of new fill. PJM notes (Item 5.c.iii) state that “approximately 5 feet of existing topsoil would be excavated, removed and replaced with new clean soil”. This discrepancy should be resolved to avoid omission of needed cost.

• Contingency of $90M has been included, added to an incomplete cost total of $481M. This value of contingency (19% total) may be too low given the open issues identified in this report.

• The added costs for the optionsler and the connection of Hudson Unit 2 to the new 345kV GIS substation have not been evaluated in detail, but the cost adders (ler; $42M addition for Hudson Unit 2) are considered reasonable.

The above cost assessment risks have been estimated in Table 1 in Attachment 9. The total increase is $179M for base (2x500MW) and ler with results as follows:

• Estimated total cost 2x500MW: $571.7M to $750.7M
6.0 Attachments

6.1 List of Attachments

- Attachment 1 – Back-To-Back DC Site Location Maps
- Attachment 2 – NJDEP Stream Encroachment Administrative Checklist
- Attachment 3 – Back-To-Back DC Preliminary Wetlands Map
- Attachment 4 – Back-To-Back DC FEMA (Preliminary) Flood Map
- Attachment 5 – One Line Diagrams and General Arrangements
- Attachment 6 – Schedule
- Attachment 7 – Cost Estimate Assessment
- Attachment 8 – Hudson Generator Unit 2 – Drawings and One-Line Diagrams
- Attachment 9 – Cost Analysis Table

7.0 Outside References

Burns and Roe has utilized the latest information provided by PJM and Pattern, which includes Pattern’s presentation with general arrangements, one-line diagrams, schedule, cost estimates and for 2x500MW back-to-back HVDC Converter Stations and other consultant’s report. All the above information are dated in a report as of October 2013.
ATTACHMENT 1

BACK-TO-BACK DC SITE LOCATION MAPS
PSE&G 345-1 and 345-2 Transformers

Assumed 345kV Connection Point

Assumed 230kV Connection Point
ATTACHMENT 2

NJDEP STREAM ENCROACHMENT ADMINISTRATIVE CHECKLIST
State of New Jersey  
Department of Environmental Protection  
STREAM ENCROACHMENT ADMINISTRATIVE CHECKLIST  
Revised: April 5, 2006  Website: www.state.nj.us/dep/landuse

A stream encroachment permit is required for most construction activities along streams and in floodplains. Examples of regulated activities include new buildings, roads, bridges, utility lines, and stormwater discharges. Storing material, placing fill and clearing vegetation can also be regulated. Some minor activities:

To apply for a permit complete this checklist and send the material required below to the following address:

Postal Mailing Address:  
NJDEP Division of Land Use Regulation  
P.O. Box 439  
Trenton, NJ 08625

Street Address (For courier service and hand deliveries only):  
NJDEP Division of Land Use Regulation  
501 East State Street, Station Plaza Five, 2nd Floor  
Trenton, NJ 08609

CONTACT A STREAM ENCROACHMENT ENGINEER AT (609) 292-0060 IF YOU HAVE ANY

PART A: The following is required for all projects (please do not send more copies of items than required):

- One completed copy of this checklist.
- One completed LURP-1 application form with original signatures (available from DEP website above).
- Check or money order for the project review fee payable to: Treasurer, State of New Jersey (see Part F).
- Two sets of location maps (USGS quad maps required; local tax, county soil and flood maps where available).
- Two sets of color photographs showing the entire project area (mounted on 8½” by 11” paper).
- Three copies of an environmental report (see Part E) including State plane coordinates of the site.
- Six sets of individually folded, signed and sealed construction plans referencing 1929 NGVD. Show all proposed work and provide soil erosion/sediment control plans, cross-sections, profiles and details as appropriate.

PART B: The following is required for certain projects depending on your answers in Part C below:

- One copy of proof of local notice to all parties listed at N.J.A.C. 7:13-4.2 (see Part C question 1).
- One copy of a signed and sealed engineering report (see Part D).
- One copy of a hardship waiver request, if the project does not meet all regulations (see N.J.A.C. 7:13-4.8).

PART C: Please answer the following questions:

1. Proof of local notice (under N.J.A.C. 7:13-4.2) is required if any of the following occur (check all that apply):

- The project includes one or more major element under Part F.
- The project will disturb the channel or buffer of a trout-associated water (see question 3 below for buffer widths).
- The project will expose acid-producing soils.
- The project involves a hardship waiver request (see N.J.A.C. 7:13-4.8).

2. In most cases the extent of the floodplain must be known in order to issue a permit (check one of the following):

- Floodplain was taken from a State flood hazard area delineation (get State maps at (609) 292-2296).
- Floodplain was taken from a tidal FEMA map that shows flood elevations (get FEMA maps at (800) 358-9616).
- Floodplain was taken from a non-tidal FEMA map that shows flood elevations in a fully developed watershed.
- Floodplain is unknown and calculations have been submitted to delineate it (see question 5 below).
- Floodplain is unknown and does not need to be delineated for the project (explain why).

3. All streams have a buffer (measured from the top of the bank) within which vegetation is protected as follows:

- 300 ft Along Category-One waters if stormwater management does apply under question 6 below.
- 50 ft Along Category-One waters if stormwater management does not apply under question 6 below.
- 50 ft Along waters that are trout-associated associated with threatened or endangered species.
- 50 ft Along waters associated with threatened or endangered species.
- 50 ft Along waters where acid-producing soils will be exposed.
- 25 ft Along all waters not listed above.

4. The placement of fill is restricted in a flood fringe and no obstruction is allowed in a floodway (check all that apply):

- No fill is proposed within either the flood fringe or the floodway.
- A negligible amount of fill is proposed within the floodway, which obviously does not obstruct flow.
- A negligible amount of fill is proposed within the flood fringe, which obviously meets the rules by inspection.
- Fill is proposed in the flood fringe and proof that the standards at N.J.A.C. 7:13-2.14 and 15 are met is included.

5. Hydrologic and hydraulic calculations are generally required if any of the following occur (check all that apply):

- The peak 100-year flow in the stream will be significantly increased or decreased.
- The size, shape, skew, location and/or alignment of the stream channel will be altered.
- A new bridge or culvert will be constructed where none currently exists.
- A replacement bridge or culvert will be constructed, which is different in size, length, shape, material, skew, location and/or alignment from the existing structure.
- The floodplain limits are unknown and need to be delineated in order to demonstrate compliance with the requirements of the rules, such as for net-fill calculations or determining lowest floor elevations.
- The floodplain limits are unknown and need to be delineated to establish stream encroachment lines.
6. Stormwater management must be provided as described below (see www.njstormwater.org). Explain if the project:
☐ Is exempt from this section at N.J.A.C. 7:8-5.2(d) or ☐ Meets the public roadway waiver at N.J.A.C. 7:8-5.2(e)

Part 1: Enter the total amount of land that will be disturbed onsite: _______ ft² or acres (circle one).
☐ If at least 1 acre (43,560 ft²) of land will be disturbed, submit the following (in the engineering report):
☐ One completed Low Impact Design checklist (see Appendix A of BMP manual at www.njstormwater.org).
☐ One copy of a USGS map, showing the site and its HUC-14 watershed and indicating any 300-ft buffers onsite.
☐ Proof that the groundwater recharge standards at N.J.A.C. 7:8-5.4(a)2 are met (unless exempted at 5.4(a)2ii).
☐ Proof that the runoff quantity standards at N.J.A.C. 7:8-5.4(a)3 are met (unless project lies in a tidal floodplain).
☐ Proof that the use of nonstructural stormwater strategies has been maximized onsite via one of the following:
☐ A detailed narrative (including an alternative analysis where necessary) explaining how the project does
(or does not) implement all nine nonstructural strategies required at N.J.A.C. 7:8-5.3.

Part 2: Enter the net-increase in impervious area onsite: _______ ft² or acres (circle one). Include all new
imd pervious areas, as well as existing impervious areas from which stormwater currently sheet-flows, but which will be
colected into a basin or storm sewer system. Subtract any impervious areas being removed onsite. If a net-increase
of at least ½ acre (10,890 ft²) of Impervious area will occur, submit all material in Part 1 and the following:
☐ Proof (in the engineering report) that the water quality standards at N.J.A.C. 7:8-5.5 are met.

PART D: Engineering report: Must be signed and sealed by a NJ licensed professional engineer. Detail all regulated
activities onsite and explain how the submitted calculations demonstrate compliance with the rules. Provide complete
printouts (and electronic copies if possible) of all calculations. Check all that apply:
☐ Net-fill calculations (see Part C question 4). Explain the methodology used to demonstrate compliance. Include
both existing and proposed flood storage calculations and depict all cross-sections and other relevant data.
☐ Hydrologic and hydraulic calculations (see Part C question 5). Include any State or FEMA flood maps or profiles
that were referenced (with site outlined to scale on maps). If flow rates were determined for a stream, depict
the contributory drainage area on USGS maps and provide a hydrologic description of the watershed.
☐ Stormwater management (see Part C question 6). Explain how the groundwater recharge, runoff quantity and
water quality standards at N.J.A.C. 7:8 are met. Detail how TSS removal is achieved, provide detention,
retention and infiltration calculations for all basins, and compare existing and proposed recharge and discharge
rates.
☐ Stability analysis for any retaining wall that is at least 4 ft high. Include both sliding and overturning analyses.

PART E: Environmental report: Address all proposed environmental impacts including, at minimum, the following:
☐ A complete description of the project, including justification for its size and location, an evaluation of all
anticipated environmental impacts and a demonstration that such impacts have been minimized where possible.
☐ A description of anticipated access points to streams and proposed disturbance to near-stream vegetation.
☐ Adverse effects of any stormwater management basins on the stream's biota and on mosquito breeding.
☐ An evaluation and mitigation plan if acid-producing soils will be exposed.
☐ An evaluation of whether threatened and endangered species will be impacted.
☐ The qualifications of the report's preparer and all relevant data that was used in the report's preparation.

PART F: The total review fee is $________ and was calculated as follows (indicate number of each element):

<table>
<thead>
<tr>
<th>Stormwater review fee (if any) $________</th>
<th>Minor element ($1,000 plus $100 per each 100-ft segment of stream, not to exceed $4,000)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Attach stormwater fee worksheet)</td>
<td>Stream cleaning or pond/dike dredging project¹</td>
</tr>
<tr>
<td><strong>Major element ($4,000)</strong></td>
<td>Minior element ($1,000)</td>
</tr>
<tr>
<td>Hardship waiver request ¹</td>
<td>Utility crossing</td>
</tr>
<tr>
<td>Review of net-fill calculations ¹,²</td>
<td>Stormwater outfall structure</td>
</tr>
<tr>
<td>Bridge, culvert or footbridge ²</td>
<td>Retaining wall less than 4 ft high</td>
</tr>
<tr>
<td>Retaining wall at least 4 ft high</td>
<td>One private residence or duplex ¹</td>
</tr>
<tr>
<td><strong>Major element ($3,000 plus $300 per each 100-ft segment of stream)³</strong></td>
<td>Residential addition, garage, shed or barn</td>
</tr>
<tr>
<td>Flood hazard limit delineation ³</td>
<td>Stream channel modification ⁵,⁶</td>
</tr>
<tr>
<td>Stream channel modification ⁵,⁶</td>
<td>Stream bank stabilization or protection project ⁶</td>
</tr>
<tr>
<td>Stream bank stabilization or protection project ³</td>
<td>Grading not associated with another project ⁶</td>
</tr>
<tr>
<td><strong>Major element ($2,000)</strong></td>
<td>Any regulated activity not listed in this table ⁸</td>
</tr>
<tr>
<td>Bridge or culvert to a private residence or duplex ⁶</td>
<td>Minor element ($500) ⁸</td>
</tr>
<tr>
<td></td>
<td>Flood hazard limit delineation ¹,⁸</td>
</tr>
</tbody>
</table>

Footnotes for fees:
1. No fee if associated with one private residence or duplex not being constructed as part of a larger residential subdivision.
2. No fee if associated with a bridge or culvert that lies nearly perpendicular to a stream.
3. Provided a review of hydrologic and/or hydraulic calculations is required.
4. Length of stream is measured along centerline of channel.
5. No fee if associated with (and located within 100 ft upstream or downstream of) a new bridge or culvert.
6. Provided private residence or duplex is not being constructed as part of a larger residential subdivision.
8. Provided no review of calculations is required. Otherwise this is considered a major element.
ATTACHMENT 3

BACK-TO-BACK DC PRELIMINARY WETLANDS MAP
User Remarks:
Close-up view of site.
ATTACHMENT 4

BACK-TO-BACK DC FEMA (PRELIMINARY) FLOOD MAP
Best Available Flood Hazard Data

Legend

Preliminary Work Maps (supersede ABFES)

- Limit of Moderate Wave Action (LMWA) (zoom in to make visible)

- Floodplain Boundaries (zoom in to make visible)
  - 0.2% Annual Chance Flood Hazard
  - 1% Annual Chance Flood Hazard
  - Floodway

- Gutters (zoom in to make visible)

- Coastal Shoreline (zoom in to make visible)

- Floodplain Areas (zoom in to make visible)
  - A
  - AE
  - AO
  - VE
  - Shaded X

Advisory Base Flood Elevation Layers

- Advisory Zone V-A Boundary (zoom in to make visible)

- Limit of Moderate Wave Action (LMWA) (zoom in to make visible)

FEMA, NRP, Terms of Use, Privacy, Contact Us, Report Abuse

11/14/2013 9:15 AM
ATTACHMENT 6

SCHEDULE
Conceptual 2x500MW Project Schedule

Assumes PJM Board Approval on 10/31/13.

Assumes 3-months of Engineering preparation and a 12-month Environmental Permitting program.

Assumes a 30-month Project Execution Program.
ATTACHMENT 7

COST ESTIMATE ASSESSMENT
ATTACHMENT 8

HUDSON GENERATOR UNIT 2 OPTION – DRAWINGS AND ONE-LINE DIAGRAMS
ATTACHMENT 9

COST ANALYSIS TABLE
## Cost Analysis Table

<table>
<thead>
<tr>
<th>Cost Issue</th>
<th>Amount ($)</th>
<th>Assessment From Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Acquisition</td>
<td>Estimated $0M</td>
<td>The project cost estimate is incomplete. Costs for land acquisition have not been included.</td>
</tr>
<tr>
<td>Relocation of Overhead Transmission Lines</td>
<td>Estimate $2M</td>
<td>Cost for relocation of the existing overhead transmission lines has been estimated as $2M. As ROW is unknown, cost estimate will likely increase. After PSE&amp;G examines the necessary relocation and performs some conceptual planning, this cost value will likely increase.</td>
</tr>
<tr>
<td></td>
<td>Our estimation likely increase to $4M</td>
<td>Comment: In addition to the likelihood of cost increase, the second transmission structure will have to be located close the property boundary while going around the VSC building making it a difficult placement around wetlands and the creek. (Add $2M, $4M total)</td>
</tr>
<tr>
<td>Modifications at Hudson and Farragut</td>
<td>Estimated 230kV Cable Extension $3.4M</td>
<td>Costs for modifications at Hudson and Farragut have been estimated without interface with PSE&amp;G and Con Edison. These cost values are at risk until both utilities review and assess the required modifications.</td>
</tr>
<tr>
<td></td>
<td>Our estimation $9.2M for 230kV XLPE Cable ($1.4<em>3.4M</em>2)</td>
<td>Comment: Some of the modifications include the XLPE cables estimated at $3.4M for the 230kV XLPE. The length for this estimation is based on 1000 ft. total distance. From the attached satellite image, the estimated distance is approximately 1400 ft. for each circuit. The same is done for the 345kV Cables estimated at $2.5M. The average distance can be estimated the same as the 230kV cables.</td>
</tr>
<tr>
<td></td>
<td>Estimated 345kV Cable Extension $2.5M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Our estimation $7M for 345kV XLPE Cable ($1.4<em>2.5M</em>2)</td>
<td></td>
</tr>
<tr>
<td>Wetlands Credits</td>
<td>Availability, Schedule Risk</td>
<td>Costs of Wetlands Mitigation Bank Credits are estimated at $16M. The actual costs for this item are dependent on the availability of wetlands credits that can be purchased. This cost value is at risk.</td>
</tr>
<tr>
<td>VSC HVDC Systems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Site Construction | Estimated $750K | The cost estimate does not include excavation and removal of existing contaminated topsoil; included in the cost estimate is $750K for installation of a protective membrane over the existing soil prior to placement of new fill. PJM notes (Item 5.c.iii) state that “approximately 5 feet of existing topsoil would be excavated, removed and replaced with new clean soil”. This discrepancy should be resolved to avoid omission of needed cost.
| Risk and Contingency | Estimated $90M | Contingency of $90M has been included, added to an incomplete cost total of $481M. This value of contingency (19% total) may be too low given the open issues identified in this report.
| 2x850MW GIS and Unit 2 Connection | $42M Hudson Unit 2 connection | The added costs for the options of the 2x850MW and the connection of Hudson Unit 2 to the new 345kV GIS substation have not been evaluated in detail; $42M addition for Hudson Unit 2) are considered reasonable.
| 2x500MW Total Pattern Estimated | $571.7M | Comment: Found reasonable.
| Total BREI Estimated (Difference) | $750.7M | |
| 2x850MW Total Pattern Estimated | $179M | |
Distance Measurement Tool

Click on the map to trace a path you want to measure.

Units:
- Metric
- English

Total distance:
1411.49 ft

Delete last point  Reset