BENEFIT COST ANALYSIS FILING: WATER STREET AND PLYMOUTH STREET NON-WIRE SOLUTIONS PROJECT

June 13, 2019

Prepared by Consolidated Edison Company of New York, Inc.

Table of Contents

Table of Contents 2

Water Street & Plymouth Street Project 3

Overview 3

Background 4

NWS Project Details 6

Table 2: Water / Plymouth NWS portfolio BCA summary 7

Water/Plymouth Load Relief 7

BCA Summary 8

Table 3: Water / Plymouth NWS portfolio societal benefits and costs 10

Appendix A: Traditional Whitepapers 11

Farragut to Plymouth Feeder Project 11

Farragut Cooling Project 14

Water Street Cooling Project 17

Water Street & Plymouth Street Project

Overview

As detailed in the Non-Wires Solutions Quarterly Expenditures & Program Reports,[1] Consolidated Edison Company of New York, Inc. ("Con Edison" or the "Company") began implementing the Water and Plymouth Street Non-Wires Solutions (NWS) Project in 2018. The project alleviates the projected overloads at the Water Street and Plymouth Street area substations and their common supply transformers at the Farragut transmission substation as well as on limiting sections of the supply cables between Farragut and Plymouth over the 2019-2021 period. The overloads were projected to start in summer 2019 and increase year over year within the 10 year horizon in these areas.[2] This approximately 32 MW NWS eliminates the need for the traditional projects detailed in Appendix A; these were necessary smaller upgrades that could be implemented prior to summer 2019.

[1] Matter/Case Details: 16-00253/16-E-0060. http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={F5ACE426-F564-40DC-990B-41986848D2BE}

[2] The incremental load growth forecasted beyond 2022 will be addressed by the Hudson Avenue Distribution Switching Station (HADSS) project as described in the Company's current rate case. Case 19-E-0065, Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Electric Service (January 30, 2019). http://documents.dps.ny.gov/public/MatterManagement/MatterFilingItem.aspx?FilingSeq=220036&MatterSeq=58901. This NWS was needed immediately to meet the short term overload until the larger project can be built.

This filing provides the Benefit Cost Analysis ("BCA") results for this NWS because the Company now has reasonable certainty related to the costs to implement the full three year portfolio, as required by the Commission.[3]

Background

The Water Street Substation ("Water") supplies power to the Williamsburg[4] and Prospect Park networks in Brooklyn. The Plymouth Street Substation ("Plymouth") supplies power to the Borough Hall network in Brooklyn. The Company's 2016 load forecast analysis demonstrated that over the next 10 years, these two substations will need up to approximately 43 MW and 30 MW of load relief, respectively, starting in 2019, as shown in Table 1 below.

[3] The New York Public Service Commission ("PSC" or "Commission") issued its *Order Approving Shareholder Incentives* ("Incentives Order"), requiring, inter alia, that Con Edison's Targeted Demand Management Program end on January 25, 2017, (Case 15-E-0229, Petition of Consolidated Edison Company of New York, Inc. for Implementation of Projects and Programs that Support Reforming the Energy Vision, *Order Approving Shareholder Incentives* ("Incentives Order") (issued January 25, 2017), p. 9.). Henceforth, any non-wires solution ("NWS") project were to be completed under the NWS provisions of the rate plan adopted in the Con Edison Rate Case order ("Rate Case Order") issued on the same date. (Case-16-E-0060, Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Electric Service, *Order Approving Electric and Gas Rate Plans* (issued January 25, 2017)). The Incentives Order also provides a methodology for determining incentives that applies to large as well as small NWS projects under the NWS framework approved in the Rate Case Order

[4] The Company's latest reliability assessment for the Williamsburg network resulted in four primary feeders needing load relief. These feeder needs are also addressed through this NWS project.

Area Station	2019	2020	2021	2022	2023	2024	2025	2026	2027	Total
Water St	4	10	10	5	1	4	3	4	2	43
Plymouth St			8	6	0	4	4	5	3	30

Table 1: Projected Incremental Yearly Overloads

To address these forecasted overloads, the Company designed four traditional projects that would increase the supply capacity of the existing infrastructure that could be built quickly to meet the required timeline. These projects are listed below and detailed in Appendix A.

- Farragut to Plymouth Feeder Project
- Farragut Cooling Project
- Water Street Cooling Project
- Williamsburg Primary Feeder Project

Given the substations' common supply source (Farragut) the Company has combined these projects into a single NWS portfolio. The Company identified these projects as NWS candidates and released a Request for Proposals (RFP) to the market in 2017.

NWS Project Details

The Company used RFP responses to design and develop a cost-effective portfolio of solutions with a BCA score of 1.14 and net benefits at a value of $18.39 million to provide approximately 32.57 MW of load relief to meet the immediate need. This portfolio entirely eliminates the need to build the four projects discussed above.

The NWS portfolio consists of energy efficiency, distributed generation, and energy storage. The Company initiated energy efficiency program adders in 2018, incurring a cost of $2.54 million[5] through year end 2018. These costs, including the costs of the NWS portfolio as a whole, are discussed in the Company's Customer Energy Solutions testimony in the current rate filing.

The remaining portfolio items required additional time for the Company to be "reasonably certain" that they would be finalized. In 2019, the Company released incentives for distributed generation technologies. The incentives needed for the portfolio's energy storage projects remained unclear while dual participation in the NYISO was debated, and then later while the NYSERDA incentive was finalized. Once the eligibility of the Market Acceleration Bridge Incentive from NYSERDA was determined, the Company issued an additional RFP in April 2019 for energy storage. With the proposals

[5] Implementation costs are documented in the most recent NWS quarterly report filed for the fourth quarter of 2018. Matter/Case Details: 16-00253/16-E-0060.
http://documents.dps.ny.gov/public/MatterManagement/MatterFilingItem.aspx?FilingSeq=221930&MatterSeq=50091

received, costs were confirmed, and the BCA was finalized.[6] A high level summary of the BCA is found in Table 2 below.

Project Name	Peak Load Relief (MW)	Load Relief Period	Total Benefits (NPV)	Total Costs (NPV)	BCA SCT Score	Con Edison Investment (NPV)	Customer Portion of Net Benefits	Company Incentive[7]
Water & Plymouth Street Portfolio	32.57	2019 – 2021	$151.17M	$132.78M	1.14	$63.61M	$12.87M (70% of Net Benefits)	$5.52M (30% of Net Benefits)

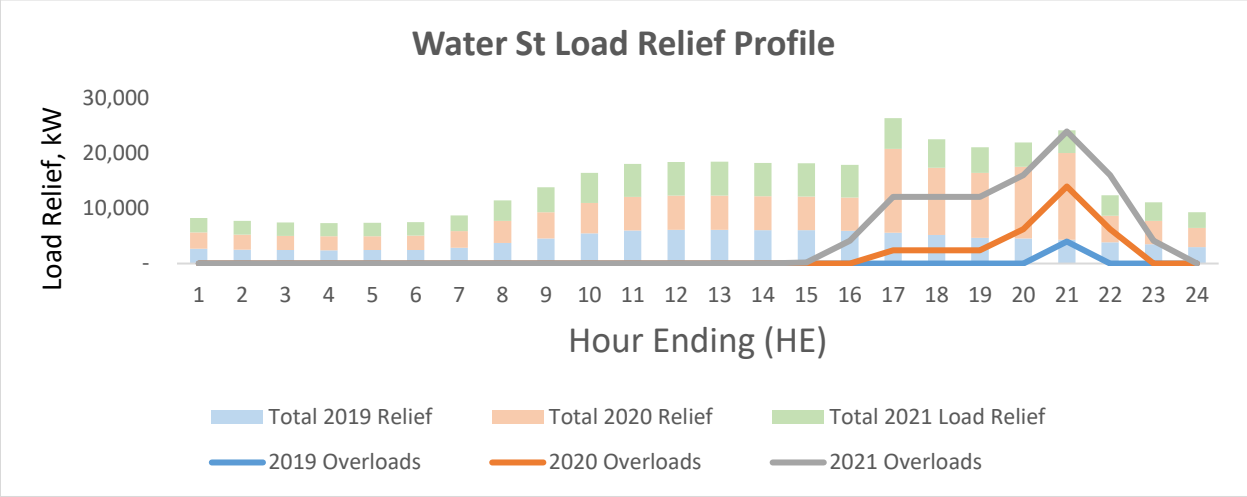
Table 2: Water / Plymouth NWS portfolio BCA summary

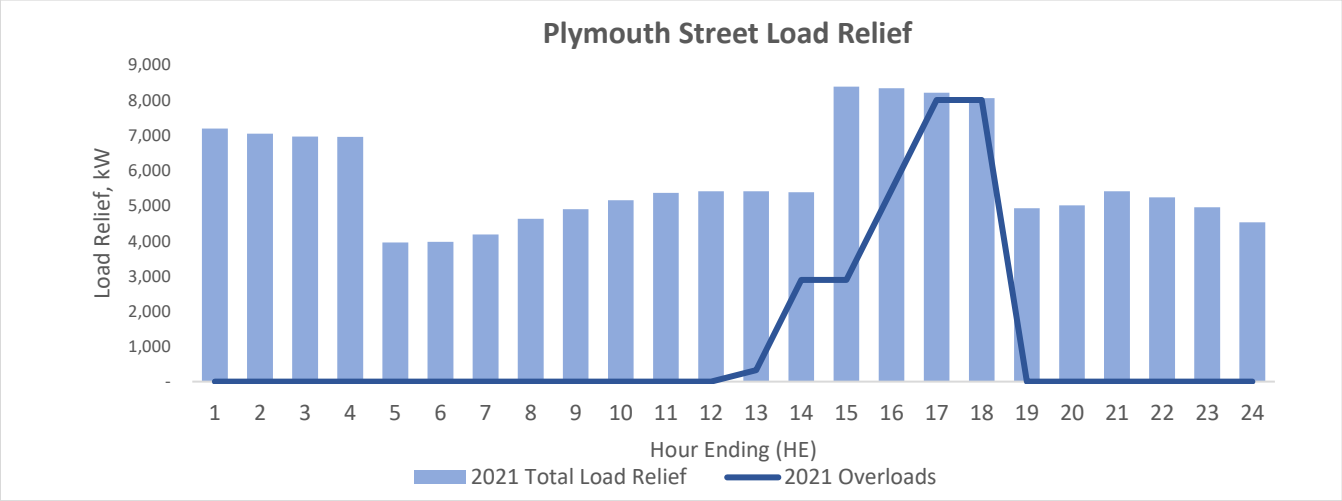
Water/Plymouth Load Relief

The charts below illustrate the projected overloads and planned load relief for the Water/Plymouth NWS portfolio.

[6] For the BCA, the Company used the Marginal Cost study dated July 30, 2018

[7] Per Public Service Commission Matter/Case: 15-00844/15-E-0229, Order Approving Shareholder Incentives, ratepayers receive 70% of a NWS portfolio's net benefits, and Con Edison shareholders earn 30%. http://documents.dps.ny.gov/public/MatterManagement/MatterFilingItem.aspx?FilingSeq=175182&MatterSeq=47911





BCA Summary

The portfolio of solutions assembled for the Water/Plymouth deferral project results in a Societal Cost

Test (SCT) score of 1.14 and net benefits at a value of $18.39 million. Table 3 below is a screenshot from

Con Edison's BCA tool, which calculates the costs and benefits of the project. Pursuing the NWS project over the traditional solutions yields the following benefits:

- The avoidance of 174,418 MWh of generated energy and a customer savings of $45.07 million;
- The avoidance of 32.57 MW of generation capacity at the network peak that will save customers $23.80 million;
- The avoidance of costs associated with transmission and secondary distribution capacity infrastructure at a value of $7.97 million for customers;
- The curbing of CO_2 emissions, supporting New York State and New York City CO_2 emission goals and providing a $23.99 million benefit; and
- Elimination of the need to build the traditional solutions, saving customers $50.35 million.

Through the benefit-cost analysis, the Company identified the following costs associated with implementing the NWS project:

- $58.46 million in program incentive costs to accelerate market adoption of energy efficiency, distributed generation and energy storage technologies in the specified NWS networks;
- $5.15 million in non-incentive costs associated with the Company's administration and implementation of the NWS programs. Examples of these include planning costs, training, marketing, and payments to independent contractors; and
- $69.17 million in funds necessary to implement measures under the NWS program not provided by the Company.

NWS: Water/Plymouth St Cooling	
Elimination	Elimination
$ 50,345,036	T&D Deferral Benefit

Electric	*All Programs*																
MWh + MW BCA	**Total**		**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Total MWh - Network Peak	174,418		44,516	55,846	74,056	-	-	-	-	-	-	-	-	-	-	-	-
Total MW - Network Peak	32.57		4.31	14.55	13.7	-	-	-	-	-	-	-	-	-	-	-	-
Total MW - System Peak	34.97		5.62	14.02	15.3	-	-	-	-	-	-	-	-	-	-	-	-

Net Present Value of Benefits	**Total**		**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Avoided Energy	45.07M		12.34M	15.39M	21.15M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M
Avoided Generation Capacity Costs (AGCC)	23.80M		3.89M	10.43M	11.71M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M
Avoided Transmission	0.00M		0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M
Avoided Primary Distribution	0.00M		0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M
Avoided Secondary Distribution	7.97M		1.27M	4.02M	3.38M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M
Net Avoided CO2	23.99M		7.23M	8.68M	9.98M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M	0.00M
T&D Deferral	50.35M																
Total Benefits	**151.17M**		**24.727M**	**38.521M**	**46.215M**	**0.0M**	**0.0M**	**0.0M**	**0.0M**	**0.0M**	**0.0M**	**0.0M**	**0.0M**	**0.0M**	**0.0M**	**0.0M**	**0.0M**

Net Present Value of Costs	**Total**		**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Program Incentive Costs (Rev. Req't.)	58.46M		9.03M	22.69M	22.46M	1.65M	1.65M	1.65M	1.65M	1.65M	1.65M	1.65M	1.65M	0.63M	0.00M	0.00M	0.00M
Portfolio Non-Incentive Costs (Rev. Req't.)	5.15M		0.90M	2.27M	2.25M	0.03M	0.03M	0.03M	0.03M	0.03M	0.03M	0.03M	0.03M	0.01M	0.00M	0.00M	0.00M
Participant Costs	69.17M		8.54M	22.82M	35.77M	1.56M	1.56M	1.56M	1.56M	1.56M	1.56M	1.56M	1.56M	0.51M	0.00M	0.00M	0.00M
Total Costs	**132.78M**		**18.5M**	**47.8M**	**60M**	**3M**	**3M**	**3M**	**3M**	**3M**	**3M**	**3M**	**3M**	**1M**	**0M**	**0M**	**0M**

NPV Benefits - NPV Costs																	
SCT Benefit/Cost Ratio	1.14		1.34	0.81	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#DIV/0!	#DIV/0!	#DIV/0!
Net Benefits	18.39M		6.26M	-9.25M	-14.26M	-3.24M	-3.24M	-3.24M	-3.24M	-3.24M	-3.24M	-3.24M	-3.24M	-1.15M	0.00M	0.00M	0.00M

Table 3: Water / Plymouth NWS portfolio societal benefits and costs

Appendix A: Traditional Whitepapers

Farragut to Plymouth Feeder Project

X	Capital
	O&M

2019 Central Operations/System & Transmission Operations

Project/Program Title	Farragut to Plymouth - Replace Limiting Section(s) of Cable for Feeders 32072, 32076, 32710
Project Manager	TBD
Hyperion Project Number	TBD
Organization's Project Number	TBD
Status of Project	Planning
Estimated Start Date	January 2019
Estimated Completion Date	June 2021
Work Plan Category	Operationally Required

Work Description:

Feeders 32072, 32076, 32710 are three of five 138 kV feeders that supply the Plymouth Area Substation from the Farragut 345 kV Substation. These feeders have limiting cable sections that limit the power flow from the Farragut Substation to Plymouth Street Substation. This project will replace one limiting cable section of Feeder 32072, one limiting cable section of Feeder 32076, two limiting cable sections of Feeder 32710 and all potheads associated with each feeder at the Farragut Substation.

Justification Summary:

As per the 2018 – 2027 Area Substation and Subtransmission Feeder Ten-Year Load Relief Program, Feeders 32072, 32076, 32710 located between Farragut and Plymouth Substation will not meet the 2021 Summer 300 hour rating of 622A under contingency conditions per each feeder. The current 300 hour rating for feeders 32072, 32076 is 598A and for feeder 32710 is 619A. This project is required to ensure that reliability criteria are met for the Plymouth Substation.

Supplemental Information:

- Alternatives: Expand the Gowanus Substation and establish the new Nevins Area Substation in Brooklyn, and transfer part of the load from the Plymouth Area Substations to the new Nevins Area Substation. This alternative requires the installation of three new circuit breakers and three new transformers. In addition, several miles of 138kV underground cable to the new Nevins Area Substation would be required. The feeder uprate project is preferred to this alternative.

- Risk of No Action: If this project is not performed, the limiting sections of cable will not be able to meet customer demand during summer peak load conditions in 2021.

- Non-financial Benefits: This project will accommodate load growth and facilitate deterministic reliability standards being met in the networks fed by Plymouth Substation.

- Summary of Financial Benefits (if applicable) and Costs: Not applicable.

- Technical Evaluation/Analysis: An increase in the cable conductor size increases the rating of the cable, which in this case is the most cost effective and viable solution. This requires replacing three sections and pulling new cable for each Feeder 32072, 32076, 32710 and replacing the potheads at Farragut Substation. Approximately 2,500 linear feet cable will be replaced with 2500kcmil cable. This larger cable will be capable of achieving the needed 2021 Summer Normal rating of 622 Amps.

- Project Relationships (if applicable): None.

- Basis for Estimate: Previous feeder and transformer installations and budget based on order of magnitude estimate.

Total Funding Level ($000):

Historical Spend

Actual 2015	Actual 2016	Actual 2017	Actual 2018	Historic Year (O&M only)	Forecast 2019
N/A	N/A	N/A	N/A		N/A

Historical Elements of Expense

(Historical EOE breakout will only be completed for Steam projects/programs of $500 thousand or more and, for all other organizations, projects/programs of $1million or more.)

EOE	2	Actual 2016	Actual 2017	Actual 2018	Historic Year (O&M only)	Forecast 2019

Labor						
M&S						
A/P						
Other						
Total	N/A	N/A	N/A	N/A		N/A

Request by Elements of Expense

EOE	2019	2020	2021	2022	2023
Labor	$806	$930	$802		
M&S	$391	$451	$389		
A/P	$105	$121	$104		
Other	$992	$1,145	$988		
Overheads	$756	$873	$753		
Total	**$3,050**	**$3,520**	**$3,036**	**$0**	**$0**

Farragut Cooling Project

X	Capital
	O&M

2019 – Central Operations/ Substation Operations

Project/Program Title	Farragut - Install Additional Cooling – Transformers 1, 2, 3, 4, 5, 6, 7, 8 and 10
Project Manager	TBD
Hyperion Project Number	TBD
Status of Project	Planning
Estimated Start Date	2019
Estimated Completion Date	2021
Work Plan Category	Operationally Required

Work Description:

This project will install dual speed cooling fans at Farragut Station on transformers at 1, 2, 3, 4, 5, 6, 7, 8 and 10 to increase their rated capability. The work will begin in 2018 and the upgrades will be completed in two phases. The upgrades on transformers 3, 4, 5 and 10 will be completed by the summer of 2020 and the upgrades on Transformers 1,2,6,7 and 8 will be completed by the summer of 2021.

Justification Summary:

The Farragut X-winding load that serves Plymouth Street (Transformers 1, 2, 6, 7 & 8) is projected to develop a 2MW capability shortfall in 2021 that will continue to increase in subsequent years. This project will provide additional station capacity, and is expected to serve the station's capability needs through 2024.

The Farragut X-winding load that serves Water Street (Transformers 3, 4, 5 &10) is projected to develop a 14MW capability shortfall in 2020 that will continue to increase in subsequent years. This project will provide additional station capacity, and is expected to serve the station's capability needs through 2025.

Supplemental Information:

- Alternatives:
  One alternative would be to transfer loads out of Plymouth Substation and Water Substations. However, the nearby stations are also near capacity and this is expected to be a costlier option, due to the amount of feeder work that would be required for the transfer. Another alternative would be to replace the transformers with units of higher capability. However, these transformers are not currently targeted for replacement and this would be costlier option.

- Risk of No Action:
  If no action is taken, there would be a potential risk of losing customers due to the higher network load as compared with the station capability.

- Non-financial Benefits:
  Ensures continued and uninterrupted service to our customers. Maintains our system reliability.

- Summary of Financial Benefits (if applicable) and Costs:

- Technical Evaluation/Analysis:

  Based on Area Station Planning's load flow and forecast analyses, Farragut X-winding load (Transformers 1,2,6,7 & 8) and Farragut X-winding load (Transformers 3, 4, 5&10) is projected to develop an 2MW in 2021 and a 14MW in 2020 capability shortfall. If left unaddressed the shortfall by 2024 would be 37MW on Transformers 3, 4, 5& 10 and 13MW on transformers 1,2,6,7 by 2025. Equipment Engineering evaluated the loading capability of the transformers based on the IEEE loading guide C57.91.

- Project Relationships (if applicable):

  There are associated projects to replace limiting 138kV feeder sections and Y joints planned by Transmission Operations that will also provide capability to Plymouth Street in 2021. In addition, limiting 27kV bus sections have been replaced so that the full capacity of the station equipment can be deployed to the distribution feeders supplied by this station.

- Basis for Estimate:

  Order of magnitude estimate.

Annual Funding Levels ($000):

Historic Elements of Expense

EOE	Actual 2014	Actual 2015	Actual 2016	Actual 2017	Historic Year (O&M only)	Forecast 2018
Labor						
M&S						
A/P						
Other						
Overheads						
Total						

Future Elements of Expense

EOE	Budget 2019	Request 2020	Request 2021	Request 2022	Request 2023
Labor	$807	$777	$182		
M&S	$77	$74	$17		
A/P	$1,667	$1,604	$375		
Other	$1,253	$1,206	$282		
Overheads	$996	$959	$224		
Total	**$4,800**	**$4,620**	**$1,080**		

Water Street Cooling Project

X	Capital
	O&M

2019 – Central Operations/ Substation Operations

Project/Program Title	Water Street – Install Transformer Cooling
Project Manager	TBD
Hyperion Project Number	TBD
Status of Project	Planning
Estimated Start Date	2019
Estimated Completion Date	2020
Work Plan Category	Operationally Required

Work Description:

This project will install dual-speed cooling fans on Transformers 1-4 at Water Street Substation to increase their rated capability. The work will begin in 2019 and the upgrade will be completed prior to the summer of 2020.

Justification Summary:

The Water Street Substation is projected to develop a 10MW capability shortfall in 2021 that will continue to increase in subsequent years. This project will provide additional station capacity, and is expected to serve the station's capability needs through 2025.

Supplemental Information:

- Alternatives:
  One alternative would be to transfer load out of Water Street Substation. However, the nearby stations are also near capacity and this is expected to be a costlier option, due to the amount of feeder work that would be required for the transfer. Another alternative would be to replace the transformers with units of higher capability. However, these transformers are not currently targeted for replacement and this would be a costlier option.

- Risk of No Action:

If no action is taken, there will be a potential risk of losing customers due to the higher network load as compared with the station capability.

- Non-financial Benefits:
  Ensures continued and uninterrupted service to our customers. Maintains our system reliability.

- Summary of Financial Benefits (if applicable) and Costs:

- Technical Evaluation/Analysis:
  Based on Area Station Planning's load flow and forecast analyses, Water Street Substation is projected to develop a 10 MW capability shortfall in 2020 that increases in subsequent years. If left unaddressed the shortfall would be 30 MW by 2025. Equipment Engineering evaluated the loading capability of the transformers based on the IEEE loading guide C57.91.

- Project Relationships (if applicable):
  There is an associated project to install additional cooling on Farragut 345/138kV transformer No. 3, 4, 5 & 10 that serves Water Street Substation.

- Basis for Estimate:
  Order of magnitude estimate

Annual Funding Levels ($000):

Historic Elements of Expense

EOE	Actual 2014	Actual 2015	Actual 2016	Actual 2017	Historic Year (O&M only)	Forecast 2018
Labor						
M&S						
A/P						
Other						
Overheads						
Total	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

Future Elements of Expense

EOE	Budget 2019	Request 2020	Request 2021	Request 2022	Request 2023

Labor	$502	$515			
M&S	$83	$85			
A/P	$463	$476			
Other	$559	$574			
Overheads	$467	$479			
Total	**$2,075**	**$2,130**			

Williamsburg Primary Feeder Traditional Project Cost Estimates

Description of Williamsburg Primary Feeder Relief Project

The traditional costs were determined using typical unit costs for the proposed scope of work to resolve the overload conditions. Specifically to relieve the overloads on 6B41, 6B43, 6B44, and 6B57, based on the latest forecast, the Company would perform the following scope:

6B41

Replace 1 cable sections of 500 EPR with 750 EPR

6B43

Replace 14 cable sections 500 EPR with 750 EPR, and 3 sections 500 XLP with 750 EPR

6B44

Replace 20 cable sections 500 EPR with 750 EPR

6B57

Replace 9 cable sections 500 EPR with 750 EPR

The cost was determined using 2019 unit pricing plus 10% escalation:

- $47,000 per primary section of cable
- $715 per linear foot of conduit

In this case it is assumed that 50% (4,500 ft.) would need new conduit installed due to the larger cable size.

- $47,000 x 47 sections = $2,209,000
- $715 x 4,500 ft. = $3,217,500
- Total = $5,426,500