



## RELIABILITY ENHANCEMENT PROGRAM

2017 Report to the NH Public Utilities Commission

# **EVERSOURCE**

## **RELIABILITY ENHANCEMENT PROGRAM**

**2017 Report to the NH Public Utilities Commission  
May 15, 2018**

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Eversource

Reliability Enhancement Program

Executive Summary

## Executive Summary Eversource Reliability Enhancement Program

This report provides program-specific details for Eversource's Reliability Enhancement Program (REP). This includes Operation and Maintenance (O&M) expenditures from the initial REP program (Base REP) through the end of 2015 and the second program year of REP 3 through June 30, 2016.

The initial REP was established under the settlement agreement approved by the Commission in Order No. 24,750 in Docket No. DE 06-028 and became effective July 1, 2007. The results of the reliability work under the initial REP were documented in the report submitted by Eversource on February 18, 2011.

As part of the Settlement Agreement on Permanent Distribution Rates approved by the Commission in Order No. 25,123 issued in Docket No. DE 09-035, the settling parties agreed that Eversource should continue its existing REP expenditures from the initial REP and incorporate the revenue requirement for the O&M portion into base distribution rates. Additionally, the Settlement Agreement provided for an additional \$4 million per year of revenue for the duration of the Settlement to support enhanced O&M and capital spending under a so-called "REP II" initiative. The REP II initiative ended in 2015 and the final results of that program were included in the report submitted by Eversource on September 30, 2016.

The "REP 3" initiative is a two year extension of REP and was included in the Generation Divestiture settlement agreement of Docket No. DE 14-238. It became effective July 1, 2015, and continued for two years through June 30, 2017.

A further extension was agreed to as part of Docket No. 17-076 (REP 4). It became effective July 1, 2017 and continued for six months, ending December 31, 2017.

This report covers the second year of the REP3 program and the six month REP 4 for a total of eighteen months: the period July 1, 2016 through December 31, 2017.

### **O&M**

Actual O&M spending for the twelve months ended December 31, 2016 under the Base REP program was \$9.0 million with 54,888 tasks completed. Actual O&M spending for the twelve months ended December 31, 2017 under the Base REP program was \$8.1 million with 36,039 tasks completed. See Section 2 *Base REP 2016 O&M Summary* for details on individual activity cost and unit count.

Actual O&M spending for the twelve months ended June 30, 2017 under REP 3 was \$4.9 million. See Section 4, *REP 3 Program Year 2 O&M Summary* for the detail spending by program.

Actual O&M spending for the six month period ending December 31, 2017 under REP 4 was \$1.5 million. See Section 6 *REP 4 O&M Summary* for details on individual activity cost and unit count.

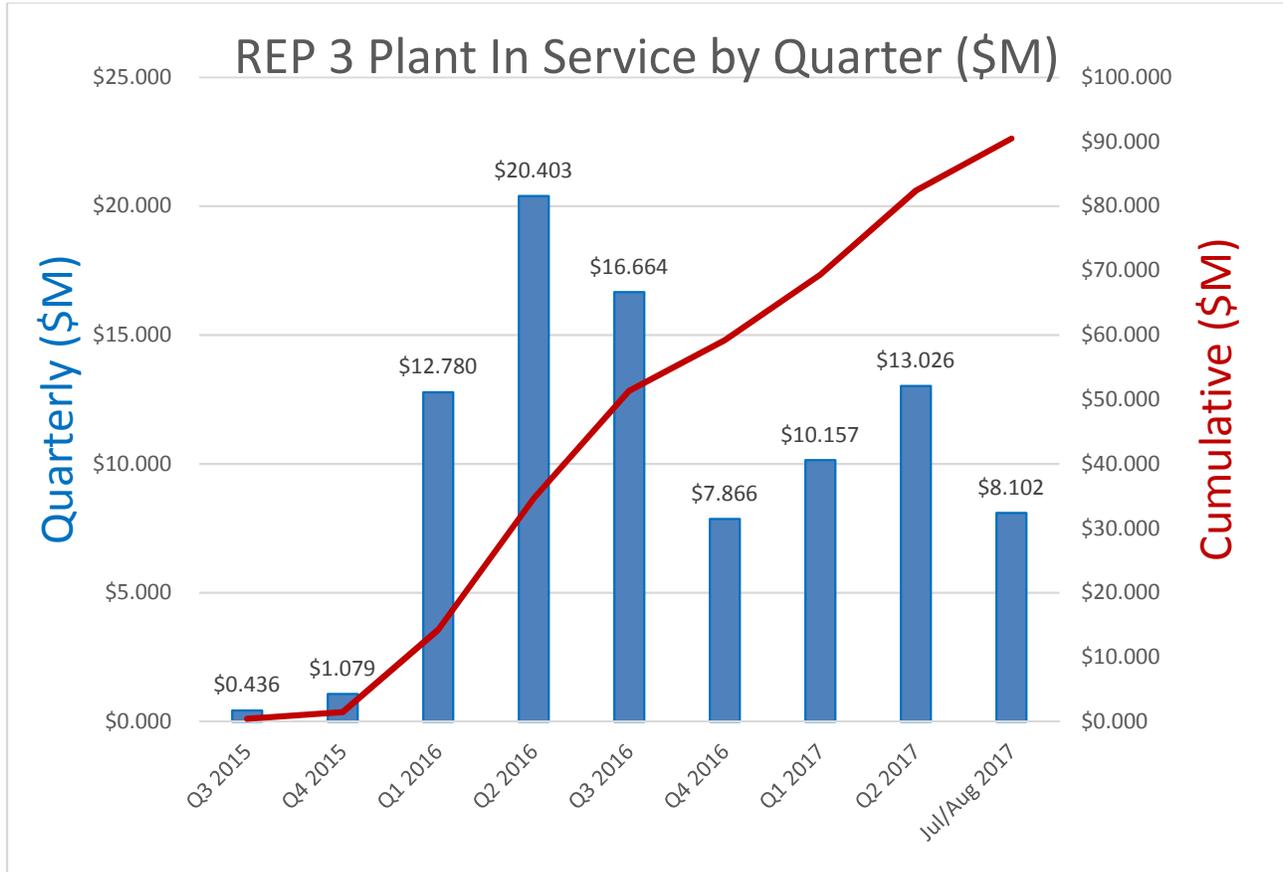
### **Capital**

Capital expenditures for the twelve months ended December 31, 2016 under the Base REP program was \$2.88 million. Capital expenditures for the twelve months ended December 31, 2017 under the Base REP program was \$2.97 million. See Section 3 *Base REP Capital* for details on budget item/project descriptions and expenditures by item or project.

Capital expenditures under the REP 3 program for the 12 months ended June 30, 2017, totaled \$44.8 million, with \$48.4 million placed in service. An additional \$8.1 million was placed in service in July and August 2017 for projects started earlier in the year but not placed in service until those months. See Section 5, *REP 3 Program Year 2 Capital Summary* for details on budget item and project descriptions, and expenditures by item or project.

The following chart depicts total plant in service by quarter (blue bars) and the cumulative amount over the two years of the REP 3 program (red line).

### Executive Summary Eversource Reliability Enhancement Program



Plant in service under the REP 4 program totaled \$7.5 million at the end of 2017, with an additional \$1.6 million placed in service in early 2018 for projects which were started in 2017. Total plant in service under REP 4 is \$9.1 million. See Section 7, *REP 4 Capital Summary* for details on budget item and project descriptions, and expenditures by item or project.

Storm related impacts to the electric system affected Eversource’s absolute SAIDI performance. There was one declared Major Storm during 2017 (October 29 through November 4) compared to one in 2016 (July 23 through July 24). There were a total of 28 minor storm days in 2017 compared to 14 in 2016. These storms contributed 46 minutes to Eversource’s SAIDI performance in 2017, compared to 59 minutes in 2016.

Since the REP was implemented, the trend from 2006 onward has been improved reliability on a weather normalized basis. Eversource’s customers continue to see benefits from the REP activities. REP programs are preventing problems from occurring (improving SAIFI) and reducing outage times (improving SAIDI). The REP activities are critical and important in concert with Eversource’s continued efforts to maintain and improve the system in the normal course of business. See Section 1 *NHPUC Reliability Graphs*.

# Periods and programs in this report



Base REP started January 1 2007 and is ongoing. This report covers the period 1/1/2016 through 12/31/2017.  
REP 3 started July 1 2015 and ends June 30 2017. This report covers the period 7/1/2017 through 6/30/2017 and is the final report for REP 3.  
REP was extended six months starting 7/1/2017 and ending 12/31/2017. This report covers that extension.

# Section 1

## NHPUC Reliability Graphs

## NHPUC SAIDI Graphs Summary Reliability Enhancement Program

The following is a brief description of the SAIDI Graphs contained in this section and the related REP activities for them. All graphs represent data through the end of 2017.

1. Graphs 1 and 2 depict the Eversource SAIDI – NHPUC Criteria. The Company SAIDI was worse in 2017 compared to 2016, primarily due to the number of small storms in 2017. The pre-REP trend lines shown are based on data for 1989 through 2005 and are intended to show where SAIDI might have been without the REP program. The second chart shows a trend line for SAIDI for the period since the implementation of REP.
2. Top 50 Hit List SAIDI Contribution from Year to Year. Each year Eversource reviews SAIDI by circuit and determines which have contributed the most minutes according to the NHPUC Criteria. Shown on this graphic are the total SAIDI minutes for the top 50 circuits in a year, the amount of SAIDI minutes for those circuits remaining on the top 50 list from the previous year, and the percentage of SAIDI these carry forward circuits represent compared to the Top 50 total. In 2017 the results improved versus 2016 results. The top 50 circuits continue to contribute less than half of Eversource's overall SAIDI. See section 6 Other Activities for specific actions taken on each circuit.
3. Eversource SAIDI – NHPUC Criteria With and Without Storms. NHPUC SAIDI does not include emergency events which are booked to the storm reserve. These are catastrophic events and are shown on this chart over and above the NHPUC reported SAIDI. Off-scale impacts are shown for the December Ice Storm in 2008; the February wind storm in 2010; the two major storms declared in 2011, Tropical Storm Irene in August and a major snowstorm in October; Hurricane Sandy in 2012; the Thanksgiving weekend storm in 2014, and the October windstorm in 2017. A major storm is declared when there are 200 concurrent power outages affecting 10% of customers served or 300 concurrent power outages. Eversource also tracks minor storms when 100 or more primary power outages occur within a storm timeframe and not deemed a NHPUC major storm. Eversource experienced a total of 28 minor storm days in 2017 compared to 14 in 2016 and 10 in 2015<sup>(1)</sup>. These storms contributed 46 minutes to Eversource's SAIDI performance in 2017, compared to 59 minutes in 2016 and 30 minutes in 2015. This minor storm component subtracted from NHPUC reported SAIDI leaves a Weather normalized SAIDI. As shown, that component continues to be below levels present when REP was initiated in July, 2007.
4. Eversource Tree Related SAIDI. The largest cause group for SAIDI is trees and limbs, primarily from outside of the clearance area. Tree related SAIDI and the NHPUC reported SAIDI trend very closely and are sensitive to weather. Weather Normalized Tree SAIDI had been trending upward slightly with a slowing and improving trend in recent years. There is a cumulative effect for vegetation management and we believe the effort from last half of 2007 through year end 2016 is showing results. Our efforts to establish the target 4.5 year trimming cycle for the

<sup>(1)</sup> For internal reporting purposes, these are referred to as "minor" and "work order" storms. There were eight minor plus 14 work order storms in 2016 and six minor plus five Work Order storms in 2015. These storms are included in reliability reporting statistics.

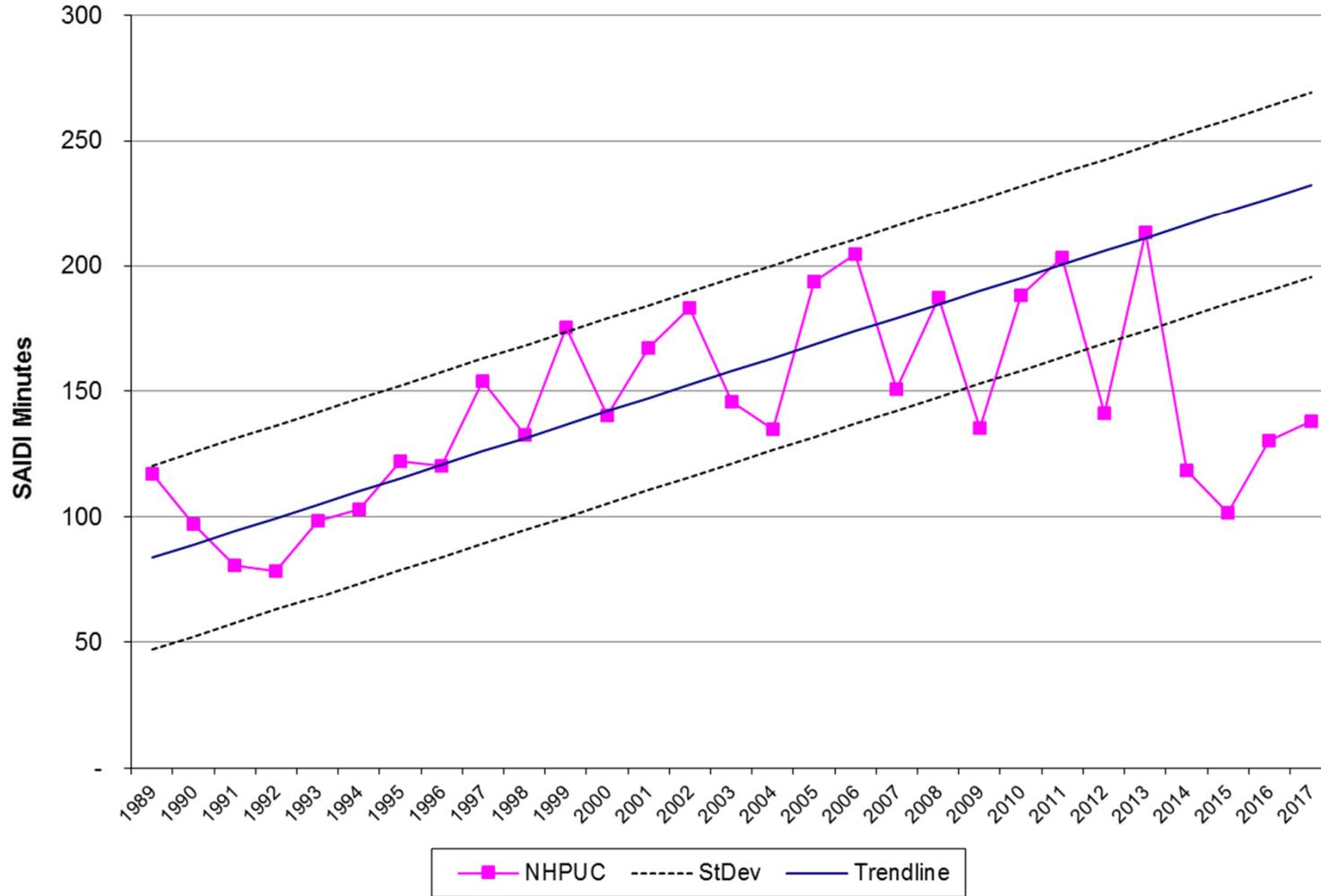
## NHPUC SAIDI Graphs Summary Reliability Enhancement Program

distribution system have succeeded. Eversource's trimming cycle remains at approximately 3.9 years, well below the maximum five year cycle required by PUC 307.10 Tree-Pruning Standards. REP activities relating to this are:

- a. O&M expense Vegetation Management activities including Scheduled Maintenance trimming to shorten the maintenance cycle, and ROW Mowing
  - b. Capital trimming at Enhanced Tree Trimming specifications for establishing larger clearance both for existing lines and whenever new additions and upgrades are made to the system and Hazard tree removals for trees outside the trim zone identified as having the potential to fall into the lines.
5. Eversource Equipment Related SAIDI. The second largest cause group for SAIDI is equipment failures in substations and on distribution lines. There is much less weather effect to these outages so the difference between NHPUC criteria performance and weather normalized performance is small. Results in this area continued to improve in 2017, to the lowest value in the 15 years depicted on the chart. A variety of REP actions work to reduce outages caused by equipment failures including:
- a. Porcelain equipment replacement
  - b. Switch maintenance and replacement programs
  - c. Recloser maintenance
  - d. Cable testing and replacement
6. Eversource SAIDI – NHPUC Criteria Substation Reliability. Power outages caused by actions or problems inside substations are typically large and widespread. The amount of SAIDI minutes relating to these events is generally declining and there is essentially no difference due to weather. After a slight uptick in SAIDI minutes due to substation events in 2016, it declined again in 2017. The total impact to SAIDI remains at historically low levels, having been less than one minute for the last three years. This performance can be associated with REP activities such as:
- a. 34.5 kV Substation Breaker replacement program
  - b. Animal Protection in Substations
  - c. Reducing the corrective maintenance backlog.

# PSNH SAIDI - NHPUC Criteria

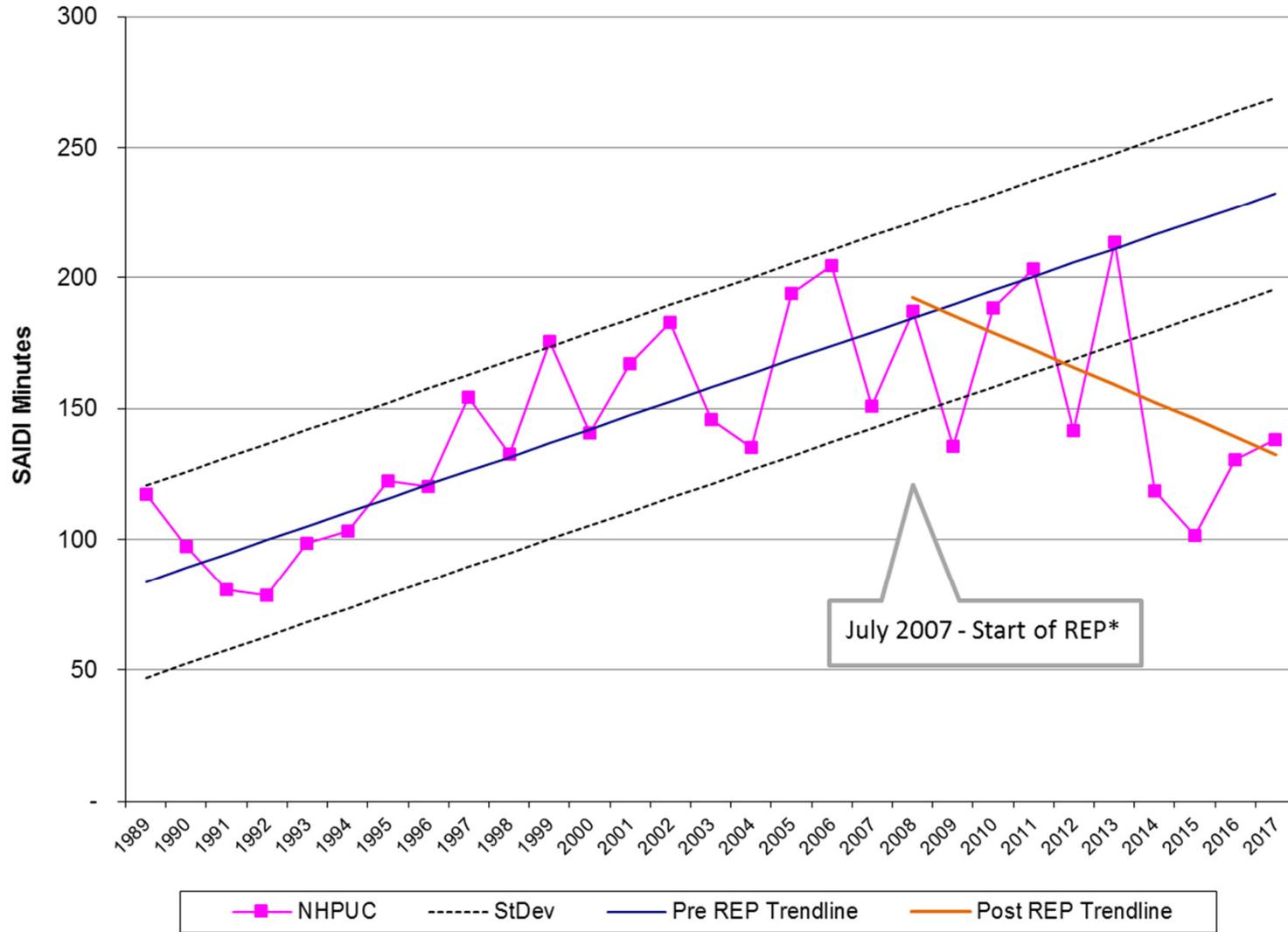
Original trendline



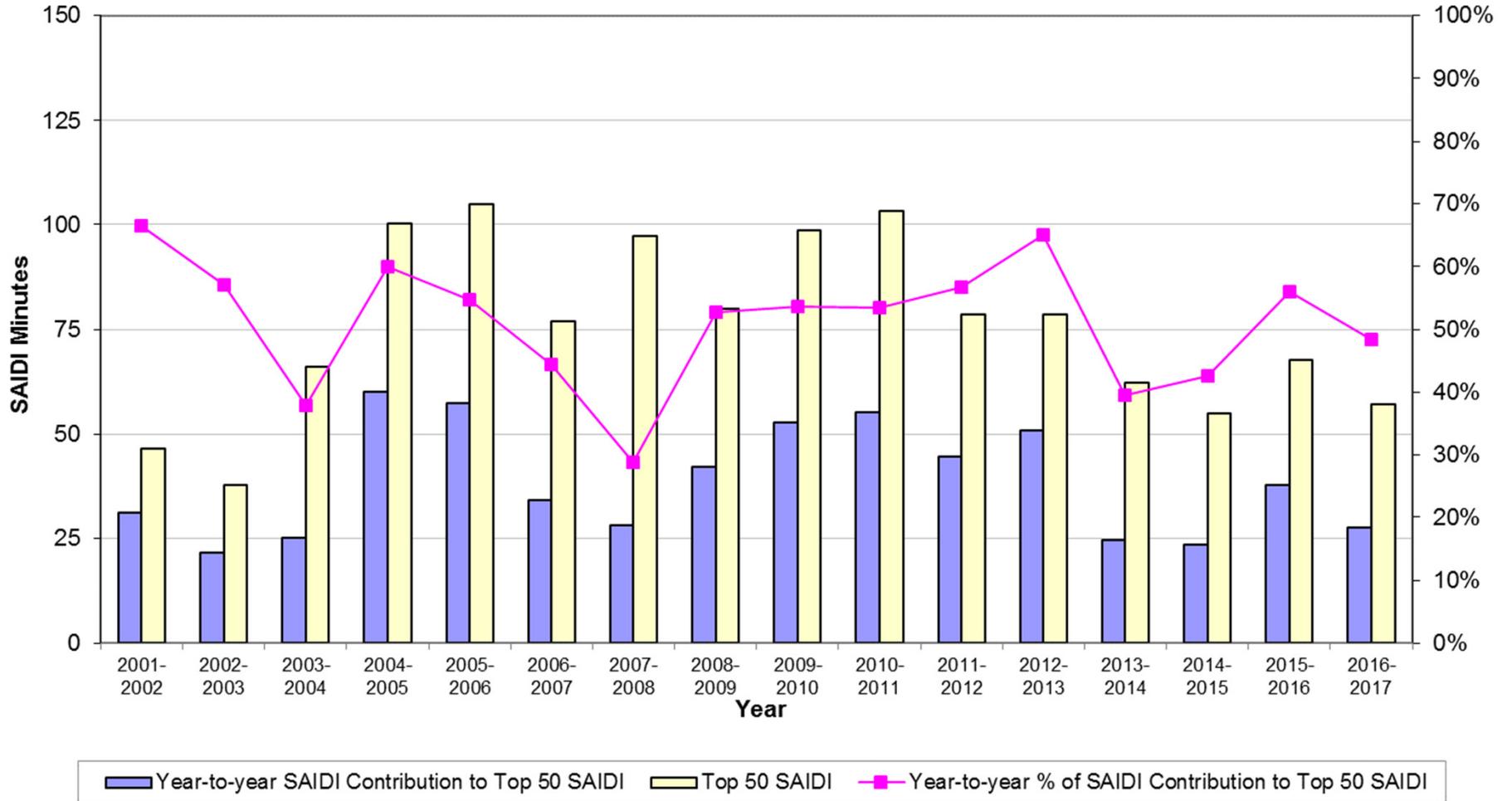
Trend Lines are based upon 1989 - 2005 data and are intended to depict where SAIDI might have tracked without the REP Program

# Eversource SAIDI - NHPUC Criteria

## Post REP Trendline



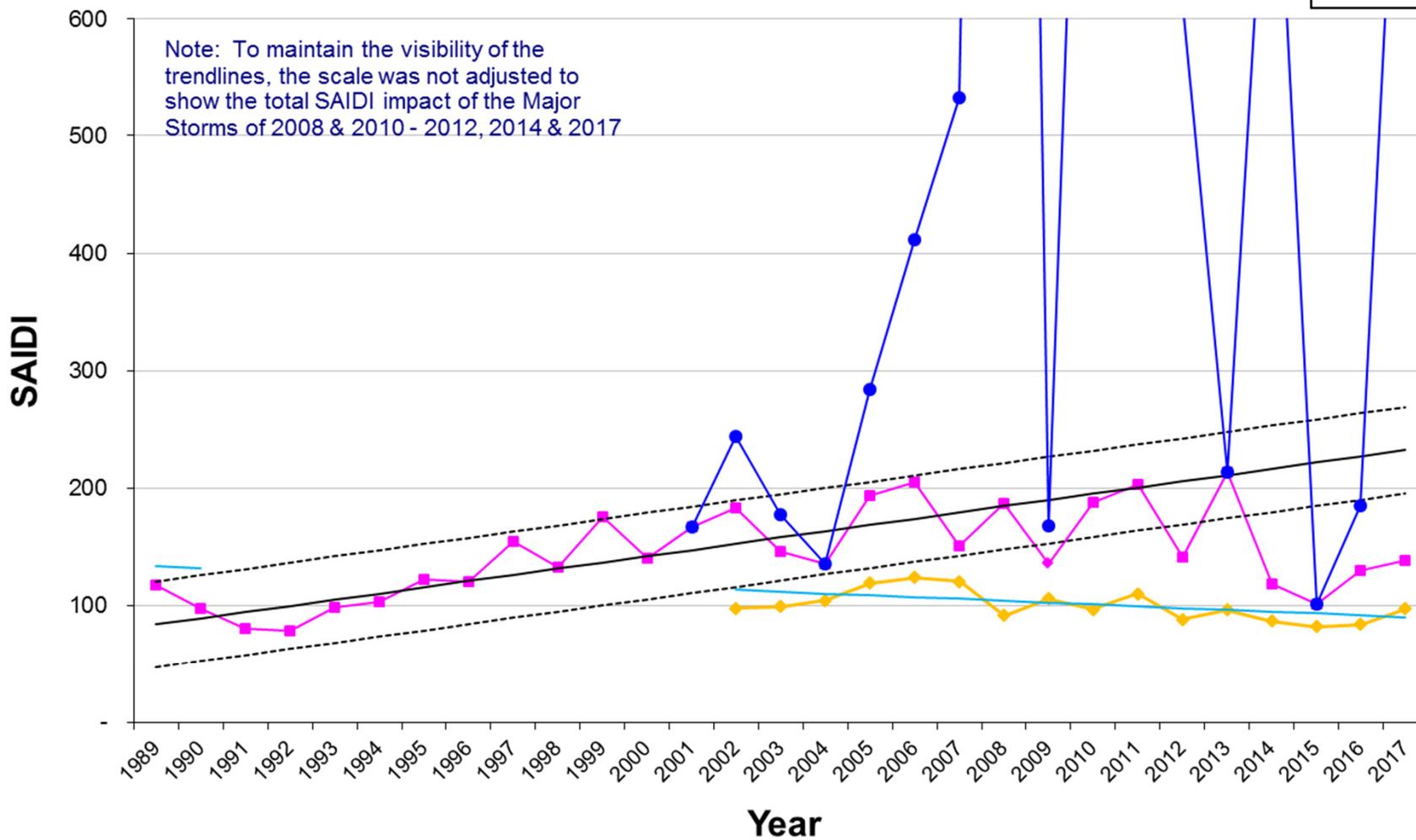
## Top 50 Hit List SAIDI Contribution from year to year NHPUC Criteria



# Eversource SAIDI - NHPUC Criteria

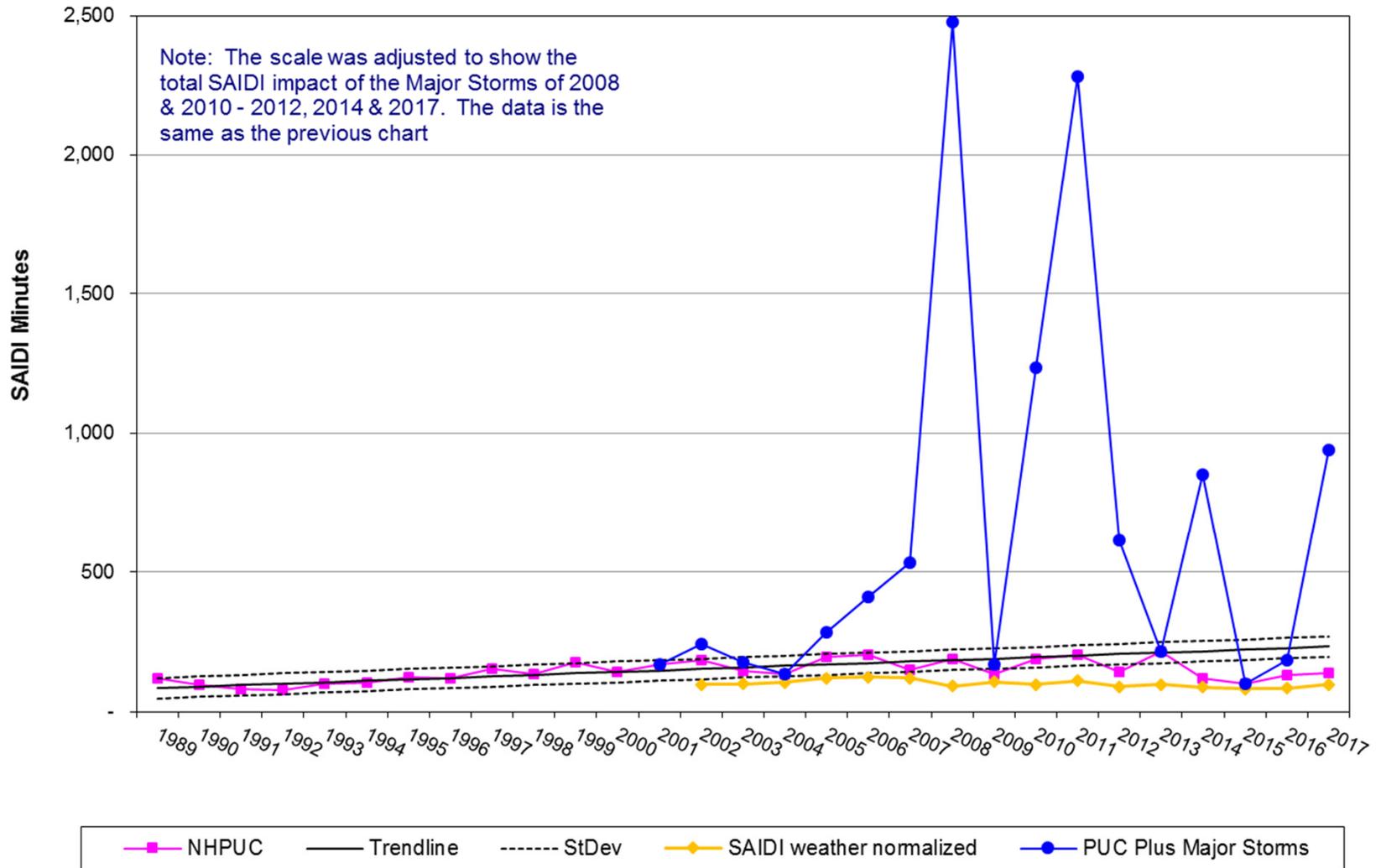
## With and Without Storms

Off scale SAIDI values:	
2008:	2477
2010:	1236
2011:	2281
2012:	613
2014:	732
2017:	800



# Eversource SAIDI - NHPUC Criteria

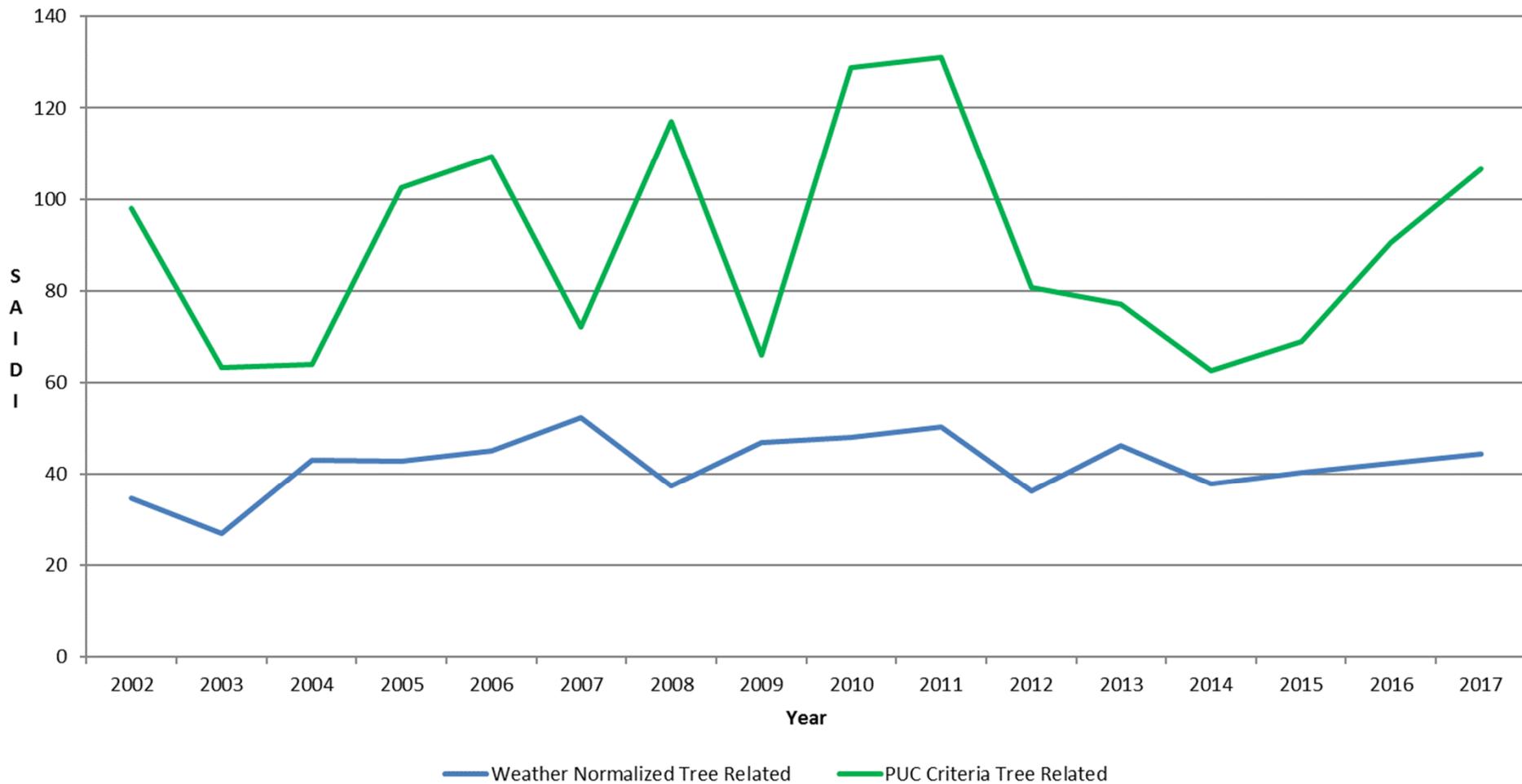
## With and Without Storms



# Eversource Tree Related SAIDI

## NHPUC Criteria

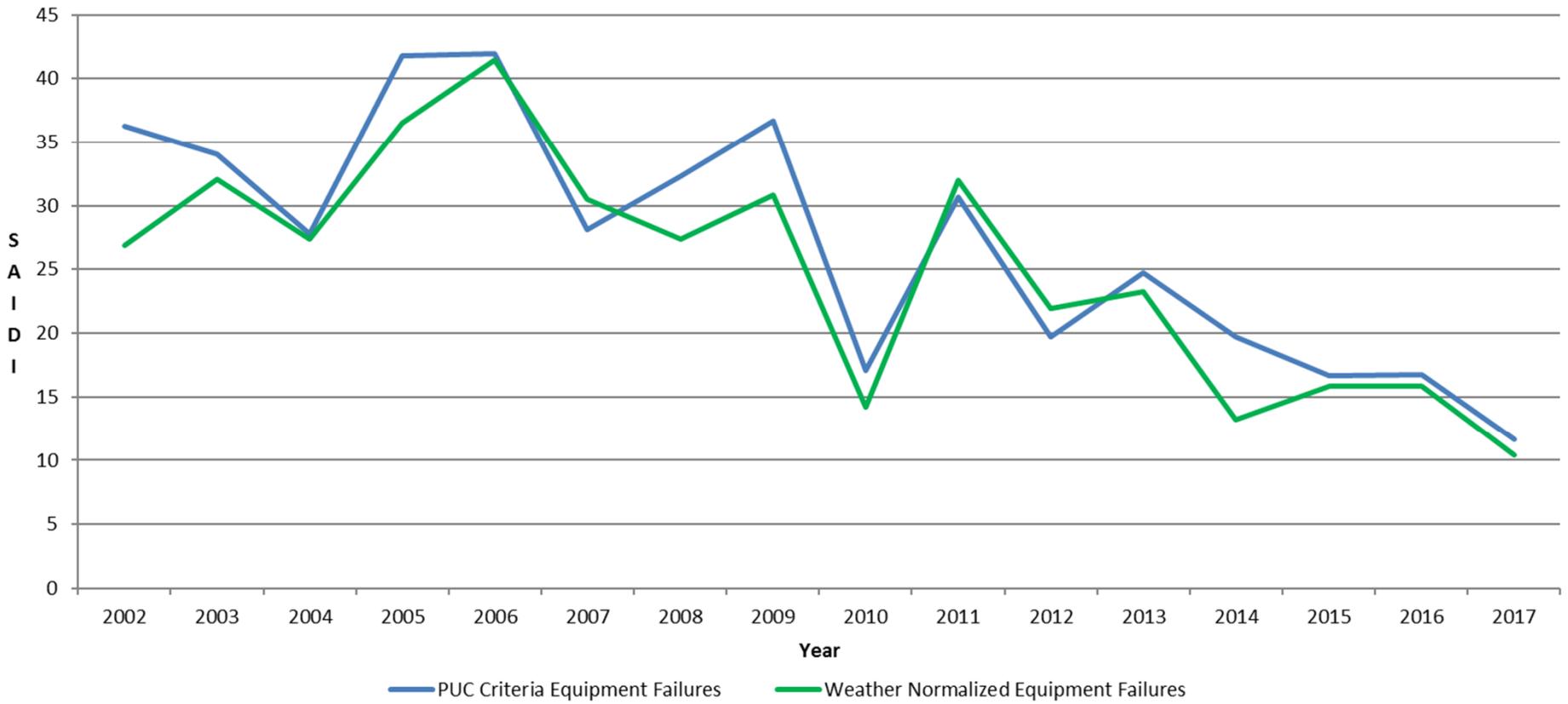
100% of Trees/Limbs, 50% of Snow/Ice Loading, 40% of Patrolled Nothing Found related troubles)



# Eversource Equipment Failure Related SAIDI

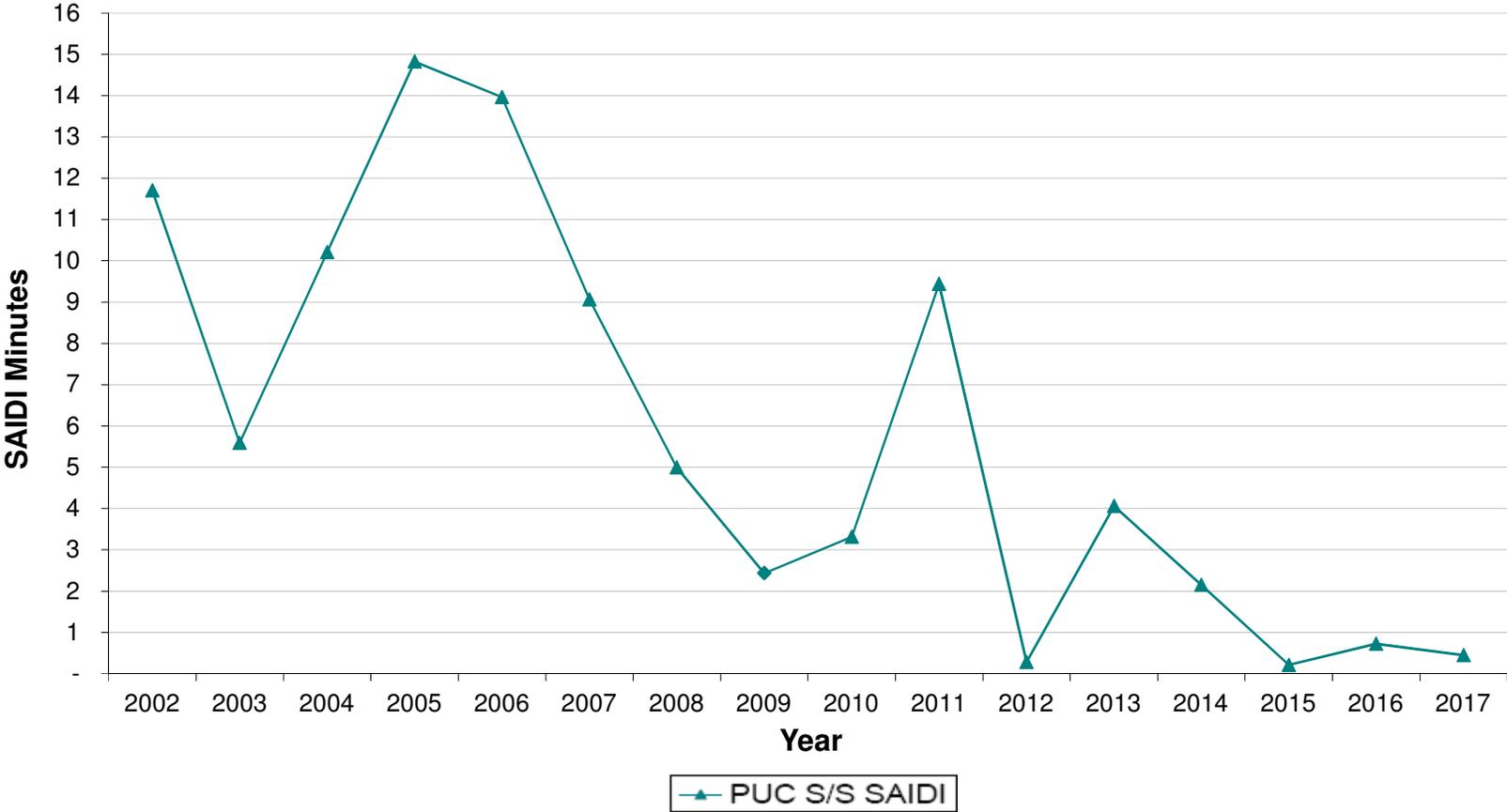
## NHPUC Criteria

### 100% Equipment Failure and Overload Events



# Eversource SAIDI - NHPUC Criteria

## Substation Reliability



## Section 2

### Base REP O&M Summary

January 1, 2016 – December 31, 2016

January 1, 2017 – December 31, 2017

**Year End 2016 - Base REP**  
**Summary of Eversource Reliability Enhancement Program – O&M**



Jan 1 2016 - Dec 31 2016

<b>TRIMRC - VEGETATION MANAGEMENT (O&amp;M)</b>						
	<b>Units</b>	<b>\$ Planned</b>	<b>\$ Expended</b>	<b>Units Planned</b>	<b>Units Completed</b>	<b>Cost Per Unit</b>
Reduce Scheduled Maintenance Trim Cycle	Miles	\$7,370,000	\$6,775,768	1,379	1,340	\$5,057
Hot Spot Trimming	Locations	N/A	\$5,192	N/A	7	\$742
Mid Cycle Trimming	Miles	0	0	0	0	N/A
Inspect Contractor	Miles	N/A <sup>(2)</sup>	N/A <sup>(2)</sup>		N/A <sup>(2)</sup>	N/A
Distribution Rights-of-Way Maintenance Cycle	Acres	\$500,000	\$400,551	1,365	1,357	\$295
<b>Total TRIMRC</b>		<b>\$ 7,870,000</b>	<b>\$7,181,511</b>	<b>2,744</b>	<b>2,704</b>	

<b>NESCRC - National Electrical Safety Code (O&amp;M)</b>						
	<b>Units</b>	<b>\$ Planned</b>	<b>\$ Expended</b>	<b>Units Planned</b>	<b>Units Completed</b>	<b>Cost Per Unit</b>
Full Circuit Patrol	Miles	N/A <sup>(1)</sup>	\$42,012	0	40	\$1,050
Inspect and Repair Underground Systems	Maps	N/A <sup>(1)</sup>	\$374,580	233	252	\$1,486
Inspect Manholes	Manholes	N/A <sup>(1)</sup>	N/A <sup>(2)</sup>	N/A <sup>(2)</sup>	N/A <sup>(2)</sup>	N/A
Pole Inspection and Treatment	Poles	N/A <sup>(1)</sup>	\$1,362,669	24,000	51,758	\$26
Overhead Repair Activity	Repair Orders	N/A <sup>(1)</sup>	\$31,431	N/A	7	\$4,490
Foot Patrol ROW	Miles	N/A <sup>(1)</sup>	\$506	0	0.0	N/A
<b>Total NESCRC</b>		<b>N/A <sup>(1)</sup></b>	<b>\$1,811,198</b>	<b>24,233</b>	<b>52,057</b>	

<b>RELIOM - RELIABILITY (O&amp;M)</b>						
	<b>Units</b>	<b>\$ Planned</b>	<b>\$ Expended</b>	<b>Units Planned</b>	<b>Units Completed</b>	<b>Cost Per Unit</b>
Overhead Switch Maintenance	Switches	N/A <sup>(1)</sup>	\$11,849	34	34	\$349
Recloser Maintenance	Reclosers	N/A <sup>(1)</sup>	\$0	0	0	N/A
Fault Indicators	Units	N/A <sup>(1)</sup>	\$4,837	93	93	\$52
Test & Repair Direct Buried Unjacketed Cable	Runs	N/A <sup>(1)</sup>	\$0	0	0	N/A
<b>Total RELIOM</b>		<b>N/A <sup>(1)</sup></b>	<b>\$16,686</b>	<b>127</b>	<b>127</b>	

<b>TOTAL O&amp;M ONGOING FROM BASE REP</b>		<b>\$ 9,009,395</b>	<b>27,104</b>	<b>54,888</b>		
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(1) O&M budgets are no longer developed at this level of detail

(2) Data is embedded in another category as specified in O&M Briefing Sections.

# **O&M – BASE REP - 2016**

## **REDUCE SCHEDULED MAINTENANCE TRIM CYCLE (BASE REP):**

**Program Description:** Eversource is responsible for trimming approximately 11,000 miles of overhead distribution lines. Reduce the schedule maintenance trimming (SMT) cycle to a system average of less than 4.5 years.

**Maintenance Cycle:** For 2016, the trim cycle is 3.86 years – 2,540 miles of regular maintenance, 139 miles of ETT Maintenance (METT) and 171 miles of ETT.

**Results:** 1,340 miles were trimmed under this program in 2016

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$7,370,000	\$6,775,768	(\$594,232)

## **HOT SPOT TRIMMING (BASE REP)**

**Program Description:** Trim locations identified outside normal maintenance cycle that have been identified during reliability improvement inspections.

**Maintenance Cycle:** None.

**Results:** Hot spot trimming was performed on 7 miles.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$5,192	\$5,192

## **MID CYCLE TRIMMING (BASE REP):**

**Program Description:** Perform mid-cycle trimming in areas where vegetation problems develop between maintenance cycles.

**Maintenance Cycle:** Prior to 2010, the maintenance trimming program did not identify areas that could benefit from trimming between cycles. The Reliability Enhancement Program targeted a limited mid-cycle program of approximately 50 miles in 2010 and 100 miles annually thereafter. By reducing the maintenance trimming cycle to less than four years, mid-cycle trimming needs have been significantly reduced.

**Results:** With a trim cycle of under four years, no mid-cycle trimming was required.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$0	\$0

**INSPECT ALL CONTRACTOR WORK (BASE REP):**

**Program Description:** Inspect 100% scheduled maintenance trimming to ensure that the contractor is trimming to specification within the bounds of owner permissions.

**Inspection Cycle:** The quality assurance program currently targets inspections on approximately 80% of the circuit miles. The Reliability Enhancement Program will target inspecting 100% of the circuit miles trimmed annually. The cost of this program is included within the maintenance trimming budget

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$0	\$0

**REDUCE DISTRIBUTION RIGHTS-OF-WAY (ROW) MOWING CYCLE (BASE REP):**

**Program Description:** Reduce the average maintenance mowing cycle of 34.5 kV rights-of-way to an average of 4 years.

**Total Unit Population:** Eversource is responsible for mowing approximately 7,930 acres of 34.5 kV right-of-ways. Approximately 6,641 acres are in “distribution only” rights-of-way and approximately 1,289 acres in rights-of-way shared with transmission lines.

**Inspection Cycle:** ROW mowing averages 1,660 acres per year, which results in a four year cycle.

**Results:** In 2016, 1,357 acres were completed.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$500,000	\$400,551	(\$99,449)

**FULL CIRCUIT PATROL (BASE REP):**

**Program Description:** Establish a full circuit patrol cycle for distribution lines to inspect for adherence to the National Electrical Safety Code including primary distribution lines, secondaries and services. Identify and log all issues requiring maintenance, additions or replacement, including animal protection, within a reasonable time period. This provides proactive identification of potential problems related to safety, grounding, clearance, attachments, asset maintenance and replacement. Starting in 2017 NESC circuit patrols are performed by the contractors performing pole inspections.

**Total Unit Population:** Eversource is responsible for approximately 11,000 circuit miles of distribution lines.

**Maintenance Cycle:** A full circuit patrol of the 11,000 miles was completed in four years. Beyond the initial cycle, perform full circuit patrols on a cycle similar to scheduled maintenance trimming (SMT).

**Results:** Approximately 40 circuits totaling 557 circuit miles were patrolled in 2016. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$42,012	\$42,012

**INSPECT & REPAIR UNDERGROUND SYSTEMS (BASE REP):**

**Program Description:** Establish an inspection cycle for underground systems to identify and repair any issues and to install fault indicators.

**Total Unit Population:** Eversource is responsible for approximately 2,142 underground development system maps in addition to underground facilities providing service from the company's overhead system.

**Maintenance Cycle:** A complete cycle of the underground system maps was completed in 2014. Eversource Maintenance requirements were revised in 2013 incorporating a 10 year inspection cycle.

**Results:** Two hundred and thirty three (233) inspections and 22 repairs were completed in 2016. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$374,580	\$374,580

**INSPECT MANHOLES (BASE REP):**

**Program Description:** Establish a cycle program to inspect manholes. A rating is given to each manhole to indicate the structural condition. A program has been established to replace the structurally deficient manholes.

**Total Unit Population:** Eversource has approximately 634 manholes.

**Maintenance Cycle:** Inspect on a cycle not to exceed ten years per NU Maintenance Manual, except those requiring inspection more frequently. This program is now part of Inspect and Repair Underground Systems.

**POLE INSPECT AND TREAT (BASE REP):**

**Program Description:** Establish a long-term preventive maintenance cycle for roadside distribution poles to inspect, treat, reinforce or replace decayed or damaged poles to ensure reliable and safe use of this asset.

**Total Unit Population:** Eversource is responsible for approximately 240,000 poles to inspect and treat. Eversource performs pole inspect and treatment in Eversource set areas only.

**Maintenance Cycle:** 10 years at 24,000 poles annually to inspect and treat (240,000 divided by 10).

**Results:** In 2016, 51,758 poles were inspected with 1,487 found to be defective and requiring replacement (2.9 % defective rate). Due to the change in standard pole from a Class 4 to a Class 2, deficient poles are replaced rather than treated in an effort to harden the system. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$1,362,669	\$1,362,669

**OVERHEAD REPAIR ACTIVITY (BASE REP):**

**Program Description:** Complete O&M maintenance orders generated from National Electrical Safety Code (NESC) inspection including work associated with animal guards. This provides proactive identification of potential problems related to safety, grounding, clearance, attachments, asset maintenance and replacement. Items are prioritized from 1 (correct immediately) to 5 (low priority work to be scheduled in conjunction with other work).

**Total Unit Population:** Dependent on program inspection results.

**Maintenance Cycle:** Complete maintenance orders within a reasonable period of time from initial identification.

**Results:** Seven corrective items in the priority 1-3 category were completed in 2016. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$31,431	\$31,431

**FOOT PATROL RIGHT-OF-WAY (BASE REP):**

**Program Description:** Inspect from the ground the 862 miles of overhead line in ROW. Identify for correction all NESC code violations and reliability issues.

**Total Unit Population:** 862 miles (171 lines)

**Maintenance Cycle:** Starting in 2015, the Eversource Maintenance Manual recommends an annual helicopter patrol or foot patrol.

**Results:** All 862 miles were patrolled by helicopter in 2016 (171 lines). No distribution ROW lines were foot patrolled under this program. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$506	\$506

**OVERHEAD LINE SWITCH MAINTENANCE (BASE REP):**

**Program Description:** Establish program to maintain and exercise overhead switches to ensure reliable operation when needed. Bypass switching will be installed as needed to facilitate this program going forward.

**Total Unit Population:** Eversource has approximately 380 switches remaining on the distribution system included in this program. Switches are being replaced with reclosers as part of the Distribution Automation program, so the population of switches decreases every year.

**Maintenance Cycle:** Eversource Maintenance Manual specifies a six year maintenance cycle.

Results:

In 2016, 34 switches were maintained. Note that O&M budgets are no longer developed at this level of detail.

\$ Plan	\$ Actual	\$ Variance
N/A	\$11,849	\$11,849

**OVERHEAD RECLOSER MAINTENANCE (BASE REP):**

Program Description:

Reclosers are scheduled to be maintained on a time and fault operation based frequency or based on remaining contact life.

Total Unit Population:

Eversource has 1,652 reclosers installed.

Maintenance Cycle:

Starting in 2013, Eversource Maintenance Manual specifies 12 years for oil type reclosers and ≤ 5% contact life or duty cycle for reclosers with contacts under vacuum and modern electronic controls.

Results:

No reclosers were due for maintenance in 2016 so none were completed. Note that O&M budgets are no longer developed at this level of detail.

\$ Plan	\$ Actual	\$ Variance
N/A	\$0	\$0

**INSTALL FAULT INDICATORS (BASE REP):**

Program Description:

Install fault indicators on equipment and at locations which will facilitate identifying the locations of faults on the distribution system. Installation will reduce the outage duration.

Total Unit Population:

Underground - 1:1 ratio with single phase padmount transformers, overhead to be determined.

Maintenance Cycle:

Battery life is in excess of 20 years. Fault indicators will be replaced before the end of their useful lives. Underground fault indicator battery replacement will be performed during underground inspections, within an appropriate timeframe. Overhead fault indicator locations will be entered into CASCADE maintenance data base with an appropriate trigger for replacement.

Results:

Ninety three (93) fault indicators required replacement in 2016 and these were completed. Note that O&M budgets are no longer developed at this level of detail.

\$ Plan	\$ Actual	\$ Variance
N/A	\$4,837	\$4,837

**TEST & REPAIR DIRECT BURIED UNJACKETED CABLE - CONCENTRIC NEUTRALS (BASE REP):**

Program Description:

Testing of direct buried unjacketed cable concentric neutral to determine if there is a sufficient neutral path. If the neutral has degraded to an inadequate level, the cable will be replaced.

Total Unit Population:

Eversource has approximately 2,000,000 feet or 5,764 runs of direct buried cable.

Maintenance Cycle:

Once.

Results:

Testing of unjacketed cable has been incorporated into the REP 3 program. Cable with adequate neutral integrity is now considered as a candidate for rejuvenation. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$0	\$0

**Year End 2017 - Base REP**  
**Summary of Eversource Reliability Enhancement Program – O&M**



Jan 1 2017 - Dec 31 2017

**TRIMRC - VEGETATION MANAGEMENT (O&M)**

	Units	\$ Planned	\$ Expended	Units Planned	Units Completed	Cost Per Unit
Reduce Scheduled Maintenance Trim Cycle	Miles	\$6,422,000	\$6,581,533	1,288	1,320	\$4,986
Hot Spot Trimming	Locations	N/A	\$0	N/A	0	\$0
Mid Cycle Trimming	Miles	0	0	0	0	N/A
Inspect Contractor	Miles	N/A <sup>(2)</sup>	N/A <sup>(2)</sup>		N/A <sup>(2)</sup>	N/A
Distribution Rights-of-Way Maintenance Cycle	Acres	\$651,000	\$673,166	1,326	1,371	\$491
<b>Total TRIMRC</b>		<b>\$ 7,073,000</b>	<b>\$7,254,699</b>	<b>2,614</b>	<b>2,691</b>	

**NESCRC - National Electrical Safety Code (O&M)**

	Units	\$ Planned	\$ Expended	Units Planned	Units Completed	Cost Per Unit
Full Circuit Patrol	Miles	N/A <sup>(2)</sup>	\$0	0	36	\$0
Inspect and Repair Underground Systems	Maps	N/A <sup>(1)</sup>	\$217,794	326	310	\$703
Pole Inspection and Treatment	Poles	N/A <sup>(1)</sup>	\$520,590	24,000	32,916	\$16
Overhead Repair Activity	Repair Orders	N/A <sup>(1)</sup>	\$93,265	N/A	6	\$15,544
Foot Patrol ROW	Miles	N/A <sup>(1)</sup>	\$0	0	0.0	N/A
<b>Total NESCRC</b>		<b>N/A <sup>(1)</sup></b>	<b>\$831,649</b>	<b>24,326</b>	<b>33,268</b>	

**RELIOM - RELIABILITY (O&M)**

	Units	\$ Planned	\$ Expended	Units Planned	Units Completed	Cost Per Unit
Overhead Switch Maintenance	Switches	N/A <sup>(1)</sup>	\$48,997	73	73	\$671
Recloser Maintenance	Reclosers	N/A <sup>(1)</sup>	(\$8,832)	0	0	N/A
Fault Indicators	Units	N/A <sup>(1)</sup>	\$4,985	7	7	\$712
Test & Repair Direct Buried Unjacketed Cable	Runs	N/A <sup>(1)</sup>	\$0	0	0	N/A
<b>Total RELIOM</b>		<b>N/A <sup>(1)</sup></b>	<b>\$45,150</b>	<b>80</b>	<b>80</b>	

**TOTAL O&M ONGOING FROM BASE REP**

**\$ 8,131,498      27,020      36,039**

(1) O&M budgets are no longer developed at this level of detail

(2) Data is embedded in another category as specified in O&M Briefing Sections.

# O&M – BASE REP - 2017

## REDUCE SCHEDULED MAINTENANCE TRIM CYCLE (BASE REP):

**Program Description:** Eversource is responsible for trimming approximately 11,000 miles of overhead distribution lines. Reduce the schedule maintenance trimming (SMT) cycle to a system average of less than 4.5 years.

**Maintenance Cycle:** For 2017, the trim cycle is 3.88 years – 2,640 miles of regular maintenance, 60 miles of ETT Maintenance (METT) and 171 miles of ETT.

**Results:** 1,320 miles were trimmed under this program in 2017

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$6,422,000	\$6,581,533	\$159,533

## HOT SPOT TRIMMING (BASE REP)

**Program Description:** Trim locations identified outside normal maintenance cycle that have been identified during reliability improvement inspections.

**Maintenance Cycle:** None.

**Results:** No hot spot trimming was performed in 2017.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$0	\$0

## MID CYCLE TRIMMING (BASE REP):

**Program Description:** Perform mid-cycle trimming in areas where vegetation problems develop between maintenance cycles.

**Maintenance Cycle:** Prior to 2010, the maintenance trimming program did not identify areas that could benefit from trimming between cycles. The Reliability Enhancement Program targeted a limited mid-cycle program of approximately 50 miles in 2010 and 100 miles annually thereafter. By reducing the maintenance trimming cycle to less than four years, mid-cycle trimming needs have been significantly reduced.

**Results:** With a trim cycle of under four years, no mid-cycle trimming was required.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$0	\$0

**INSPECT ALL CONTRACTOR WORK (BASE REP):**

**Program Description:** Inspect 100% scheduled maintenance trimming to ensure that the contractor is trimming to specification within the bounds of owner permissions.

**Inspection Cycle:** The quality assurance program currently targets inspections on approximately 80% of the circuit miles. The Reliability Enhancement Program will target inspecting 100% of the circuit miles trimmed annually. The cost of this program is included within the maintenance trimming budget

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$0	\$0

**REDUCE DISTRIBUTION RIGHTS-OF-WAY (ROW) MOWING CYCLE (BASE REP):**

**Program Description:** Reduce the average maintenance mowing cycle of 34.5 kV rights-of-way to an average of 4 years.

**Total Unit Population:** Eversource is responsible for mowing approximately 7,930 acres of 34.5 kV right-of-ways. Approximately 6,641 acres are in "distribution only" rights-of-way and approximately 1,289 acres in rights-of-way shared with transmission lines.

**Inspection Cycle:** ROW mowing averages 1,660 acres per year, which results in a four year cycle.

**Results:** 1,371 acres were completed in 2017.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$600,000	\$673,166	\$73,166

**FULL CIRCUIT PATROL (BASE REP):**

**Program Description:** Establish a full circuit patrol cycle for distribution lines to inspect for adherence to the National Electrical Safety Code including primary distribution lines, secondaries and services. Identify and log all issues requiring maintenance, additions or replacement, including animal protection, within a reasonable time period. This provides proactive identification of potential problems related to safety, grounding, clearance, attachments, asset maintenance and replacement. Starting in 2017 NESC circuit patrols are performed by the contractors performing pole inspections.

**Total Unit Population:** Eversource is responsible for approximately 11,000 circuit miles of distribution lines.

**Maintenance Cycle:** A full circuit patrol of the 11,000 miles was completed in four years. Beyond the initial cycle, perform full circuit patrols on a cycle similar to scheduled maintenance trimming (SMT).

**Results:** Twenty circuits were patrolled in their entirety plus portions of sixteen more were patrolled in 2017. The cost of this program is now included in the Pole Inspection program.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$0	\$0

**INSPECT & REPAIR UNDERGROUND SYSTEMS (BASE REP):**

**Program Description:** Establish an inspection cycle for underground systems to identify and repair any issues and to install fault indicators.

**Total Unit Population:** Eversource is responsible for approximately 2,142 underground development system maps in addition to underground facilities providing service from the company's overhead system.

**Maintenance Cycle:** Ten year inspection cycle.

**Results:** Two hundred ninety inspections and 20 repairs were completed in 2017. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$217,794	\$217,794

**INSPECT MANHOLES (BASE REP):**

**Program Description:** Establish a cycle program to inspect manholes. A rating is given to each manhole to indicate the structural condition. A program has been established to replace the structurally deficient manholes.

**Total Unit Population:** Eversource has approximately 634 manholes.

**Maintenance Cycle:** Inspect on a cycle not to exceed ten years per NU Maintenance Manual, except those requiring inspection more frequently. This program is now part of Inspect and Repair Underground Systems.

**POLE INSPECT AND TREAT (BASE REP):**

**Program Description:** Establish a long-term preventive maintenance cycle for roadside distribution poles to inspect, treat, reinforce or replace decayed or damaged poles to ensure reliable and safe use of this asset.

**Total Unit Population:** Eversource is responsible for approximately 240,000 poles to inspect and treat. Eversource performs pole inspect and treatment in Eversource set areas only.

**Maintenance Cycle:** 10 years at 24,000 poles annually to inspect and treat (240,000 divided by 10).

**Results:** In 2017, 32,916 poles were inspected with 550 found to be defective and requiring replacement (1.7 % defective rate). Due to the change in standard pole from a Class 4 to a Class 2, deficient poles are replaced rather than treated in an effort to harden the system. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$520,590	\$520,590

**OVERHEAD REPAIR ACTIVITY (BASE REP):**

**Program Description:** Complete O&M maintenance orders generated from National Electrical Safety Code (NESC) inspection including work associated with animal guards. This provides proactive identification of potential problems related to safety, grounding, clearance, attachments, asset maintenance and replacement. Items are prioritized from 1 (correct immediately) to 5 (low priority work to be scheduled in conjunction with other work).

**Total Unit Population:** Dependent on program inspection results.

**Maintenance Cycle:** Complete maintenance orders within a reasonable period of time from initial identification.

**Results:** Six corrective items in the priority 1-3 category were completed in 2017. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$93,265	\$93,265

**FOOT PATROL RIGHT-OF-WAY (BASE REP):**

**Program Description:** Inspect from the ground the 862 miles of overhead line in ROW. Identify for correction all NESC code violations and reliability issues.

**Total Unit Population:** 862 miles (171 lines)

**Maintenance Cycle:** Starting in 2015, the Eversource Maintenance Manual recommends an annual helicopter patrol or foot patrol.

Results:

All 862 miles were patrolled by helicopter in 2017 (171 lines). No distribution ROW lines were foot patrolled under this program, therefore there are no costs under this item.

\$ Plan	\$ Actual	\$ Variance
N/A	\$0	\$0

**OVERHEAD LINE SWITCH MAINTENANCE (BASE REP):**

Program Description:

Establish program to maintain and exercise overhead switches to ensure reliable operation when needed. Bypass switching will be installed as needed to facilitate this program going forward.

Total Unit Population:

Eversource has approximately 380 switches remaining on the distribution system included in this program. Switches are being replaced with reclosers as part of the Distribution Automation program, so the population of switches decreases every year.

Maintenance Cycle:

Eversource Maintenance Manual specifies a six year maintenance cycle.

Results:

In 2017, 73 switches were maintained. Note that O&M budgets are no longer developed at this level of detail.

\$ Plan	\$ Actual	\$ Variance
N/A	\$48,997	\$48,997

**OVERHEAD RECLOSER MAINTENANCE (BASE REP):**

Program Description:

Reclosers are scheduled to be maintained on a time and fault operation based frequency or based on remaining contact life.

Total Unit Population:

Eversource has 1,652 reclosers installed.

Maintenance Cycle:

Starting in 2013, Eversource Maintenance Manual specifies 12 years for oil type reclosers and  $\leq$  5% contact life or duty cycle for reclosers with contacts under vacuum and modern electronic controls.

Results:

No reclosers were due for maintenance in 2017 so none were completed. Note that O&M budgets are no longer developed at this level of detail.

\$ Plan	\$ Actual	\$ Variance
N/A	\$0	\$0

**INSTALL FAULT INDICATORS (BASE REP):**

**Program Description:** Install fault indicators on equipment and at locations which will facilitate identifying the locations of faults on the distribution system. Installation will reduce the outage duration.

**Total Unit Population:** Underground - 1:1 ratio with single phase padmount transformers, overhead to be determined.

**Maintenance Cycle:** Battery life is in excess of 20 years. Fault indicators will be replaced before the end of their useful lives. Underground fault indicator battery replacement will be performed during underground inspections, within an appropriate timeframe. Overhead fault indicator locations will be entered into CASCADE maintenance data base with an appropriate trigger for replacement.

**Results:** Seven (7) fault indicators required replacement in 2017 and these were completed. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$4,985	\$4,985

**TEST & REPAIR DIRECT BURIED UNJACKETED CABLE - CONCENTRIC NEUTRALS (BASE REP):**

**Program Description:** Testing of direct buried unjacketed cable concentric neutral to determine if there is a sufficient neutral path. If the neutral has degraded to an inadequate level, the cable will be replaced.

**Total Unit Population:** Eversource has approximately 2,000,000 feet or 5,764 runs of direct buried cable.

**Maintenance Cycle:** Once.

**Results:** Testing of unjacketed cable has been incorporated into the REP 3 program. Cable with adequate neutral integrity is now considered as a candidate for rejuvenation. Note that O&M budgets are no longer developed at this level of detail.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
N/A	\$0	\$0

## Section 3

### Base REP Capital Summary

January 1, 2016 – December 31, 2016

January 1, 2017 – December 31, 2017

**Year End 2016 - Base REP**  
**Summary of Eversource Reliability Enhancement Program – CAPITAL**



Jan 1 2016 - Dec 30 2016

<b>CAPITAL - DUE TO BASE REP</b>			
	<b>\$ PLAN</b>	<b>\$ ACTUAL</b>	<b>\$ VARIANCE</b>
Reject Pole Replacement	\$0	(\$30,300)	(\$30,300)
Pole Reinforcement	\$0	\$0	\$0
NESC Capital Work	\$0	\$282,300	\$282,300
Airbreak Switch Replacement	\$0	\$0	\$0
Direct Buried Cable Replacement	\$0	\$2,552,600	\$2,552,600
Direct Buried Cable Injection	\$0	\$78,700	\$78,700
<b>TOTAL BASE REP CAPITAL</b>	<b>\$0</b>	<b>\$2,883,300</b>	<b>\$2,883,300</b>

# **CAPITAL - BASE REP - 2016**

## **REJECT POLE REPLACEMENT (BASE REP):**

**Program Description:** The preventive maintenance cycle for distribution poles to inspect, treat, reinforce or replace decayed or damaged poles to ensure reliable and safe use of this asset will generate approximately 2% of the poles inspected for replacement.

Eversource maintains 240,000 poles on its system. These are inspected every 10 years or an average of 24,000 poles per year

**Total Unit Population:** Dependent upon inspection results, estimate 480 poles to replace each year.

**Results:** Pole inspections are an O&M item (see section 2 of this report). Pole replacement work was completed under REP3 (see section 5). Small credit in 2016 was due to an accounting adjustment to prior years' charges.

## **POLE REINFORCEMENT (BASE REP):**

**Program Description:** Inspection of poles generates approximately 0.6% of poles that require being made safe or replaced within five working days, approximately 0.8% of poles must be replaced within one year and approximately 0.5% are eligible for reinforcement. Each of the poles eligible for reinforcement are reviewed in the field to determine if they will be reinforced.

**Total Unit Population:** Dependent upon inspection results.

**Results:** Due to the change in standard pole from a Class 4 to a Class 2 in order to improve system hardness, the decision was made to replace rather than reinforce the smaller poles. Therefore, no poles were reinforced in 2016.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$0	\$0

## **NATIONAL ELECTRICAL SAFETY CODE (NESC) GENERATED CAPITAL WORK (BASE REP):**

**Program Description:** Replace distribution plant units with deficiencies identified during NESC inspections which are required to conform to the National Electrical Safety Code (NESC).

Correct NESC violations by installing plant units. Most often, the installation of poles and conductors are required to meet clearance problems to buildings, communications conductors, or over streets and roadways.

**Total Unit Population:** The backlog of NESC capital maintenance orders is 371. Additional units are identified during the Overhead Plant inspections.

**Results:** The most common requirement is to replace poles to gain additional height to meet clearance to communications conductors or clearance to buildings or structures.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$282,300	\$282,300

**AIRBREAK SWITCH REPLACEMENT (BASE REP):**

**Program Description:** Air break switches are being replaced with Distribution Automation devices. Of the 725 airbreak switches on the system at the beginning of the REP program, only 164 remain on distribution lines. This project accounts for the replacement of distribution line switches that are not suitable to be maintained.

**Total Unit Population:** 164

**Maintenance Cycle:** Airbreak Switches are maintained on a six year cycle with inspection every year.

**Results:** No switches were replaced under this program in 2016.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$0	\$0

**DIRECT BURIED CABLE REPLACEMENT (BASE REP):**

**Program Description:** Replace direct buried cable with cable in conduit.

2,000,000 feet of direct buried cable was installed at Eversource until 1985 with earliest vintages from 1970. Cable insulation is subject to age failure and bare concentric neutral conductors are subject to corrosion. Testing has indicated that in many locations the concentric neutral is no longer sufficient to provide a path to ground for the electric system. This project is to replace unjacketed direct buried cable in specific developments which have experienced a high failure rate or where cable has been rejected as a candidate for cable injection. Live front transformers and/or pre-1987 elbows are replaced along with the cable.

**Total Unit Population:** 2,000,000 feet

**Results:** An estimated 52,803 feet of direct buried cable was replaced with new cable in conduit as part of this project in 2016.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$2,552,600	\$2,552,600

**DIRECT BURIED CABLE INJECTION (BASE REP):**

**Program Description:** 2,000,000 feet of direct buried cable was installed at Eversource until 1985 with earliest vintages from 1970. The cable insulation is subject to age failure and the bare concentric neutral is subject to corrosion. This project is to inject unjacketed direct buried cable if it has shown by test that the concentric neutral has the majority of its integrity remaining.

**Total Unit Population:** 2,000,000 feet of direct buried cable. The actual amount eligible for injection is determined after concentric neutral testing.

**Results:** Approximately 9,047 feet of cable was injected in 2016. The cost was \$8.69 per foot, compared to \$48.34 per foot for cable replacement in conduit.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$78,700	\$78,700

**Year End 2017 - Base REP**  
**Summary of Eversource Reliability Enhancement Program – CAPITAL**



Jan 1 2017 - Dec 30 2017

<b>CAPITAL - DUE TO BASE REP</b>			
	<b>\$ PLAN</b>	<b>\$ ACTUAL</b>	<b>\$ VARIANCE</b>
Reject Pole Replacement	\$0	\$1,402,300	\$1,402,300
Pole Reinforcement	\$0	\$0	\$0
NESC Capital Work	\$0	\$55,300	\$55,300
Airbreak Switch Replacement	\$0	\$0	\$0
Direct Buried Cable Replacement	\$0	\$1,495,300	\$1,495,300
Direct Buried Cable Injection	\$0	\$13,700	\$13,700
<b>TOTAL BASE REP CAPITAL</b>	<b>\$0</b>	<b>\$2,966,600</b>	<b>\$2,966,600</b>

# **CAPITAL - BASE REP - 2017**

## **REJECT POLE REPLACEMENT (BASE REP):**

**Program Description:** The preventive maintenance cycle for distribution poles to inspect, treat, reinforce or replace decayed or damaged poles to ensure reliable and safe use of this asset will generate approximately 2% of the poles inspected for replacement.

Eversource maintains 240,000 poles on its system. These are inspected every 10 years or an average of 24,000 poles per year

**Total Unit Population:** Dependent upon inspection results, estimate 480 poles to replace each year.

**Results:** Pole inspections are an O&M item (see section 2 of this report). 230 Poles were replaced under this item in 2017, with additional poles replaced under REP3 (see section 5). Average cost per pole was \$6,097.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$1,402,300	\$1,402,300

## **POLE REINFORCEMENT (BASE REP):**

**Program Description:** Eversource's standard pole was changed from a Class 4 to a Class 2 to improve system hardness so smaller poles are replaced rather than reinforced.

**Total Unit Population:** Dependent upon inspection results.

**Results:** Due to the change in standard pole from a Class 4 to a Class 2 to improve system hardness, the decision was made to replace rather than reinforce the smaller poles. Therefore, no poles were reinforced in 2017.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$0	\$0

## **NATIONAL ELECTRICAL SAFETY CODE (NESC) GENERATED CAPITAL WORK (BASE REP):**

**Program Description:** Replace distribution plant units with deficiencies identified during NESC inspections which are required to conform to the National Electrical Safety Code (NESC).

Correct NESC violations by installing plant units. Most often, the installation of poles and conductors are required to meet clearance problems to buildings, communications conductors, or over streets and roadways.

**Total Unit Population:** The backlog of NESC capital maintenance orders is 1,403. Additional units are identified during the Overhead Plant inspections.

**Results:** The most common requirement is to replace poles to gain additional height to meet clearance to communications conductors or clearance to buildings or structures or to replace tree guys with guy-to-anchor. In 2017, 13 repair work orders were placed in service.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$55,300	\$55,300

**AIRBREAK SWITCH REPLACEMENT (BASE REP):**

**Program Description:** Air break switches are being replaced with Distribution Automation devices. Of the 725 airbreak switches on the system at the beginning of the REP program, only 52 remain on distribution lines. They are of various manufacturers, models, type, and vintage. This project accounts for the replacement of distribution line switches that are not suitable to be maintained, but remain in service.

**Total Unit Population:** 52

**Maintenance Cycle:** Airbreak Switches are maintained on a six year cycle with inspection every year.

**Results:** No switches were replaced under this program in 2017.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$0	\$0

**DIRECT BURIED CABLE REPLACEMENT (BASE REP):**

**Program Description:** Replace direct buried cable with cable in conduit. 2,000,000 feet of direct buried cable was installed at Eversource until 1985 with earliest vintages from 1970. Cable insulation is subject to age failure and bare concentric neutral conductors are subject to corrosion. Testing has indicated that in many locations the concentric neutral is no longer sufficient to provide a path to ground for the electric system. This project is to replace unjacketed direct buried cable in specific developments which have experienced a high failure rate or where cable has been rejected as a candidate for cable injection. Live front transformers and/or pre-1987 elbows are replaced along with the cable.

**Total Unit Population:** 2,000,000 feet

**Results:** Approximately 19,117 feet of direct buried cable was replaced with new cable in conduit as part of this project in 2017.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$1,495,300	\$1,495,300

**DIRECT BURIED CABLE INJECTION (BASE REP):**

**Program Description:** This project is to inject unjacketed direct buried cable if it has shown by test that the concentric neutral has the majority of its integrity remaining.

**Total Unit Population:** 2,000,000 feet of direct buried cable. The actual amount eligible for injection is determined after concentric neutral testing.

**Maintenance Cycle:** None.

**Results:** Approximately 5,485 feet of cable was injected in 2017. The cost was \$2.50 per foot, compared to \$78.22 per foot for cable replacement in conduit.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$0	\$13,700	\$13,700

# Section 4

## REP 3 Program Year 2

July 1 2016 – June 30 2017

### O&M Summary

**Program Year 2 - REP 3**  
**Summary of Eversource Reliability Enhancement Program – O&M**

**EVERSOURCE** July 1 2016 - Jun 30 2017

<b>REP 3 O&amp;M</b>			
	<b>\$ Planned</b>	<b>\$ Expended</b>	<b>Variance</b>
O&M Portion of Capital	\$2,400,000	\$2,756,278	\$356,278
Troubleshooter Organization	\$2,400,000	\$2,150,590	(\$249,410)
Maintenance of DA and Rights-Of-Way	\$120,000	\$151	(\$119,849)
<b>TOTAL O&amp;M REP 3</b>	<b>\$ 4,920,000</b>	<b>\$ 4,907,019</b>	<b>\$ (12,981)</b>

## **O&M – REP 3**

### **O&M PORTION OF CAPITAL:**

**Program Description:** This represents the O&M portion (allocation) from Capital work related to the Reliability Enhancement Program.

**Results:** The O&M portion of REP 3 capital projects averaged 4.88% over the program year.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$2,400,000	\$2,756,278	\$356,278

### **TROUBLESHOOTER ORGANIZATION:**

**Program Description:** The Troubleshooter Organization consists of two supervisors and 18 Troubleshooter positions, broken up into three six person teams working twelve hour shifts providing coverage 24 hours a day, 365 days a year to the primary coverage area. The primary coverage area consists of the Bedford, Derry, Hooksett, Milford, and Nashua Area Work Centers (AWCs). This coverage area includes 235,704 customers across 1,052 square miles. When available, the Troubleshooters also provide coverage to a secondary coverage area consisting of the Epping, Keene, Newport, Portsmouth, Rochester and Tilton AWCs. This secondary coverage area includes 229,341 customers across 2,642 square miles.

**Results:** Eversource has utilized this organization to provide improved response times to emergency situations for both customers and municipal partners.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$2,400,000	\$2,150,590	(\$249,410)

### **MAINTENANCE OF DISTRIBUTION AUTOMATION (DA) AND RIGHT OF WAY (ROW):**

**Program Description:** This program consists of performing maintenance of distribution lines in ROW to address items such as damaged insulators and heating connectors or splices and maintenance of equipment associated with the significant increase in deployment of distribution automation

**Results:** No incremental work was performed under this category in program year 2.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$120,000	\$151	(\$119,849)

# Section 5

## REP 3

July 1 2016 – June 30 2017

## Capital Summary

**Program Year 2 - REP 3**  
**Summary of Eversource Reliability Enhancement Program – CAPITAL**



July 1 2016 - June 30 2017

<b>CAPITAL - REP 3</b>					
	<b>PLANT IN SERVICE PLAN</b>	<b>PLANT IN SERVICE ACTUAL</b>	<b>ADDITIONAL PLANT IN SERVICE July, August 2017</b>	<b>TOTAL PLANT IN SERVICE</b>	<b>\$ VARIANCE (Note 2)</b>
Distribution Automation/SCADA	\$18,946,000	\$17,727,504	\$2,591,742	\$20,319,246	\$1,373,246
Pole top Distribution Automation devices		\$13,468,192	\$2,444,479	\$15,912,671	
Substation Automation		\$1,574,513	\$55,757	\$1,630,270	
Line Sensor Project		\$278,088	\$68,124	\$346,212	
Telecom Expansion to Support Automation		\$2,406,711	\$23,382	\$2,430,093	
Field Connectivity Survey	\$4,263,000	\$4,846,139	(\$64,021)	\$4,782,118	\$519,118
Direct Buried Cable Replacement/Rejuvenation	\$569,000	\$3,409,382	\$359,579	\$3,768,961	\$3,199,961
Direct Buried Cable Replacement		\$2,015,124	\$283,749	\$2,298,873	
Direct Buried Cable Rejuvenation		\$1,394,258	\$75,830	\$1,470,088	
Overhead System Reliability	\$20,657,000	\$13,777,516	\$5,205,723	\$18,983,239	(\$1,673,761)
Circuit Tie Construction		\$3,071,665	\$1,990,762	\$5,062,427	
Worst Performing Circuits Reliability Impr.		\$2,544,517	\$111,622	\$2,656,139	
Reject Pole Replacement		\$2,974,078	\$2,607,524	\$5,581,602	
ROW System Hardening		\$3,386,552	\$208,402	\$3,594,954	
NESC Capital Repairs		\$442,085	\$48,188	\$490,273	
Heatherlite Replacement		\$325,238	\$148,264	\$473,502	
Distribution Line Porcelain Replacement		\$1,033,381	\$90,961	\$1,124,342	
Substation Aging Infrastructure	\$2,959,000	\$5,243,210	\$8,844	\$5,252,054	\$2,293,054
Oil Circuit Breaker Replacement		\$1,032,075	\$0	\$1,032,075	
Substation Relay Upgrades		\$1,854,944	\$0	\$1,854,944	
Eliminate 4 and 12 kV substations		\$2,356,191	\$8,844	\$2,365,035	
Vegetation Management	\$3,765,000	\$3,393,023	\$0	\$3,393,023	(\$371,977)
Enhanced Tree Trimming		\$3,570,119	\$0	\$3,570,119	
Hazard Tree Removal		(\$680,202)	\$0	(\$680,202)	(see note 1)
Reclaim ROWs to Full Width		\$503,106	\$0	\$503,106	
	<b>\$51,159,000</b>	<b>\$48,396,776</b>	<b>\$8,101,867</b>	<b>\$56,498,641</b>	<b>\$5,339,641</b>

(1) Actual expenditures for Hazard Tree Removal were \$503,446. Reimbursements from Fairpoint credited to this resulted in a net credit.

(2) Significant driver of variance in REP 3 Year 2 due to lower capital placed in service than planned in REP 3 Year 1.



## REP 3 Year Two Plant In Service

July 1 2016 - August 30 2017

	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Total
<b>Distribution Automation</b>															
Central Region Pole Top DA Devices	\$ 448,879	\$ 304,364	\$ 654,203	\$ 159,894	\$ (5,303)	\$ (126,955)	\$ 21,932	\$ 42,650	\$ 633,428	\$ 99,896	\$ 293,414	\$ 993,129	\$ 569,533	\$ 180,677	\$ 4,269,739
Eastern Region Pole Top DA Devices	\$ 205,086	\$ 434,350	\$ 395,734	\$ 188,944	\$ 7,474	\$ (128,715)	\$ 27,916	\$ 126,692	\$ 44,394	\$ 264,587	\$ 172,524	\$ 890,650	\$ 276,339	\$ 121,586	\$ 3,027,561
Northern Region Pole Top DA Devices	\$ 225,122	\$ 108,971	\$ 225,961	\$ (15,845)	\$ 265	\$ 91	\$ (7,138)	\$ (191)	\$ 24,590	\$ 596,749	\$ 10,198	\$ 435,872	\$ 252,185	\$ 495,366	\$ 2,352,198
Southern Region Pole Top DA Devices	\$ 1,021,128	\$ 524,132	\$ 37,743	\$ 89,453	\$ 290,523	\$ 183,558	\$ 236,921	\$ (3,126)	\$ 479,395	\$ 92,299	\$ 318,533	\$ 603,325	\$ 284,687	\$ 228,913	\$ 4,387,482
Western Region Pole Top DA Devices	\$ 106,856	\$ 121,389	\$ (3,673)	\$ 126,007	\$ 3,435	\$ 70,959	\$ 34,173	\$ 172,442	\$ 517,199	\$ 138,318	\$ 250,314	\$ 303,079	\$ 14,204	\$ 20,989	\$ 1,875,691
Substation Automation	\$ 4,696	\$ 1,350	\$ 257	\$ 4,098	\$ 691,791	\$ 1,992	\$ 13,625	\$ 1,951	\$ 69,752	\$ 467,781	\$ 137,746	\$ 179,473	\$ 57,069	\$ (1,312)	\$ 1,630,270
Line Sensor Project	\$ -	\$ 23,257	\$ 285,806	\$ (31,614)	\$ 697	\$ (131)	\$ 66	\$ -	\$ 7	\$ -	\$ -	\$ -	\$ 67,940	\$ 185	\$ 346,213
Telecom Expansion to Support Automation	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 831,657	\$ 562,183	\$ 392,813	\$ 327,445	\$ 292,614	\$ 17,297	\$ 6,084	\$ 2,430,093
<b>Field Connectivity Survey</b>															
	\$ 683,449	\$ 872,757	\$ 425,984	\$ 1,048,388	\$ (218,202)	\$ 1,117,841	\$ 211,178	\$ 257,345	\$ 882,854	\$ (432,606)	\$ (53,850)	\$ 51,000	\$ 49,931	\$ (113,953)	\$ 4,782,118
<b>Direct Buried Cable Replacement / Rejuvenation</b>															
Direct Buried Cable Replacement	\$ 521,666	\$ 312,790	\$ 207,850	\$ 248,635	\$ 15,274	\$ (789)	\$ 410,418	\$ 39,933	\$ 21,161	\$ 172,512	\$ (57,933)	\$ 123,606	\$ 42,397	\$ 241,352	\$ 2,298,873
Direct Buried Cable Rejuvenation	\$ 349,246	\$ 248,614	\$ 345,517	\$ 13,964	\$ 70,679	\$ (3,682)	\$ 137	\$ 830	\$ -	\$ 423	\$ (3,036)	\$ 371,565	\$ 102,257	\$ (26,427)	\$ 1,470,088
<b>OH System Reliability</b>															
Circuit Tie Construction	\$ 568,906	\$ 144,173	\$ 276,138	\$ 161,940	\$ 399,124	\$ 548,372	\$ 33,131	\$ 37,948	\$ (3,660)	\$ 115,835	\$ 244,147	\$ 545,612	\$ 2,278,337	\$ (287,575)	\$ 5,062,427
Worst Performing Circuits Reliability Improvements	\$ 82,715	\$ 50,776	\$ 4,297	\$ 58,030	\$ 27,658	\$ 2,591	\$ 82,500	\$ 749,118	\$ 118,783	\$ 77,798	\$ 139,570	\$ 1,150,681	\$ 111,381	\$ 241	\$ 2,656,139
Reject Pole Replacement	\$ 121,312	\$ 226,113	\$ 101,384	\$ 87,561	\$ 216,517	\$ 9,971	\$ 101,736	\$ 267,635	\$ 270,852	\$ 350,608	\$ 81,036	\$ 1,139,352	\$ 923,574	\$ 1,683,950	\$ 5,581,602
ROW System Hardening	\$ 608,501	\$ 27,830	\$ 53,227	\$ 41,579	\$ 11,460	\$ (1,279)	\$ 115,603	\$ 1,677	\$ 65,100	\$ 423	\$ 1,619,420	\$ 843,012	\$ 5,188	\$ 203,214	\$ 3,594,954
NESC Capital Repairs	\$ 69,041	\$ 166,482	\$ 98,145	\$ 21,601	\$ (10,270)	\$ 1,492	\$ 10,731	\$ (1,774)	\$ 5,112	\$ 39,219	\$ (1,561)	\$ 43,865	\$ 26,004	\$ 22,185	\$ 490,273
Heatherlite Replacement	\$ 54,948	\$ 62,707	\$ 87	\$ (149)	\$ 3,632	\$ (13,137)	\$ 47,251	\$ 4,337	\$ 24,682	\$ 5,195	\$ 79,107	\$ 56,579	\$ 45,022	\$ 103,242	\$ 473,502
Distribution Line Porcelain Replacement	\$ 4,127	\$ 11,444	\$ 51,209	\$ (4,811)	\$ (10,182)	\$ (525)	\$ 15,026	\$ 84,883	\$ 8,030	\$ 182	\$ 32,926	\$ 841,073	\$ 75,848	\$ 15,114	\$ 1,124,343
<b>Substation Aging Infrastructure</b>															
Oil Circuit Breaker Replacement	\$ 996,725	\$ 12,952	\$ 1,557	\$ 15,101	\$ 213	\$ 3,000	\$ 970	\$ 519	\$ -	\$ 266	\$ 953	\$ (180)	\$ -	\$ -	\$ 1,032,075
Substation Relay Replacements	\$ 1,054,239	\$ 3,786	\$ 11,059	\$ 614,490	\$ (89,590)	\$ 260,030	\$ 857	\$ (112)	\$ 185	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,854,944
Eliminate 4 & 12 kV Substations	\$ 251,794	\$ 257,307	\$ 69,783	\$ 482,964	\$ 4,275	\$ 231,375	\$ (3,882)	\$ 129,500	\$ 78,898	\$ 10,272	\$ 277,409	\$ 566,494	\$ 7,668	\$ 1,176	\$ 2,365,035
<b>Vegetation Management</b>															
Enhanced Tree Trimming	\$ 1,303,954	\$ 1,041,103	\$ 601,783	\$ 734,313	\$ (349,556)	\$ 649,634	\$ 942,328	\$ 336,896	\$ 978,076	\$ (2,668,410)	\$ -	\$ -	\$ -	\$ -	\$ 3,570,119
Hazard Tree Removal	\$ (280,603)	\$ 318,735	\$ (301,028)	\$ -	\$ (387,068)	\$ -	\$ 1,129	\$ (32,229)	\$ 862	\$ -	\$ -	\$ -	\$ -	\$ -	\$ (680,202)
Reclaim ROWs to Full Width	\$ 27,476	\$ 57,849	\$ 42,097	\$ -	\$ 311,897	\$ 30,537	\$ -	\$ 20,883	\$ 9,479	\$ 2,888	\$ -	\$ -	\$ -	\$ -	\$ 503,106
<b>Grand Total</b>	<b>\$ 8,429,262</b>	<b>\$ 5,333,232</b>	<b>\$ 3,585,119</b>	<b>\$ 4,044,545</b>	<b>\$ 984,742</b>	<b>\$ 2,836,234</b>	<b>\$ 2,296,609</b>	<b>\$ 3,069,463</b>	<b>\$ 4,791,361</b>	<b>\$ (272,953)</b>	<b>\$ 3,868,363</b>	<b>\$ 9,430,799</b>	<b>\$ 5,206,860</b>	<b>\$ 2,895,007</b>	<b>\$ 56,498,643</b>

# **CAPITAL – REP 3**

## **DISTRIBUTION AUTOMATION/SCADA**

**Program Description:** This program consists of Pole Top Distribution Automation Devices, Substation Automation, Line Sensor Project, and Telecom Expansion to Support Automation.

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$18,946,000	\$20,319,246	\$1,373,246

### **Pole Top Distribution Automation Devices:**

**Program Description:** Install Pole-Top Devices with SCADA control.

**Total Unit Population:** Install devices to allow sectionalizing of customers into blocks of 500 or fewer.

**Reliability Benefit:** Remote control of sectionalizing devices allows operators in the company's dispatch centers to respond to troubles by sectionalizing down to the fewest number of customers impacted. This decreases the duration of outages experienced by customers by restoring power where possible and minimizing the area which responding crews have to patrol.

**Results:** A total of 261 units were placed in service during the program year. A list of locations and the associated costs are included in section 9.

### **Substation Automation:**

**Program Description:** Expand SCADA control to 4 and 12 kV substations.

**Total Unit Population:** 162 substations

**Reliability Benefit:** Remote indication and control of substation circuit breakers allows quicker response to outages by providing operators with indication when the devices operate. Operators are then able to remotely operate the circuit breakers to assist crews working in the field

**Results:** SCADA control was added to a total of 12 substations during the program year. A list of locations and the associated costs are included in section 9. The cost at the most expensive location, Opechee Bay Substation in Laconia, was primarily driven by a lack of manufacturer drawings which required hand tracing the wiring. In the process of performing this work it was discovered that the insulation on the wiring was saturated with PCBs which required significant safety precautions and the job was stopped and restarted several times while safety analysis was performed to ensure the physical wellbeing of Company employees.

**Line Sensor Project:**

Program Description:	The Line Sensor program is a pilot program using the Tollgrade sensor. Sensors will be installed on distribution substation getway conductors and on large step down transformer locations and report back to a central database using cellular communications.
Total Unit Population:	N/A
Reliability Benefit:	These sensors will provide circuit loading and fault indication in locations without automated devices at a lower cost than adding DA.
Results:	171 units were placed in service during the program year. A list of locations and the associated costs are included in section 9. Costs per location were reasonably consistent at slightly less than \$2,000 per sensor.

**Telecom Expansion to Support Automation:**

Program Description:	Expand Eversource's private radio network to support pole top DA equipment.
Total Unit Population:	Install new base station radios.
Reliability Benefit:	Expansion of Eversource's radio network is required in order to allow the remote control of distribution automation devices in areas not currently covered.
Results:	<p>29 new DSCADA base stations were placed in service and battery backups were added at three existing base station locations during the program year. Cost per location varied widely based on the amount of work required at the site. A list of sites and the cost for each is included in section 9. Cost drivers for the six most expensive sites are as follows:</p> <ul style="list-style-type: none"><li>• Cates Hill work included a refurbished used precast concrete telecommunications shelter that was transported to Cates Hill, new electrical and telco underground services, relocation of the existing generator and propane tank, demolition of the old wooden shack, clearing and grading of the site, and graveling the access road to facilitate safe access for the shelter delivery and crane.</li><li>• Legends Drive required the purchase and installation of a new 100' self-supporting telecommunications tower, outdoor cabinet, new electrical and fiber services, interface to our existing fiber network at Pine Hill Substation, and substantial contracted engineering services.</li><li>• Gunn Mt included a refurbished used precast concrete telecommunications shelter that was transported to Gunn Mt, new electrical and telco underground services, refurbishment and installation of an existing generator, and new propane tank. Minor grading of the access road was completed to facilitate safe access for shelter delivery and a crane.</li><li>• The Rivier site was not sufficiently sized to accommodate the shelter and generator required so significant site work was necessary to expand the compound and fencing. Improvements also included a</li></ul>

refurbished used precast concrete telecommunications shelter that was transported to Nashua, new electrical and telco underground services, purchase and installation of a new generator and propane tank, relocation of a DC battery plant from Candia to Nashua, new RF filter system, and removal of the former equipment cabinet and utilities.

- Goodwin Hill work included a new precast concrete telecommunications shelter that was hauled to the site, DC battery plant, generator, propane tank, and new electrical and telco underground services.
- The 2-mile access road to Green Mt was unsafe for normal vehicular traffic, and would not permit the transport of a shelter and generator to the site so substantial contracted road work was required prior to other needed improvements. A refurbished used precast concrete telecommunications shelter was transported to Green Mt, new electrical and telco underground services installed, the purchase and installation of a new generator and liquid propane fuel system, and an existing concrete block shelter was demolished.

**FIELD CONNECTIVITY STUDY:**

**Program Description:** Accurately map each customer to the correct transformer, phase, and protective device in GIS which will enhance the accuracy and effectiveness of the OMS implementation and outage reporting to our customers.

**Reliability Benefit:** The increased accuracy following the Field Connectivity Survey significantly improves identification of fault locations and priorities for outage response, resulting in shorter outage durations and will provide better data to support post storm analysis and reporting.

**Results:** The Field Connectivity study was completed in March of 2017 and placed in service. A separate report was filed with the Commission detailing the project and results.

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$4,263,000	\$4,782,118	\$519,118

**DIRECT BURIED CABLE REPLACEMENT AND REJUVENATION:**

**Program Description:** This program consists of injecting aged but serviceable cable to extend its life and replacing cable which has reached the end of its useful life.

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$569,000	\$3,768,961	\$3,199,961

**Direct Buried Cable Replacement:**

**Program Description:** Replacement of direct buried (DB) unjacketed cable which has reached the end of its useful life. The DB cable is replaced with new jacketed cable in conduit to extend the life of the cable and shorten repair times should cable failure occur.

**Total Unit Population:** Eversource has approximately 2,000,000 feet of direct buried cable.

**Reliability Benefit:** Reduce the number of outages which customers served from the DB cable experience.

**Results:** Approximately 44,540 feet of DB cable was replaced during the program year. A list of locations and the associated costs are included in section 9. Costs for the projects varied from approximately \$50 per foot to \$150 per foot, with the exception of Longwoods Mobile Home Park in Deering where the underground line was replaced with an equivalent overhead line for approximately \$13 per foot. Most municipalities do not allow new overhead lines in residential developments so this location was an exception.

**Direct Buried Cable Rejuvenation:**

**Program Description:** DB cable which maintains the integrity of the concentric neutral is injected to extend the useful life of the cable. This is a cost effective alternative to replacing the cable when conditions allow.

**Total Unit Population:** Eversource has approximately 2,000,000 feet of direct buried cable. Not all cable is suitable for injection.

**Reliability Benefit:** Reduce the number of outages which customers served from the DB cable experience.

**Results:** Approximately 125,700 feet of DB cable was injected during the program year. A list of locations and the associated costs are included in section 9. The actual injection work is performed at a fixed price per foot of cable. Additional costs are incurred if underground splices must be replaced to allow the fluid to pass or if the development has live front transformers which are changed to dead front to allow injection and as a system betterment initiative, since live front transformers have not been purchased by the company in nearly 40 years so these units are generally deteriorating due to exposure to the elements.

**OVERHEAD SYSTEM RELIABILITY:**

**Program Description:** This program consists of Circuit Tie Construction, Worst Performing Circuits Reliability Improvements, Reject Pole Replacements, ROW System Hardening, NESC Capital Repairs, Heatherlite Replacement, and Distribution Line Porcelain Replacement.

Plant in service:

\$ Plan	\$ Actual	\$ Variance
\$20,657,000	\$18,983,239	(\$1,673,761)

**Circuit Tie Construction:**

**Program Description:** Construct circuit ties for large radial circuits which would allow a backup source of power with Distribution Automation.

**Reliability Benefit:** Constructing circuit ties and installing associated distribution automation devices allows for restoration of service to the majority of the customers fed from these circuits while repairs are made to the cause of the outage.

**Results:** Nine projects impacting 17,887 customers were completed. A list of locations and the associated costs are included in section 9.

**Worst Performing Circuits Reliability Improvements:**

**Program Description:** This project provides funding for a variety of activities relating to reliability of electric service. This includes unfused lateral protection, recloser upgrades and installs, line construction to provide added phases or alternate feeds, switch and manual disconnect installations, and other specific capital work to improve circuit and area reliability.

**Maintenance Cycle:** None.

**Reliability Benefit:** All projects are intended to reduce the number of outages, reduce the number of customers affected by an outage, or reduce the time required to restore power after an outage.

**Results:** 10 Reliability projects were completed on hit list (top 50) circuits. An additional 28 projects were completed on other circuits to address reliability issues. A list of locations and the associated costs are included in section 9.

**Reject Pole Replacements:**

**Program Description:** This project provides funding for the replacement of decayed or damaged poles identified through the annual pole inspection and treatment program.

**Total Unit Population:** 240,000 poles

**Maintenance Cycle:** None.

**Reliability Benefit:** Reliable performance and safety of poles in high winds, heavy wet snow, pole accidents, or other events which cause undue stress in addition to normal service of this asset.

**Results:** During the program year from July 1 2016 through June 30 2017, 82,880 poles were inspected and 1,612 were found to be defective and required replacement (1.9% defective rate). A total of 817 poles were replaced.

**ROW System Hardening:**

**Program Description:** This project provides funding for rebuilding portions of lines in ROW to improve operational performance. Typical work involves replacing poles and crossarms, additional guying and replacing insulators.

**Reliability Benefit:** Strengthening ROW lines reduces the frequency of outages on these lines which are often in locations which are difficult to reach without

specialized equipment and construction methods such as portable matting for crossing wetlands.

**Results:** Projects were completed on the ROW portions of seven lines. A list of locations and the associated costs are included in section 9.

**NESC Capital Repairs:**

**Program Description:** Replace distribution plant units with deficiencies identified during NESC inspections which are required to conform to the National Electrical Safety Code (NESC)

**Maintenance Cycle:** 10 year inspection cycle

**Reliability Benefit:** This work is required to conform to NESC requirements.

**Results:** The most common requirement is to replace poles to gain additional height to meet clearance to communication conductors or clearance to buildings or structures. 108 locations were addressed during the program year.

**Heatherlite Replacement:**

**Program Description:** This targeted capital project, addressing safety and reliability, is a proactive program aimed at eliminating fiberglass "Heatherlite" brackets and installing crossarms.

**Maintenance Cycle:** None

**Reliability Benefit:** Reduced failure of this product.

**Results:** Heatherlite brackets were replaced with crossarms on approximately 176 structures. A list of locations and the associated costs are included in section 9.

**Distribution Line Porcelain Replacement:**

**Program Description:** This targeted capital project, addressing safety and reliability, is a proactive program aimed at eliminating distribution line porcelain equipment with a known impact on the System Average Interruption Duration Index (SAIDI).

The specific goal is to replace all designated porcelain equipment with polymer in ten years. The program will specifically replace porcelain 4 1/4" disc insulators, cutouts, non-transformer lightning arrestors, and solid core in-line disconnect switches with new polymer equipment.

**Total Unit Population:** Estimate of 150,000 porcelain units to change out. Eversource has 11,000 miles of line so this equates to 13.6 pieces of porcelain per mile on average.

**Reliability Benefit:** Reduced failure of this product.

**Results:** An estimated 4,800 porcelain cutouts, insulators, lightning arresters and in-line disconnect were replaced with polymer units in the program year. Failures of polymer insulators and cutouts have been very low.

**SUBSTATION AGING INFRASTRUCTURE:**

Program Description: This program consists of Oil Circuit Breaker Replacement, Substation Relay Upgrades, and 4 & 12 kV Substation Elimination

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$2,959,000	\$5,252,054	\$2,293,054

**Oil Circuit Breaker Replacement:**

Program Description: This program addresses the replacement of existing substation oil circuit breakers which are old, problematic in repair or operation, unique or no longer supported by vendors for parts and repair material. There are 151 oil circuit breakers on the system of various voltages, manufacturers, models, types and vintage.

Total Unit Population: 151 oil circuit breakers. Between REP funded projects and other capital projects, the population of 34 kV OCBs has been reduced to 107.

Maintenance Cycle: Breakers are maintained on a 12 year cycle at the time the substation is maintained.

Reliability Benefit: Reduce equipment failure of breakers.

Results: One 34 kV oil circuit breaker was replaced at North Rochester substation as part of REP 3 during the program year.

**Substation Relay Upgrades:**

Program Description: This project is intended to replace obsolete electromechanical relays with new numerical relays. Electromechanical relays have limited setting flexibility, can be subject to calibration issues, and are affected by environmental conditions such as dust and vibration.

Total Unit Population: There are sixty-one 34.5 breakers that still have electromechanical relays installed for feeder protection.

Maintenance Cycle: Electromechanical relays are maintained on a cycle of between 2 and 6 years, depending on their function.

Reliability Benefit: The setting flexibility of numerical relays result in additional protection devices that can be installed and coordinated. Additional feeder protection devices reduce the outage zone and associated customer counts for a fault. The ability to help locate and analyze faults, especially in ROWs, can lessen outage times and provide dispatchers detailed information for use in operating the electric system during an event. Also, numerical relays can be integrated into the DMS design.

Results: Five numerical relays were placed into service during the program year: Laconia substation lines 310, 337, and 3222X, and Broad Street substation lines 3154 and 3445X

**Eliminate 4 & 12 kV Substations:**

**Program Description:** This project is to eliminate old 4 and 12 kV substations by replacing with a new padmounted step transformer or converting to a higher voltage. Many of these stations are more than 50 years old and have obsolete equipment for which spare parts are no longer available.

**Total Unit Population:** Eversource has 41 substations older than 50 years. Not all are candidates for elimination.

**Maintenance Cycle:** Transformers and circuit breakers are normally maintained on a 12 year cycle.

**Reliability Benefit:** Replacing obsolete equipment with new will reduce outages caused by equipment failure.

**Results:** Durham, Guild, Henniker, Hillsborough, Huse Road 12 kV, and North Stratford Substations were eliminated due to obsolescence.

**VEGETATION MANAGEMENT:**

**Program Description:** This program consists of Enhanced tree trimming, Hazard tree removal, and Full width ROW clearing.

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$3,765,000	\$3,393,023	(\$371,977)

**Enhanced Tree Trimming (ETT):**

**Program Description:** Trim main lines for reliability using an enhanced tree trimming (ETT) specification to create ground to sky clearance versus the standard maintenance trim zone. Expanded clearance is obtained by performing greater off zone takedowns and clearing and higher than normal vertical clearing. Approximately 11,000 miles of overhead line exists with the project targeted up to 50 miles per year on circuits with highest tree related reliability (top 50 list).

**Total Unit Population:** Eversource is responsible for trimming approximately 11,000 miles of overhead distribution line. A portion of these miles are candidates for ETT to improve reliability on main lines.

**Reliability Benefit:** Increasing the trim zone at targeted main line locations significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.

**Results:** 171 miles of ETT was performed during the program year.

Vegetation Management did not meet the expected spend in 2017 due to the lack of availability of tree trimming crews to perform the work. In an effort to prevent this from happening again in 2018, crews were brought in from Louisiana and South Carolina over the winter months to enhance the local work force. Unfortunately, this option was not available to the Company in 2017 which resulted in underspending in this category.

**Hazard Tree Removal:**

**Program Description:** Remove trees greater than 16 inches in diameter within the trim zone and others outside the trim zone that are identified as a hazard to falling onto primary conductors.

**Total Unit Population:** Population is unknown. Candidates are identified during maintenance trimming and by employees during reliability investigations.

**Reliability Benefit:** Identifying and removing trees that have a high likelihood of contacting primary conductors significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.

**Results:** 21,070 trees were removed during the program year.

**Reclaim ROWs to Full Width:**

**Program Description:** Research easements, determine the easement boundaries and clear ROWs to the full extent of the easements.

**Total Unit Population:** Distribution in ROW is approximately 841 miles. ROWs are prioritized based upon outage histories.

**Reliability Benefit:** Clearing ROWs to the full width of the easements will reduce the risk of tree outages associated with significant SAIDI (customer) impact.

**Results:** 5.6 miles of ROW were cleared to their full width during the program year

# Section 6

## REP 4 O&M Summary

July 1 2017 – December 31 2017

**Program Extension - REP 4**  
**Summary of Eversource Reliability Enhancement Program – O&M**



July 1 2017 - December 30 2017

<b>REP 4 O&amp;M</b>			
	<b>\$ Planned</b>	<b>\$ Expended</b>	<b>Variance</b>
O&M Portion of Capital	\$600,000	\$346,313 <sup>(1)</sup>	(\$253,687)
Troubleshooter Organization	\$1,200,000	\$1,156,830	(\$43,170)
Maintenance of DA and Rights-Of-Way	\$60,000	\$0	(\$60,000)
<b>TOTAL O&amp;M REP 3</b>	<b>\$ 1,860,000</b>	<b>\$ 1,503,143</b>	<b>\$ (356,857)</b>

(1) Includes \$34,574 of REP 4 projects that began in 2017 but were not in service until early 2018.

## **O&M – REP 4**

### **O&M PORTION OF CAPITAL:**

**Program Description:** This represents the O&M portion (allocation) from Capital work related to the Reliability Enhancement Program.

**Results:** The O&M portion of REP 4 capital projects averaged 3.80% over the six months of the program.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$600,000	\$346,313	(\$253,687)

### **TROUBLESHOOTER ORGANIZATION:**

**Program Description:** The Troubleshooter Organization consists of two supervisors and 18 Troubleshooter positions, broken up into three six person teams working twelve hour shifts providing coverage 24 hours a day, 365 days a year to the primary coverage area. The primary coverage area consists of the Bedford, Derry, Hooksett, Milford, and Nashua Area Work Centers (AWCs). This coverage area includes 235,704 customers across 1,052 square miles. When available, the Troubleshooters also provide coverage to a secondary coverage area consisting of the Epping, Keene, Newport, Portsmouth, Rochester and Tilton AWCs. This secondary coverage area includes 229,341 customers across 2,642 square miles.

**Results:** Eversource has utilized this organization to provide improved response times to emergency situations for both customers and municipal partners.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$1,200,000	\$1,156,830	(\$43,170)

### **MAINTENANCE OF DISTRIBUTION AUTOMATION (DA) AND RIGHT OF WAY (ROW):**

**Program Description:** This program consists of performing maintenance of distribution lines in ROW to address items such as damaged insulators and heating connectors or splices and maintenance of equipment associated with the significant increase in deployment of distribution automation

**Results:** No incremental work was performed under this category over the six months of the program.

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$60,000	\$0	(\$60,000)

## Section 7

### REP 4 Capital Summary

July 1 2017 – December 31 2017

**Program Extension - REP 4**  
**Summary of Eversource Reliability Enhancement Program – CAPITAL**



July 1 2017 - March 31 2018

<b>CAPITAL - REP 4</b>					
	<b>PLANT IN SERVICE PLAN</b>	<b>PLANT IN SERVICE ACTUAL</b>	<b>ADDITIONAL PLANT IN SERVICE Jan-Mar 2018</b>	<b>TOTAL PLANT IN SERVICE</b>	<b>\$ VARIANCE</b>
Distribution Automation/SCADA	\$2,676,000	\$2,166,231	\$135,223	\$2,301,454	(\$374,546)
Pole top Distribution Automation devices	\$2,340,000	\$1,836,610	\$123,177	\$1,959,787	(\$380,213)
Substation Automation	\$336,000	\$329,621	\$12,046	\$341,667	\$5,667
Overhead System Reliability	\$3,860,000	\$3,807,868	\$1,101,910	\$4,909,778	\$1,049,778
Circuit Tie Construction	\$2,500,000	\$2,493,813	\$1,017,252 <sup>(1)</sup>	\$3,511,065	\$1,011,065
Worst Performing Circuits Reliability Impr.	\$670,000	\$591,950	\$83,860	\$675,810	\$5,810
ROW System Hardening	\$690,000	\$722,105	\$798	\$722,903	\$32,903
Vegetation Management	\$3,464,000	\$1,523,274	\$372,406	\$1,895,680	(\$1,568,320)
Enhanced Tree Trimming	\$1,964,000	\$969,062	\$241,545	\$1,210,607	(\$753,393)
Hazard Tree Removal	\$1,000,000	\$224,603	\$40,346	\$264,949	(\$735,051)
Reclaim ROWs to Full Width	\$500,000	\$329,609	\$90,515	\$420,124	(\$79,876)
	<b>\$10,000,000</b>	<b>\$7,497,373</b>	<b>\$1,609,539</b>	<b>\$9,106,912</b>	<b>(\$893,088)</b>

<sup>(1)</sup> One project included in this number was placed in service in April 2018

# CAPITAL – REP 4

## Pole Top Distribution Automation Devices:

**Program Description:** Install Pole-Top Devices with SCADA control.

**Reliability Benefit:** Remote control of sectionalizing devices allows operators in the company's dispatch centers to respond to troubles by sectionalizing down to the fewest number of customers impacted. This decreases the duration of outages experienced by customers by restoring power where possible and minimizing the area which responding crews have to patrol.

**Results:** All devices on the planned list were installed. One device, on Manning Street in Derry, was designed for the switch and automation to be added after a small conversion. The entire conversion was charged to the Pole Top DA job so that one installation significantly exceeded the estimate. Nine other devices on the original list were not charged to the REP program but were completed under other budget items. Excluding the Manning Street job, the other 29 devices were estimated at \$2,341,956 and the actual charges were \$2,487,281 for a difference of \$145,325 or 6.2%.

Region	AWC	Circuit #	2016 Hit List Rank	Street Address	Town	SCADA Commission Complete	Storms Estimate	Powerplan Actual	Variance
Eastern	Epping	3137X	5	Ridge Rd/ROW	Northwood	7/7/17	\$ 90,552	\$ 79,828	\$ (10,724)
Eastern	Epping	3137X	5	ROW	Northwood	7/17/17	\$ 90,686	\$ 97,216	\$ 6,530
Eastern	Epping	3137X	5	ROW	Northwood	7/17/17	\$ 90,001	\$ 91,172	\$ 1,171
Southern	Nashua	3110X	105	Milford Road	Merrimack	8/18/17	\$ 90,660	\$ 73,023	\$ (17,637)
Southern	Nashua	3144	93	Dracut Rd	Hudson	8/30/17	\$ 74,746	\$ 96,891	\$ 22,145
Eastern	Epping	3137X	5	Rte 4/Hall Rd	Nottingham	9/7/17	\$ 88,287	\$ 75,990	\$ (12,297)
Eastern	Epping	3137X	5	Rte 4/Freeman Hall	Nottingham	9/7/17	\$ 88,469	\$ 75,949	\$ (12,520)
Eastern	Epping	3115X	13	Harriman Hill Rd/ROW	Raymond	9/13/17	\$ 95,553	\$ 95,042	\$ (511)
Western	Newport	316	15	RTE 114	Sutton	9/18/17	\$ 74,090	\$ 76,157	\$ 2,067
Eastern	Epping	3115X	13	Nottingham Rd	Raymond	10/4/17	\$ 95,013	\$ 85,844	\$ (9,169)
Eastern	Epping	3115X12	42	Nottingham Rd/ROW	Raymond	10/4/17	\$ 94,533	\$ 92,765	\$ (1,768)
Eastern	Epping	3115X	13	Nottingham Rd/ROW	Raymond	10/4/17	\$ 94,435	\$ 78,363	\$ (16,072)
Central	Bedford	3197	189	DW Hwy	Merrimack	10/4/17	\$ 89,231	\$ 76,696	\$ (12,535)
Northern	Tilton	3114X	58	Ragged Mtn Hwy	Danbury	10/5/17	\$ 90,242	\$ 111,698	\$ 21,456
Eastern	Rochester	3148X2	56	Cochecho St	Dover	10/12/17	\$ 85,857	\$ 115,088	\$ 29,231
Central	Bedford	18W3	179	Putnam St	Manchester	10/19/17	\$ 65,980	\$ 80,568	\$ 14,588
Eastern	Rochester	362X2	183	Spring St	Farmington	11/29/17	\$ 82,935	\$ 81,236	\$ (1,699)
Central	Hooksett	3184	11	So. Mammoth Rd	Londonderry	12/15/17	\$ 76,866	\$ 81,737	\$ 4,871
Central	Hooksett	3184	11	So. Mammoth Rd	Londonderry	12/15/17	\$ 78,329	\$ 80,919	\$ 2,590
Eastern	Rochester	371X4	95	WhiteHall Road	Rochester	2/28/18	\$ 83,599	\$ 134,855	\$ 51,256

Southern	Derry	8W1	187	Manning St.	Derry	7/11/17	\$ 116,688	\$ 288,772	\$ 172,084
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Completed under non-REP budget items

Region	AWC	Circuit #	2016 Hit List Rank	Street Address	Town	SCADA Commission Complete	Storms Estimate	Powerplan Actual	Variance
Western	Newport	75W2	71	Broad St	Claremont	7/13/17	\$ 70,188	\$ 63,267	\$ (6,921)
Southern	Derry	3115X	13	Route 122	Chester	7/27/17	\$ 67,950	\$ 70,881	\$ 2,931
Southern	Derry	3115X	13	Route 121	Chester	7/27/17	\$ 72,956	\$ 97,612	\$ 24,656
Western	Newport	46H1	131	Route 11	Newport	8/31/17	\$ 49,593	\$ 89,139	\$ 39,546
Western	Keene	3173	36	West Main St	Hillsborough	9/8/17	\$ 72,558	\$ 76,590	\$ 4,032
Western	Newport	316	15	RTE 114	New London	9/18/17	\$ 75,371	\$ 72,757	\$ (2,614)
Western	Keene	3140X1	119	Salmon Brook Rd	Antrim	9/22/17	\$ 69,829	\$ 63,044	\$ (6,785)
Western	Newport	75W2	71	South St	Claremont	9/28/17	\$ 64,478	\$ 70,251	\$ 5,773
Southern	Derry	3128X	6	High Range Rd.	Londonderry	4/18/18	\$ 78,969	\$ 102,703	\$ 23,734

Plant in service:

\$ Plan	\$ Actual	\$ Variance
\$2,340,000	\$1,959,787	(\$380,213)

**Substation Automation:**

Program Description:

Expand SCADA control to 4 and 12 kV substations.

Reliability Benefit:

Remote indication and control of substation circuit breakers allows quicker response to outages by providing operators with indication when the devices operate. Operators are then able to remotely operate the circuit breakers to assist crews working in the field

Results:

The original plan was to add SCADA control to four substations, based on an average cost of \$84,000 per location. Detailed engineering of the sites determined that these unit substations would prove to be significantly more expensive than previous installations because adequate drawings could not be found for these older substations and internal wiring had to be hand-traced. The result was that, in order to stay within the total budgeted amount, SCADA control was added to two of the four planned substations: Long Hill in Nashua (\$97,602) and Hanover Street in Manchester (\$244,064).

Plant in service:

\$ Plan	\$ Actual	\$ Variance
\$336,000	\$341,667	\$5,667

**Circuit Tie Construction:**

**Program Description:** Construct circuit ties for large radial circuits which would allow a backup source of power with Distribution Automation.

**Reliability Benefit:** Constructing circuit ties and installing associated distribution automation devices allows for restoration of service to the majority of the customers fed from these circuits while repairs are made to the cause of the outage.

**Plant in service:**

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$2,500,000	\$3,511,065	\$1,011,065

**Results:** Two projects were planned under this program – a circuit tie from Farmington to Middleton and a tie in Londonderry.

The Farmington-Middleton circuit tie was built by contractors, with the work awarded as a result of a competitive bid process. The STORMS estimate for the work was \$2,435,620. Actual cost of the work was \$2,736,413 for a difference of \$300,793 or 12%. Analysis of the work orders shows materials were within 2-3% of the STORMS estimate in most cases, while the Contract Labor to complete the jobs exceeded estimates by 20 – 30% resulting in the increased total cost. Traffic control charges were negligible, totaling less than \$3,000.

The Londonderry circuit tie was delayed into 2018. Londonderry is in a Fairpoint (now Consolidated Communications) set area. Although the work was given to Fairpoint on March 30, 2017, they failed to set poles in time for Eversource to construct the line by the end of the year so Eversource had to set approximately 36 poles which added to the cost and delayed completion of the project into 2018. In addition, significant storm activity in the first quarter of 2018 contributed to the delay. This project was built by contractors, with the work awarded as a result of a competitive bid process. The STORMS estimate for the work was \$575,045. Actual cost of the work was \$886,798 for a difference of \$311,753 or 54%. The main driver of the cost overrun on this project was setting new poles, which was not planned to be part of the work, as described above. Material costs were estimated at \$66,195 but with the addition of the poles the actual was \$133,161, an increase of \$66,966. The labor to set the poles also contributed to the increased cost. Total contract labor costs were estimated at \$192,562. Actual costs were \$310,716, an increase of \$118,154. Increased overheads associated with these increased costs caused the remainder of the overrun. This project was placed in service in April 2018.

**Worst Performing Circuits Reliability Improvements:**

**Program Description:** This project provides funding for a variety of activities relating to reliability of electric service, each of which costs less than \$50,000. This includes unfused lateral protection, recloser upgrades and installs, line construction to provide added phases or alternate feeds, switch and manual disconnect installations, and other specific capital work to improve circuit and area reliability. Average cost per typical Engineering Work Request (EWR) is about \$8,900.

**Reliability Benefit:** All projects are intended to reduce the number of outages and/or reduce the number of customers affected by an outage.

Results:

With the exception of two proposed jobs which were cancelled after performing detailed engineering, all jobs on the list provided with the filing were completed. Note that six of the jobs were written in STORMS prior to the approval of this program so were completed under base capital budget projects to avoid having to re-write the jobs. These jobs are denoted by a small triangle in the upper right corner of the "Description" field in the following list. The estimates for Spear recloser installations provided in the filing were preliminary engineering estimates not detailed estimates so the actual costs exceeded these in many cases. Spear reclosers were a new piece of equipment for the company so the jobs had not yet been written in the STORMS work management system. The total of engineering estimates for the jobs completed against this project is \$586,750. The total of actual charges is \$675,812 for a difference of \$89,062. There are five jobs which account for over \$87,000 of this overage. Three of those had engineering estimates in the original filing. When actually written in STORMS, two of those were underspent compared to the STORMS estimate while the third exceeded the labor estimate and was built by contractors. The remaining two jobs which account for the overage had more labor charged than was estimated: "Fuse upgrade 12W1" had 94 hours estimated and 324 hours charged, and "Enhance reliability, improve ties between 325X2 and 325X7" was built by contractors for \$22,000 when it was estimated for Eversource labor for \$4,000. Details on the individual jobs is shown below.

Region	AWC	Circuit	Description	STORMS #	Cost Estimate	Actual	Variance
N	32	348X2	Replace Step and Two Reclosers	2954687	\$ 13,754	\$ 16,592	\$ 2,838
N	76	5H2	Upgrade Step-Up Xfmr to provide full capacity backup in looped URD	2810078	\$ 18,000	\$ 2,623	\$ (15,377)
N	76	348X3	Replace fusing to correct coordination	2925038	\$ 1,000	\$ 2,400	\$ 1,400
N	76	351X16	Relocate Recloser from P.3/21 to 3/12	2923969	\$ 2,000	\$ 4,368	\$ 2,368
N	45	346X1	Install Single Phase Cooper Spear recloser @ P.4/86	2911729	\$ 18,000	\$ 28,890	\$ 10,890
N	45	346X1	Replace fusing to help coordination	2926114	\$ 1,000	\$ 9,714	\$ 8,714
S	23	3128X	Install 2 Spear reclosers to reduce momentaries. Hardy Rd, Londonderry.	2846017	\$ 50,000	\$ 54,109	\$ 4,109
S	23	3141X	Install additional inline disconnects to help sectionalize beyond 3141X1 and 41X1J1	2880241	\$ 2,500	\$ 14,536	\$ 12,036
S	23	3128X	Move cutout from first pole to main line pole.	2880232	\$ 2,500	\$ 8,251	\$ 5,751
W	31	3155X4	Install Spear Recloser - Hwy 123 - New Ipswich	2917230	\$ 21,261	\$ 18,689	\$ (2,572)
W	31	3173	Spear Recloser - Whitney Road, Hillsborough	2980625	\$ 18,000	\$ 22,789	\$ 4,789
N	41	398X3	Upgrade Fusing	2715120	\$ 2,000	\$ 1,612	\$ (388)
N	32	12W1	Fuse upgrade 12W1	2765143	\$ 16,765	\$ 36,280	\$ 19,515
S	21	3241X	Anheuser Busch- Install New Back Up Feed for 2300 foot Direct Buried Cable	2704513	\$ 40,000	\$ 63,082	\$ 23,082
S	21	3010X	Create Back Feed for Acacia Drive - Merrimack	2766290	\$ 35,207	\$ 42,623	\$ 7,416
S	21	3211X	#24 - Replace 100E fuse with Spear - Robinson Road, Hudson	2922444	\$ 18,317	\$ 30,092	\$ 11,775

Region	AWC	Circuit	Description	STORMS #	Cost Estimate	Actual	Variance
S	21	3175X1	Replace Greeley St p.23 fuse with Spear recloser.	2912894	\$ 30,000	\$ 6,673	\$ (23,327)
E	61	362	Install fused cutouts - unfused lateral	2795734	\$ 3,079	\$ 11,647	\$ 8,568
E	61	3148X4	Install fused C/O on two unfused laterals	2794008	\$ 3,709	\$ 4,556	\$ 847
E	61	3174X2	Install fused C/O's on three unfused laterals	2794430	\$ 2,968	\$ 5,126	\$ 2,158
E	61	3174X4	Install fused C/O's on two unfused laterals	2794483	\$ 3,678	\$ 1,252	\$ (2,426)
E	61	399X1	Fuse Coordination 399X11	2884212	\$ 2,961	\$ 2,134	\$ (827)
W	32	316	EWR W16-013-32 Add Side Tap Fusing to Improve Reliability - New London- 316 Line	2667592	\$ 1,023	\$ 1,103	\$ 80
W	32	316X1	Install Single Phase Nova SPEAR Recloser - Yankee Barn Road- 316X1	2917390	\$ 17,798	\$ 1,274	\$ (16,524)
W	32	3410	High Street - Bradford - New Spear Recloser	2987875	\$ 18,000	\$ 7,826	\$ (10,174)
W	32	44H1	**46/54**CROYDON ADD FUSING EWR POLES 1/160, 19/10	2982392	\$ 3,311	\$ 1,837	\$ (1,474)
C	11	3179	Bouchard Street, Manchester - Replace DB Cable with Overhead Feed	2713287	\$ 45,250	\$ 43,440	\$ (1,810)
C	11	370X2	Perform work to enhance reliability of circuit beyond 370X2 recloser.	2876589	\$ 10,000	\$ 3,308	\$ (6,692)
C	11	325	Enhance reliability, improve ties between 325X2 and 325X7.	2878989	\$ 6,773	\$ 35,091	\$ 28,318
C	11	16W3	Spring Valley relo cutout/tree trimming	2908503	\$ 2,471	\$ 2,798	\$ 327
C	11	3130X	Provide backfeed to 50 unit URD, Manchester.	2894454	\$ 10,000	\$ 15,034	\$ 5,034
C	11	393X20	Install Spear recloser to replace 1Ø fuse, Bodwell Rd, Manchester.	2932527	\$ 18,000	\$ 26,626	\$ 8,626
C	11	3615X2	Install Spear recloser to replace 1Ø fuse, Farmer Rd, Hooksett.	2932570	\$ 18,000	\$ 27,706	\$ 9,706
C	11	3615X3	Install Spear recloser to replace 1Ø fuse, Smyth Rd, Manchester.	2932587	\$ 18,000	\$ 32,059	\$ 14,059
C	11	324X10	Install Spear to replace 1Ø fuse, Robert Hall Rd, Londonderry. (also 2996965)	2932626	\$ 18,000	\$ 15,502	\$ (2,498)
C	12	13W1/334X2	Add in line DXs between open point of 334X2 and 13W1	2915916	\$ 5,919	\$ 329	\$ (5,590)
C	11	3615X2	Install Tripsaver to replace 1Ø fuse, Auburn Rd, Auburn.	2932611	\$ 18,000	\$ 10,304	\$ (7,696)
C	12	322X12	Add 1PH Spear Jenkins Rd.	2915960	\$ 18,000	\$ 23,233	\$ 5,233
C	12	334X14	Add 1PH Spear Goffstown Back	2915954	\$ 18,000	\$ 21,246	\$ 3,246
C	12	360X5	Add 1PH Spear Chestnut Hill	2915948	\$ 18,000	\$ 24,963	\$ 6,963
C	12	314X4	Replace Dale Street tap fuse with Spear	2913042	\$ 30,000	\$ 31,496	\$ 1,496
C	12	3155	Tap 3155 ROW to feed end half of 314X15. Hit List #26. Two Spear Reclosers. (also 2994029)	2993941	\$ 50,000	\$ 63,697	\$ 13,697

The following two jobs were cancelled

C	12	3173X1	Add 1PH Spear Deering Center Cancelled, needs to be re-engineered	2915940	\$ 18,000		
C	11	14W2	S Manchester S/S Getaways Cancelled - separate project eliminated the need for this	2885838	\$ 24,094		

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$670,000	\$675,810	\$5,810

**ROW System Hardening:**

Program Description:

This project provides funding for rebuilding portions of lines in ROW to improve operational performance. Typical work involves replacing poles and crossarms, additional guying and replacing insulators.

Reliability Benefit:

Strengthening ROW lines reduces the frequency of outages on these lines which are often in locations which are difficult to reach without specialized equipment and construction methods such as portable matting for crossing wetlands.

Results:

One of the two planned projects was completed. The original plan was to rebuild a portion of the 316 line and reconductor 0.82 miles of the 3891 line. Work on the 3891 line was completed in December 2017. Due to the cost of this project, it was decided to move the 316 line out of REP and into base budget so as to not exceed the authorized REP expenditures. The 3891 estimate originally provided was taken from an older document which had not been updated with the new construction materials and methods so was severely underestimated.

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$690,000	\$722,903	\$32,903

**VEGETATION MANAGEMENT:**

Program Description:

This program consists of Enhanced tree trimming, Hazard tree removal, and Full width ROW clearing.

**Enhanced Tree Trimming (ETT):**

Program Description:

Trim main lines for reliability using an enhanced tree trimming (ETT) specification to create ground to sky clearance versus the standard maintenance trim zone. Expanded clearance is obtained by performing greater off zone takedowns and clearing and higher than normal vertical clearing. Approximately 11,000 miles of overhead line exists with the project targeted up to 50 miles per year on circuits with highest tree related reliability (top 50 list).

Total Unit Population:

Eversource is responsible for trimming approximately 11,000 miles of overhead distribution line. A portion of these miles are candidates for ETT to improve reliability on main lines.

Reliability Benefit:

Increasing the trim zone at targeted main line locations significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.

Results: 37.37 miles of ETT was performed under the program.

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$1,964,000	\$1,210,697	(\$753,393)

**Hazard Tree Removal:**

Program Description: Remove trees greater than 16 inches in diameter within the trim zone and others outside the trim zone that are identified as a hazard to falling onto primary conductors.

Total Unit Population: Population is unknown. Candidates are identified during maintenance trimming and by employees during reliability investigations.

Reliability Benefit: Identifying and removing trees that have a high likelihood of contacting primary conductors significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.

Results: 2,838 trees were removed under the program.

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$1,000,000	\$264,949	(\$735,051)

**Reclaim ROWs to Full Width:**

Program Description: Research easements, determine the easement boundaries and clear ROWs to the full extent of the easements.

Total Unit Population: Distribution in ROW is approximately 841 miles. ROWs are prioritized based upon outage histories.

Reliability Benefit: Clearing ROWs to the full width of the easements will reduce the risk of tree outages associated with significant SAIDI (customer) impact.

Results: 5.8 miles of ROW were cleared to their full width under the program, the 314 line (Keene area) 2 miles, 3425 line (Epping area) 2 miles, and the 399X1 circuit (Rochester area) 1.8 miles.

Plant in service:

<b>\$ Plan</b>	<b>\$ Actual</b>	<b>\$ Variance</b>
\$500,000	\$420,124	(\$79,876)

## Section 8

### 2016 Other Activities

## 2016 ACTIVITIES ON TOP 50 RANKED BY COSAIDI IN 2015

2015 CoSAIDI Rank	2016 CoSAIDI Rank	Change in Rank Gain (Worse) from 2015	Circuit	AWC	SMT	ETT	NESC Full Circuit Patrol	NESC Repair Activity	Inspect URD Systems	Pole Inspect/ Test/ Replace	ROW Patrol	Switch Maint	Recloser Maint	Recloser Additions	Test & Repair/ Replace/ Inject DB Cable	Porcelain Change Out	Pole Top DA	Other Corrective Actions	Corrective Actions Comments
1	563	562	355X_76	LANCASTER AWC							X						X	X	Full Width ROW Clearing
2	3	1	355X10_76	LANCASTER AWC	X		X	X		X									
3	42	39	3115X12_65	EPPING AWC	X	X	X			X								X	Add sectionalizing point, Circuit Tie in design (2017)
4	16	12	3141X_23	DERRY AWC		X		X									X	X	Conversion to provide backup feed to residential area
5	9	4	3157X1_61	ROCHESTER AWC	X		X		X	X							X	X	Circuit tie under construction (2017)
6	53	47	3140X2_36	KEENE AWC															
7	1	(6)	316X1_32	NEWPORT AWC	X			X									X		
8	18	10	23X5_22	MILFORD AWC					X						X		X		
9	10	1	3133X_23	DERRY AWC					X								X		
10	NR	NR	398_41	TILTON AWC															
11	51	40	47W1_32	NEWPORT AWC				X											
12	15	3	316_32	NEWPORT AWC				X								X		X	Add fault indicators, Add fuses to laterals
13	54	41	334X18_11	HOOKSETT AWC															
14	137	123	348X2_41	TILTON AWC			X	X		X									
15	29	14	3108_12	BEDFORD AWC												X			
16	22	6	3525X5_77	BERLIN AWC	X	X													
17	94	77	3614_11	HOOKSETT AWC							X						X		
18	192	174	2W2_41	TILTON AWC								X							
19	NR	NR	3194_12	BEDFORD AWC															
20	23	3	19W2_45	CHOCORUA AWC				X	X	X						X			
21	57	36	3159X_21	NASHUA AWC		X			X			X			X			X	Reconductor line due to splice failure
22	2	(20)	W13_31	KEENE AWC				X	X	X				X				X	Area fuse coordination
23	13	(10)	3115X_23	DERRY AWC				X		X						X			
24	48	24	3157X3_61	ROCHESTER AWC	X				X									X	Circuit tie under construction (2017)
25	263	238	3212X_22	MILFORD AWC	X				X						X		X		
26	102	76	314X15_22	MILFORD AWC															
27	47	20	3178_31	KEENE AWC				X	X	X							X		
28	41	13	73W2_61	ROCHESTER AWC				X	X	X									
29	56	27	3148X2_61	ROCHESTER AWC				X		X		X							
30	335	305	362_61	ROCHESTER AWC				X	X	X									
31	4	(27)	3139X_31	KEENE AWC				X	X	X									
32	52	20	392X_61	ROCHESTER AWC													X		
33	72	39	37W1_12	BEDFORD AWC	X														
34	68	34	371X1_61	ROCHESTER AWC															
35	91	56	1W2_76	LANCASTER AWC				X											
36	19	(17)	3103X1_65	EPPING AWC															
37	20	(17)	3615X1_11	HOOKSETT AWC															
38	90	52	348X3_76	LANCASTER AWC				X									X		
39	6	(33)	3128X_23	DERRY AWC				X	X					X	X		X		
40	46	6	3116X1_45	CHOCORUA AWC				X	X	X									
41	82	41	3120X2_31	KEENE AWC	X														
42	96	54	25W1_77	BERLIN AWC				X											
43	121	78	3130X_11	HOOKSETT AWC													X	X	Replace xfmr due to multiple animal contacts
44	8	(36)	20W1_42	TILTON AWC	X			X		X							X		
45	7	(38)	313X1_36	KEENE AWC					X						X		X		
46	21	(25)	W15_31	KEENE AWC	X			X	X	X								X	Relocate several sections of line out of ROW
47	105	58	3110X_21	NASHUA AWC													X		
48	71	23	75W2_32	NEWPORT AWC				X										X	Replace recloser
49	173	124	11W2_41	TILTON AWC								X							
50	65	15	42X3_32	NEWPORT AWC				X											

40 # Circuits Improving in Rank      47 Avg improvement (change in position) in Rank for all 50 Circuits  
 10 # Circuits Worsening in Rank      NR NR indicates this circuit had no outages so it is Not Ranked

# Section 9

## REP3 Project Details

July 1 2017 – December 31 2017

Pole top DA

Reg.	AWC	Circuit	Pole #	St Address	Town	Date Compl	Cost
S	Nashua	3159	37/40	Continental Blvd	Merrimack	7/8/16	\$ 89,436
S	Nashua	3159	24B/15	Camp Sargent Rd	Merrimack	7/8/16	\$ 102,668
S	Nashua	3159	37/46X	Continental Blvd	Merrimack	7/8/16	\$ 93,539
S	Nashua	3445X	871/1Y	Northwest Blvd	Nashua	7/8/16	\$ 78,990
S	Nashua	3159	259/1	Continental Blvd	Merrimack	7/8/16	\$ 69,814
C	Hooksett	3614	3614/44	River Rd	Manchester	7/8/16	\$ 99,962
C	Hooksett	3614	10/136	River Rd	Manchester	7/8/16	\$ 112,284
C	Hooksett	3614	3614/44Y	River Rd	Manchester	7/8/16	\$ 81,449
E	Rochester	340X1	313/21	Chestnut Hill Rd	Rochester	7/13/16	\$ 104,782
E	Rochester	340	340/20Y	Chestnut Hill Rd	Rochester	7/13/16	\$ 89,933
E	Ports.	3172	3172/207Y	Route 27	Hampton	7/14/16	\$ 62,091
E	Ports.	3112	3112/205Y	Route 27	Hampton	7/14/16	\$ 79,614
E	Ports.	3165	3165/201Y	Route 27	Hampton	7/14/16	\$ 75,091
S	Derry	32W2	34/66	Route 28	Derry	7/15/16	\$ 82,109
S	Derry	3133X	3A/49	Central St.	Hudson	7/19/16	\$ 98,046
W	Milford	3217X	3217X / 35	Foster Rd	Milford	7/20/16	\$ 64,290
C	Bedford	3271X2	103/193Y	River Rd	Weare	7/21/16	\$ 15,336
C	Bedford	3271	3271/39	River Rd	Weare	7/21/16	\$ 7,854
S	Derry	3128X	1/5	Kendall Pond Rd.	Londonderry	7/25/16	\$ 81,054
S	Nashua	3159	259/11	Contra Way	Merrimack	7/27/16	\$ 78,793
S	Nashua	3241	0	Digital Drive	Merrimack	7/29/16	\$ 76,531
E	Epping	377	377/60Y	Wadleigh Falls Rd	Lee	8/2/16	\$ 87,385
E	Epping	377	377/61Y	Wadleigh Falls Rd	Lee	8/2/16	\$ 87,385
E	Epping	377X2	377/61A	Wadleigh Falls Rd	Lee	8/2/16	\$ 87,385
C	Hooksett	3614	3614/58	ROW	Manchester	8/5/16	\$ 108,127
C	Hooksett	3614	3614/59	ROW	Manchester	8/5/16	\$ 89,226
C	Bedford	3164	3164/24	Ogara Dr	Merrimack	8/9/16	\$ 69,573
C	Bedford	3164	3164/25Y	Ogara Dr	Merrimack	8/9/16	\$ 72,805
C	Bedford	3164X3	3/13Y	Baboosic Lake Rd	Merrimack	8/9/16	\$ 116,792
W	Keene	313	313/226Y	Peterborough Rd	Hancock	8/10/16	\$ 80,944
W	Keene	313	313/228	Peterborough Rd	Hancock	8/10/16	\$ 67,549
S	Nashua	3144	3144/103Y	Dracut Rd	Hudson	8/10/16	\$ 109,366
S	Nashua	389	1131/05Y	East Spit Brook Rd	Nashua	8/11/16	\$ 135,972
S	Nashua	3159	9/530	Boston Post Rd	Amherst	8/12/16	\$ 82,788
N	Tilton	1X4	51/1	Salisbury Rd	Franklin	8/16/16	\$ 95,720
N	Tilton	1X4	5/49	Old South Main St	Franklin	8/16/16	\$ 80,910
S	Nashua	3136X	1/55	DW Hwy S (B&N)	Nashua	8/17/16	\$ 106,557
S	Nashua	389	389/2	DW Hwy	Nashua	8/17/16	\$ 77,873
S	Nashua	3136X	1A/Y	DW Hwy South	Nashua	8/17/16	\$ 161,185
S	Derry	3128X	24/37Y	Londonderry Rd.	Windham	8/19/16	\$ 73,911

S	Derry	3133X	4/112Y	N. Lowell Rd.	Windham	8/22/16	\$ 69,433
W	Keene	24X1	105/1	Francestown Rd	Bennington	9/16/16	\$ 14,913
C	Hooksett	3614	3614/86Y	Fox Hollow Way	Manchester	9/19/16	\$ 75,248
E	Rochester	392X5	6/53	Main St	Rochester	9/20/16	\$ 75,912
E	Epping	377X2	4/31	Grant Rd	Newmarket	9/22/16	\$ 169,041
W	Keene	76W1	192/92	Court St	Keene	9/27/16	\$ 42,967
W	Keene	76W7	192/93	Court St	Keene	9/27/16	\$ 54,608
W	Keene	76W7	L13/58Y	Court St	Keene	9/27/16	\$ 30,669
C	Hooksett	3614	3614/89	Wellington Hill Rd	Manchester	9/30/16	\$ 140,753
S	Nashua	3136X	1/2	DW Hwy	Nashua	10/6/16	\$ 81,424
S	Derry	3128X	4/41	Pillsbury Rd.	Londonderry	10/11/16	\$ 98,783
C	Hooksett	3614	3614/97Y	ROW	Manchester	10/14/16	\$ 68,007
C	Hooksett	14X126A	36/38	Old Wellington Rd	Manchester	10/14/16	\$ 95,795
C	Hooksett	3614	3614/98Y	ROW	Manchester	10/14/16	\$ 92,372
S	Nashua	3175	209/78	Lowell Rd	Hudson	10/19/16	\$ 120,021
S	Nashua	3175	116/1Y	Executive Dr	Hudson	10/19/16	\$ 95,303
C	Bedford	3108	39/2X	Twin Bridge Rd	Weare	1/13/17	\$ 21,151
C	Bedford	3108X1	39/3	Twin Bridge Rd	Weare	1/13/17	\$ 21,151
W	Keene	3178X4	62/9Y	Elm St	Winchester	1/19/17	\$ 31,454
C	Bedford	3271X4	3271/16	Riverdale Rd	Weare	2/2/17	\$ 11,102
S	Nashua	3136X	1131/19-2Y	Tara Blvd	Nashua	2/3/17	\$ 109,456
S	Derry	3133X	4/73	N. Lowell Rd.	Windham	2/6/17	\$ 75,505
W	Keene	3178	3178/27C	Ashuelot S/S	Ashuelot	2/21/17	\$ 75,495
C	Hooksett	23W2	813/12	Malvern St	Manchester	2/21/17	\$ 67,686
E	Epping	377X2	19/Y	RTE 108	Newmarket	2/24/17	\$ 106,435
C	Hooksett	23W2	395/41Z	Bell St	Manchester	2/24/17	\$ 22,534
W	Keene	28W1	150/1	Main St	Jaffrey	3/1/17	\$ 64,846
S	Nashua	3136X	1/46Y-2	DW Hwy S	Nashua	3/7/17	\$ 53,957
S	Nashua	3136X	1 / 46	DW Hwy S	Nashua	3/7/17	\$ 96,030
S	Nashua	3136X	1 / 47	DW Hwy S	Nashua	3/7/17	\$ 79,021
S	Nashua	3136X	1/46Y-1	DW Hwy S	Nashua	3/7/17	\$ 64,644
C	Hooksett	393	393/86YA	Hanover St S/S	Manchester	3/8/17	\$ 92,731
S	Nashua	3136X	1131/13Y	Spit Brook Rd	Nashua	3/10/17	\$ 88,963
S	Nashua	3136X	167/2X	Brook Village Rd	Nashua	3/10/17	\$ 66,939
S	Nashua	3136X	1131/16	Spit Brook Rd	Nashua	3/10/17	\$ 66,939
W	Keene	313	313/436X	Amos Fortune Rd	Jaffery	3/17/17	\$ 167,611
C	Bedford	18W1	259/19	Mast Rd	Goffstown	3/17/17	\$ 68,637
W	Keene	W15	15A/20	Route 101	Marlboro	3/20/17	\$ 65,830
W	Keene	313X2	85/12Y	Lehtinen Rd	Jaffrey	3/20/17	\$ 71,928
W	Keene	W15	2/30	Route 101	Marlboro	3/21/17	\$ 63,460
W	Keene	W15	1/10A	Roxbury Rd	Marlboro	3/23/17	\$ 56,290
C	Hooksett	393	393/87	Hanover St S/S	Manchester	3/24/17	\$ 73,681
C	Hooksett	3614	3614/131Y	Hanover St S/S	Manchester	3/24/17	\$ 82,316
C	Bedford	3108X1	7/187Y			3/29/17	\$ 70,070

W	Keene	313	313/438	Amos Fortune Rd	Jaffery	3/30/17	\$ 109,847
N	Tilton	398	398/142	Mile Hill Rd	Belmont	3/31/17	\$ 89,758
N	Tilton	398	398/142.1	Mile Hill Rd	Belmont	3/31/17	\$ 79,551
N	Tilton	398	337L/1	Mile Hill Rd	Belmont	3/31/17	\$ 82,599
N	Tilton	337	337/133D	Mile Hill Rd	Belmont	3/31/17	\$ 80,821
N	Tilton	337	337/133.4	Mile Hill Rd	Belmont	3/31/17	\$ 70,468
N	Tilton	337	337/133B	Mile Hill Rd	Belmont	3/31/17	\$ 70,916
C	Hooksett	23W4	1056/16	Russell St	Manchester	3/31/17	\$ 70,498
N	Berlin	352	100B/5	Off Goebel st	Berlin	4/3/17	\$ 89,124
E	Epping	3137X	3137X/261Y	Rochester Rd	Northwood	4/3/17	\$ 71,121
E	Ports.	3112	3112/111	Breakfast Hill Rd	Greenland	4/7/17	\$ 88,887
E	Ports.	3172	3172/189.5	3172X1 Tap	Hampton	4/7/17	\$ 110,032
C	Bedford	18W1	179/50	Rockland	Goffstown	4/11/17	\$ 69,925
E	Ports.	3165	3165/114	Breakfast Hill Rd	Greenland	4/12/17	\$ 90,793
E	Ports.	71W4	6/36	Lafayette Rd	Portsmouth	4/13/17	\$ 69,195
S	Nashua	3136X2	1131/19-2	Tara Blvd	Nashua	4/14/17	\$ 86,141
W	Keene	3139X	101/56	RTE 9 West	Chesterfield	4/18/17	\$ 76,727
W	Keene	3139X	101/54	RTE 9 East	Chesterfield	4/18/17	\$ 76,871
W	Keene	3139X	199/98	Hwy 63	Hinsdale	4/19/17	\$ 71,709
N	Berlin	3525X3	1A/5	East Milan Rd	Berlin	4/20/17	\$ 61,423
E	Rochester	371X14	701/17	New Rochester Rd	Somersworth	4/21/17	\$ 72,393
E	Rochester	371X14	7/11	New Rochester Rd	Dover	4/21/17	\$ 70,903
S	Derry	3115X	1/96	Route 102	Chester	4/24/17	\$ 9,841
E	Epping	380X1	2/15	Sherburne Rd	Lee	4/28/17	\$ 73,888
E	Epping	3137X	318/45	Turtle Pond Rd	Lee	4/28/17	\$ 98,164
S	Nashua	3159X	9/29Z	Boston Post Rd	Amherst	4/28/17	\$ 91,175
S	Nashua	3159X	9/29X	Boston Post Rd	Amherst	4/28/17	\$ 71,346
S	Nashua	3159X	9/14Y	Boston Post Rd	Amherst	5/2/17	\$ 86,253
C	Bedford	3271X2	103/618Y	River Rd	Weare	5/2/17	\$ 69,851
W	Keene	W2	296/41Y	Winchester St	Keene	5/3/17	\$ 66,960
C	Bedford	311X1	81/52	RTE 114	Henniker	5/3/17	\$ 80,585
W	Keene	W175	185/59Y	Tiffin St	Keene	5/4/17	\$ 61,024
W	Keene	4W2	52/50	Route 10	Swanzey	5/5/17	\$ 57,933
W	Keene	4W2	10/4	Main St	Swanzey	5/5/17	\$ 51,908
N	Lancaster	355	355/474	ROW	Columbia	5/10/17	\$ 96,220
E	Ports.	71W4	100/6	Cass St	Portsmouth	5/17/17	\$ 66,186
E	Ports.	71W3	95/22	Miller Ave	Portsmouth	5/18/17	\$ 81,796
E	Ports.	64W2	5/29	South St	Portsmouth	5/18/17	\$ 73,250
S	Nashua	3217X	3217X/99	Silver Lake Rd	Hollis	5/22/17	\$ 90,965
S	Nashua	329	329X/88	Silver Lake Rd	Hollis	5/22/17	\$ 92,257
S	Nashua	329	329X/89	Silver Lake Rd	Hollis	5/22/17	\$ 75,909
C	Hooksett	5W2	3/441	Bancroft Hwy	Litchfield	5/23/17	\$ 90,701
C	Hooksett	334	334/230Y	Whittemore Rd	Pembroke	5/25/17	\$ 79,764
C	Hooksett	334	334/229	Whittemore Rd	Pembroke	5/25/17	\$ 94,920

C	Hooksett	334X18	68/10	Whittemore Rd	Pembroke	5/25/17	\$ 80,152
S	Derry	3115X	8/40Y	Route 121	Chester	5/31/17	\$ 87,182
W	Keene	4W1	44/55		Swanzey	5/31/17	\$ 66,949
E	Epping	3137X	3137X/222X	Ridge Rd	Northwood	6/1/17	\$ 100,837
E	Epping	3137X8	815/10Z	Ridge Rd	Northwood	6/2/17	\$ 69,979
E	Epping	377X2	4/33	Grant Rd	Newmarket	6/6/17	\$ 169,041
S	Derry	8W1	65/5C	Manning St.	Derry	6/13/17	\$ 58,306
C	Bedford	335	332/13Z	ROW	Hooksett	6/13/17	\$ 109,716
E	Epping	3137X	3137X/195Z	Sherburne Hill Rd	Northwood	6/15/17	\$ 86,875
E	Epping	3137X6	814/19X	Bow Lake Rd.	Northwood	6/15/17	\$ 69,758
S	Nashua	3217X	837/23	BRd St	Hollis	6/15/17	\$ 74,151
E	Epping	3137X	3137/195X	Sherburne Hill Rd	Northwood	6/16/17	\$ 84,002
S	Nashua	383	383 / 18Y	Wade Rd	Hudson	6/22/17	\$ 86,078
C	Bedford	335	335/51	Hackett Hill	Manchester	6/22/17	\$ 83,283
C	Bedford	335	335/56	Hackett Hill	Hooksett	6/22/17	\$ 68,632
C	Bedford	334	335X56/A1	ROW	Hooksett	6/22/17	\$ 38,744
C	Bedford	335X3	335/55	Hackett Hill	Hooksett	6/22/17	\$ 77,704
C	Bedford	335X2	335/53-2	Hackett Hill	Manchester	6/22/17	\$ 74,125
C	Bedford	335	335/56Y	Poore Rd	Hooksett	6/22/17	\$ 71,032
N	Tilton	398	398/151.1	Apple Ridge Rd	Laconia	6/23/17	\$ 85,098
N	Tilton	398X3	398X3/1	Apple Ridge Rd	Laconia	6/23/17	\$ 16,652
N	Tilton	398	398/152	Apple Ridge Rd	Laconia	6/23/17	\$ 75,276
C	Hooksett	334X18	6/5	Academy Rd	Pembroke	6/23/17	\$ 74,406
E	Rochester	371	371S/21	Green St	Somersworth	6/27/17	\$ 73,465
E	Rochester	32	32S/23	Green St	Somersworth	6/27/17	\$ 125,062
S	Nashua	383X1	33B/Y	Page Rd	Hudson	6/28/17	\$ 69,278

#### Substation Automation

Substation Name	Region	AWC	Town	# of Cust Served	Complete	Cost
North Hampton	Eastern	Portsmouth	N. Hampton	531	7/26/16	\$ 27,775
North Rochester	Eastern	Rochester	Rochester	1857	7/31/16	\$ 41,764
Lochmere	Northern	Tilton	Laconia	3183	9/15/16	\$ 96,290
South Laconia	Northern	Tilton	Laconia	1542	10/7/16	\$ 88,478
Laskeys Corner	Eastern	Rochester	Milton	622	11/15/16	\$ 81,717
Franklin	Northern	Tilton	Franklin	1868	11/30/16	\$ 72,305
Opechee Bay	Northern	Tilton	Laconia	2297	3/31/17	\$ 311,576
Contoocook	Central	Bedford	Hopkinton	1399	3/31/17	\$ 73,418
Hollis	Southern	Nashua	Hollis	834	5/10/17	\$ 126,505
Brown Avenue	Central	Hooksett	Manchester	1008	5/16/17	\$ 135,301
Front Street	Southern	Nashua	Nashua	1055	6/30/17	\$ 238,075

Line Sensor Installations

Region	AWC	Location	Town	Quant	Cost
E	Rochester	Twombley St	Rochester	3	\$ 5,693
E	Rochester	Laskeys	Milton	3	\$ 5,763
E	Rochester	Signal St	Rochester	6	\$ 11,000
S	Derry	Ash St	Derry	3	\$ 5,637
C	Bedford	Milford	Milford	3	\$ 5,659
E	Rochester	Somersworth	Somersworth	3	\$ 5,607
E	Rochester	N Dover	Dover	6	\$ 11,665
C	Bedford	W Milford	Milford	3	\$ 5,659
S	Derry	High St	Derry	3	\$ 5,661
E	Rochester	Portland St	Rochester	6	\$ 11,291
E	Rochester	Littleworth	Dover	6	\$ 11,071
C	Bedford	Souhegan	Milford	6	\$ 11,249
C	Hooksett	Brown Ave	Manchester	3	\$ 301
E	Rochester	Tate Brook	Somersworth	3	\$ 6,034
C	Hooksett	Hanover St	Manchester	6	\$ 11,649
W	Newport	44H1 Newport	Newport	3	\$ 5,959
W	Newport	3410 Sunapee	Sunapee	3	\$ 5,952
W	Newport	River Rd	Claremont	3	\$ 5,902
S	Nashua	Simon St	Nashua	3	\$ 5,538
S	Nashua	Lowell Rd	Hudson	3	\$ 5,654
W	Keene	S Peterboro	Peterborough	3	\$ 26,150
S	Nashua	Front St	Nashua	6	\$ 10,990
S	Nashua	Edgeville	Nashua	6	\$ 11,083
C	Bedford	Notre Dame	Manchester	3	\$ 5,896
C	Bedford	Goffstown	Goffstown	6	\$ 11,607
S	Nashua	Millyard	Nashua	36	\$ 73,136
C	Hooksett	Suncook	Allenstown	3	\$ 5,940
C	Hooksett	S Manchester	Manchester	15	\$ 29,331
C	Bedford	Meetinghouse Rd	Bedford	6	\$ 11,426
C	Hooksett	N Union St	Manchester	6	\$ 11,880
W	Keene	313X1 Greenfield	Peterborough	3	\$ 5,827

Telecom Expansion

Site ID/Name	Town	Cost
Cates Hill	Berlin	\$ 131,546
Mt Agassiz	Bethlehem	\$ 60,442
Bald Hill	Albany	\$ 49,212
Legends Drive	Hooksett	\$ 166,308
Calef Highway	Barrington	\$ 72,351
Catamount	Pittsfield	\$ 42,544
Columbia Circle	Merrimack	\$ 58,533
Dinsmore	Windham	\$ 61,514
Dram Cup	Milford	\$ 64,934
Franklin Mt	W. Swanzey	\$ 47,250
Gunn Mt	Winchester	\$ 157,196
Industrial Drive	Milton	\$ 64,668
Mitchell Hill	No. Haverhill	\$ 48,548
Monadnock SS	Troy	\$ 48,453
Newington Station	Newington	\$ 53,134
Ocean Road SS	Portsmouth	\$ 50,335
Pinnacle Hill	New Hampton	\$ 58,530
1000 Elm St	Manchester	\$ 48,448
Rivier University	Nashua	\$ 293,702
Scobie Comm	Derry	\$ 38,864
Tecumseh	Waterville Valley	\$ 52,496
Weare SS	Weare	\$ 55,539
Welcome Hill	W. Chesterfield	\$ 62,621
Wolf Hill	Deering	\$ 61,205
Center Hill	Pembroke	\$ 53,022
Goodwin Hill	Bradford	\$ 158,477
Green Mt	Claremont	\$ 294,853
Scobie Comm	Derry	\$ 16,565
Keene AWC	Keene	\$ 30,247

**Battery Backup Added Locations**

Bean Hill	Northfield	\$ 5,099
Chesley Mt	Farmington	\$ 11,268
Mt Kearsarge	Warner	\$ 40,517

DB Cable Injection

Region	AWC	Circuit	Description	Date Complete	Cost
C	Bedford	3138X	Riverway Place	07/01/2016	\$ 131,160
S	Derry	3133X	Twin St. and Romans Rd. Windham	07/06/2016	\$ 44,916
W	Keene	35W1	Birch Rd - Peterborough	07/06/2016	\$ 11,569
S	Nashua	383X3	Elmwood, Hudson	07/07/2016	\$ 43,717
S	Derry	3133X	Highland Rd. Windham	07/07/2016	\$ 18,731
C	Hooksett	3184X	Westminster Dr, Londonderry	07/08/2016	\$ 16,953
C	Hooksett	3184X	Woodhenge Circle, Londonderry	07/11/2016	\$ 15,962
W	Keene	3120X4	Monadock Trailer Park - Rindge	07/11/2016	\$ 27,973
S	Derry	3128X	Ridgemont Dr. Londonderry	07/20/2016	\$ 53,305
C	Hooksett	3613	Lindsay Rd, Hooksett	07/22/2016	\$ 37,740
S	Derry	3133X	Grandview Rd., Windham	07/27/2016	\$ 33,092
W	Newport	316	Pine Hill, New London	08/01/2016	\$ 20,704
W	Newport	316	South Cove - New London	08/01/2016	\$ 21,853
E	Rochester	340X10	Field Stone Trailer Park	08/08/2016	\$ 40,820
E	Rochester	371X1	Briar Estates, Rochester, PART 2	08/10/2016	\$ 18,025
W	Bedford	314X4	Stiles Farm, Wilton.	08/15/2016	\$ 20,781
E	Rochester	38W1	Hemlock Forest	08/15/2016	\$ 7,414
W	Keene	313X1	Peterfield - Brian Rd - Peterborough	08/15/2016	\$ 23,787
W	Newport	316	Camp Sunapee - New London	08/15/2016	\$ 14,438
C	Hooksett	325	Circle Rd, Manchester	08/23/2016	\$ 45,951
S	Derry	3133X	Farrwood Rd Windham	08/23/2016	\$ 15,098
S	Derry	3128X	Severance Dr., Londonderry	08/25/2016	\$ 73,762
E	Rochester	371X1	Briar Estates, Rochester, part 1	09/08/2016	\$ 39,880
S	Derry	3133X	Ridgewood Heights, Windham	09/14/2016	\$ 80,594
S	Derry	3133X	Heritage Hill Rd. Windham	09/15/2016	\$ 108,389
N	Berlin	3525	Grandview Dr. Berlin	10/27/2016	\$ 76,288
S	Nashua	3010X	Cota/Iris, Merrimack	06/14/2017	\$ 87,517
S	Derry	3128X	Paula Ave, Londonderry	06/16/2017	\$ 15,794
C	Bedford	334X14	Goffstown Back Rd, Goffstown	06/27/2017	\$ 133,318
W	Newport	3410	Fishers Bay, Sunapee	06/27/2017	\$ 185,359
C	Bedford	360X5	Birkdale Ln, Bedford	06/27/2017	\$ 69,426

DB Cable Replacement

Region	AWC	Circuit	Description	Approx. Footage	Date Complete	Cost
N	Berlin	3525X4	Castle Dr. & Park Ave, Milan	1,500	10/11/16	\$ 95,093
N	Tilton	338X2	Southdown, Laconia	4,900	10/04/16	\$ 254,787
E	Epping	63W1	Estate Dr. MHP, Barrington	5,591	07/18/16	\$ 380,259
E	Rochester	32X6	Rochester Manor, Rochester	445	06/16/17	\$ 50,451
N	Tilton	310X1	Country Side Dr., Gilford	7,000	08/31/16	\$ 353,034
S	Nashua	3154X2	Oak Hill Lane, Nashua	4,700	08/14/17	\$ 307,462
S	Nashua	3154X1	Skymeadow Drive, Nashua	5,800	01/12/17	\$ 441,730
W	Bedford	23X5	Holt Drive, Amherst	1,230	09/14/16	\$ 65,392
N	Berlin	3525X3	Page Hill Rd, Berlin	700	10/24/16	\$ 68,971
C	Hooksett	3173X1	Longwoods MHP, Deering	10,800	04/26/17	\$ 134,432
S	Derry	3128X	Jefferson Dr., Londonderry	875	06/27/17	\$ 135,755
S	Nashua	3110X	High Pine Avenue, Nashua	800	02/03/17	\$ 41,399
S	Nashua	3159X	Center Road, Amherst	200	03/03/17	\$ 15,563

Circuit Ties

AWC	Circuit	Description	Customer Count	Date Completed	Cost
Newport	61W2-54W1-55W2	Reconfigure and Automate Ties between 61W2, 54W1, and 55W2	3,151	05/17/17	\$34,896
Newport	42X1-315-46H1	Tie end of the 42X1 to the 315 at Guild SS	5,002	02/03/17	\$1,352,155
Derry	32W1	Reconductor 1260 feet of #2 and 2/0 CU at Derry traffic circle with 477 SC. Upgrade to accommodate DA switching recovery of 32W5 load.	1,900	06/30/17	\$445,651
Derry	32W4	Kendall Pond- Reconductor 1/0 ACSR with 477 SPCA for circuit tie capacity.	5,269	07/14/17	\$460,476
Newport	60W1-74W1	Circuit Tie Upgrade between 60W1 and 74W1	1,372	07/01/17	\$891,183
Nashua	3750	Tie to 383X1 along Page Rd, Hudson	2,733	12/19/16	\$616,798
Epping	3103 - 377X7	Convert section of 8.32kV on 3103 to create new tie with 377X7, Brentwood	745	10/05/16	\$176,820

Hit List

<b>AWC</b>	<b>Circuit</b>	<b>Description</b>	<b>Date Complete</b>	<b>Actual</b>
Bedford	317X2	Install C/O to split load	7/18/16	\$11,321
Hooksett	3615X3	Relocate primary out of shunt to refeed Leda Ave, Manchester, Hooksett.	7/19/16	\$32,766
Bedford	3197	Install 3 phase manual load break switch between 3197 and 323 outside Reeds Ferry substation for future switching purposes.	7/19/16	\$18,389
Portsmouth	3102X2	Install in-line disconnects on Route 1 between P 146/82-83	8/2/16	\$4,462
Derry	3128X	Install 2 new Viper-SP reclosers to reduce outages from momentary causes.	8/18/16	\$41,929
Bedford	3138X	Modify fuse sizes at Schiller St, Manchester	8/31/16	\$4,442
Portsmouth	2W4	Upgrade fusing at several locations on Little Harbor Road	9/13/16	\$2,671
Epping	3115X7	Resolve several miscoordination issues	10/12/16	\$31,656
Epping	3115X12	Install new solid blade cutout at pole 11/2 in Deerfield	10/14/16	\$4,567
Epping	3191X5	Resolve fuse coordination issue: New Road, Newmarket	12/20/16	\$1,727
Epping	3162X1	Fuse Coordination-Pinecrest Lane, Durham	12/30/16	\$1,275
Epping	380X1	Install new cutout on Mast Rd, Durham to split customer count	1/11/17	\$7,950
Nashua	3154X1	Add cutouts to reduce # of customers affected	1/18/17	\$612
Hooksett	3130X	Replace Transformer at pole 553/11 on Cranwell Dr. which has been subjected to multiple animal related faults.	1/27/17	\$1,052
Nashua	24W1	Fuse unfused taps - 2 locations - Hollis	2/2/17	\$3,025
Keene	W15	W15 Out of ROW - Keene Part	2/7/17	\$136,608
Keene	W15	W15 Out of ROW - Marlborough Part 1	2/7/17	\$326,839
Keene	W15	W15 Out of ROW - Marlborough Part 2	2/7/17	\$270,952
Keene	W15	W15 Out of ROW - Marlborough Part 3	2/13/17	\$309,530
Keene	W15	W15 Out of ROW - Marlborough - ROW Portion	2/13/17	\$22,237
Hooksett	23W4	Reliability enhancing improvements 23W4 ckt	2/21/17	\$1,630
Hooksett	23W3	Reliability enhancing improvements 23W3 ckt	2/21/17	\$5,492
Nashua	389x8	Upgrade 389X8 tap fuse	2/28/17	\$8,913
Hooksett	393X32	Install Floater to reduce exposure, Holt Ave. Manchester.	3/8/17	\$1,569
Lancaster	30W1	Swap end of 30W1 onto 376X6	4/8/17	\$38,476
Newport	61W2	EWR 16-042-32 .. Remove customers from ROW ..Claremont ..Manville Ave	4/21/17	\$36,564
Rochester	32X3	Tap over and Remove 50T fuses at P 7/5Y	5/8/17	\$401
Newport	311X3	**94/6**EWR INSTALL FUSING	5/10/17	\$1,407
Keene	313X7	EWR W17-010-36 Change feed for Prospect St.	5/11/17	\$6,996

Newport	48W1/316	Move customer from ROW Tap to Street - Frothingham Rd - New London	5/19/17	\$101,254
Newport	316	EWR W16-013-32 Add Side Tap Fusing to Improve Reliability - New London- 316 Line	5/24/17	\$1,103
Tilton	3222X	Replace Heatherlite on Cumberland Rd with spacer cable - 13 sections - Gilford	6/14/17	\$603,420
Portsmouth	367X2	Replace 65E fuses with 50Ts	6/19/17	\$4,280
Keene	W13 (76W7)	Replace Open Wire with Hendrix along Hwy 10 - Gilsum	6/20/17	\$115,059
Nashua	383X1	Convert 7.2 kV end of Robinson Road for backfeed to 3211X end of Robinson Road 14 Fairpoint pole sets 2 EP	6/20/17	\$228,433
Newport	47W1	Replace Open Wire with Hendrix along Hwy 12A in Cornish -	6/20/17	\$253,855
Bedford	23X5	#31 - Replace 80T tap fuse with Spear SP - Boston Post Road (Route 122),Amherst - 347 customers.	7/17/17	\$14,880
Chocorua	3116X1	Move 19 line sections onto road - Cleveland Hill Rd	8/8/17	\$116,426

ROW Hardening projects

<b>AWC</b>	<b>Circuit</b>	<b>Description</b>	<b>Date Complete</b>	<b>Cost</b>
Newport	61W2 / 54W1	ROW Hardening/Upgrade -61W2/54W1 Claremont	6/20/17	\$786,948
Portsmouth	3112/ 3165/ 3172	Rebuild I-95 Crossings	5/23/17	\$1,893,926
Bedford	324 / 3184	324 Line - Reconductor 266 ACSR (Bedford)	11/30/16	\$190,211
Bedford	324	Replace poles and reconductor pole 5 to pole 16 with spacer cable	3/29/17	\$35,149
Nashua	353/ 3445X	Eliminate service attachment to 353/3445X ROW pole	1/13/17	\$11,016
Nashua	3110X	Remove three phase tap from ROW by constructing new three phase down High Pine Ave.	9/11/16	\$26,765
Nashua	3110X	Eliminate Dublin Ave step transformer off ROW by transferring load to other area step transformers.	8/19/16	\$6,700

Heatherlite Bracket Replacements

<b>AWC</b>	<b>Circuit</b>	<b>Description</b>	<b>Locations</b>	<b>Date Complete</b>	<b>Cost</b>
Nashua	3154X2	Replace heatherlite with crossarm construction. West Hollis St - Nashua	7	07/14/2016	\$44,311
Newport	316	Replace Heatherlite with crossarm construction Rte 114 Bradford	21	08/02/2016	\$112,709
Hooksett	393X8	Replace Heather-Lite with crossarm construction East Industrial Park Dr, Manchester	1	11/01/2016	\$5,851
Nashua	3177X	Replace Heatherlite 3177X ROW between Route 111 and Route 111A Nashua	9	11/30/2016	\$55,555
Bedford	3138X	Replace Heatherlite with crossarm construction S. River Rd Bedford	5	01/30/2017	\$3,162
Keene	3140	Replace Heatherlite with crossarm construction Clinton St Antrim	29	03/22/2017	\$65,701
Nashua	3110X	Replace Heatherlite construction with conventonal cross arms - Pine Hill Road Hollis	10	05/09/2017	\$60,284
Derry	3128X	Repl Heatherlite Kendall Pond Rd, Mammoth Rd, and Nashua Rd Londonderry	11	05/11/2017	\$40,172
Tilton	3222X	Replace Heatherlite with crossarm construction Cherry Valley Rd Gilford	20	06/19/2017	\$73,975
Tilton	398X3	Replace Heatherlite with crossarm construction Route 106, Belmont	11	06/23/2017	\$39,868
Derry	26W1	Replace Heatherlite brackets with crossarms, Hoodcroft Rd. Derry.	6	07/12/2017	\$83,191
Nashua	3177X	Replace Heatherlite construction with conventional cross arms Harris Road Nashua	12	08/01/2017	\$73,660
Derry	3184X	Replace heatherlite with crossarm construction, Mammoth Rd. Londonderry	8	08/10/2017	\$24,157
Derry	3133X	Replace Heatherlite with crossarms Route 111 Windham and Hudson	26	08/28/2017	\$51,036

# Section 10

## REP Extension (REP5)

January – December 2018

### Summary Plan

## 2018 REP CAPITAL PLAN January– December 2018

### Summary of proposed budget by program

All \$ in thousands

<b>OH System Reliability</b>	
Circuit Tie Construction	3,000
<b>Vegetation Management</b>	
ETT	4,000
Hazard Tree Removal	2,000
<b>Total REP 5 Capital</b>	<b>9,000</b>

<b>O&amp;M</b>	
O&M Portion of Capital	300
Troubleshooter Organization	2,000
<b>Total O&amp;M</b>	<b>2,300</b>

### OVERHEAD SYSTEM RELIABILITY:

#### Circuit Tie Construction:

**Program Description:** Construct circuit ties for large radial circuits which would allow a backup source of power with Distribution Automation.

**Reliability Benefit:** Constructing circuit ties and installing associated distribution automation devices allows for restoration of service to the majority of the customers fed from these circuits while repairs are made to the cause of the outage.

**2018 Plan:** Complete two circuit ties, as described below. These circuits were chosen due to their poor performance and based on the number of customers positively impacted by the proposed tie.

**Planned Plant in Service:** \$3,000,000

# Circuit Tie – W185 to 4W1 along Safford Drive

## Executive Summary

Create a circuit tie between the W185 circuit fed out of Emerald Street S/S, and the 4W1 fed out of Swanzev S/S by closing in a gap along Safford Drive. This will create a 12.47 kV tie between Hwy 12 and Old Homestead Highway in Swanzev. Conversion work, wire upgrades, and Distribution Automation will be required. Estimated Total Cost: \$1.4 million.

## Project Need Statement

The 4W1 and a large portion of the W185 are radially fed circuits. In 2016, the 4W1 circuit was ranked #26. Outages this Spring impacted over 3,000 customers for close to 560,000 outage minutes so it is anticipated the circuit will be higher on the 2017 list. There is also the need to be able to shift load between Emerald Street S/S and Swanzev S/S. This tie would allow up to 3 MW to be moved between stations for loading, maintenance, and emergency situations. This project offers the potential to save 487,000 customer minutes annually.

## Project Objectives

Improve reliability on the 4W1 and W185 circuits by creating a circuit tie and installing DA devices for isolation. This will increase flexibility for maintaining, restoring, and operating the distribution system in the Keene and Swanzev areas.

## Project Scope

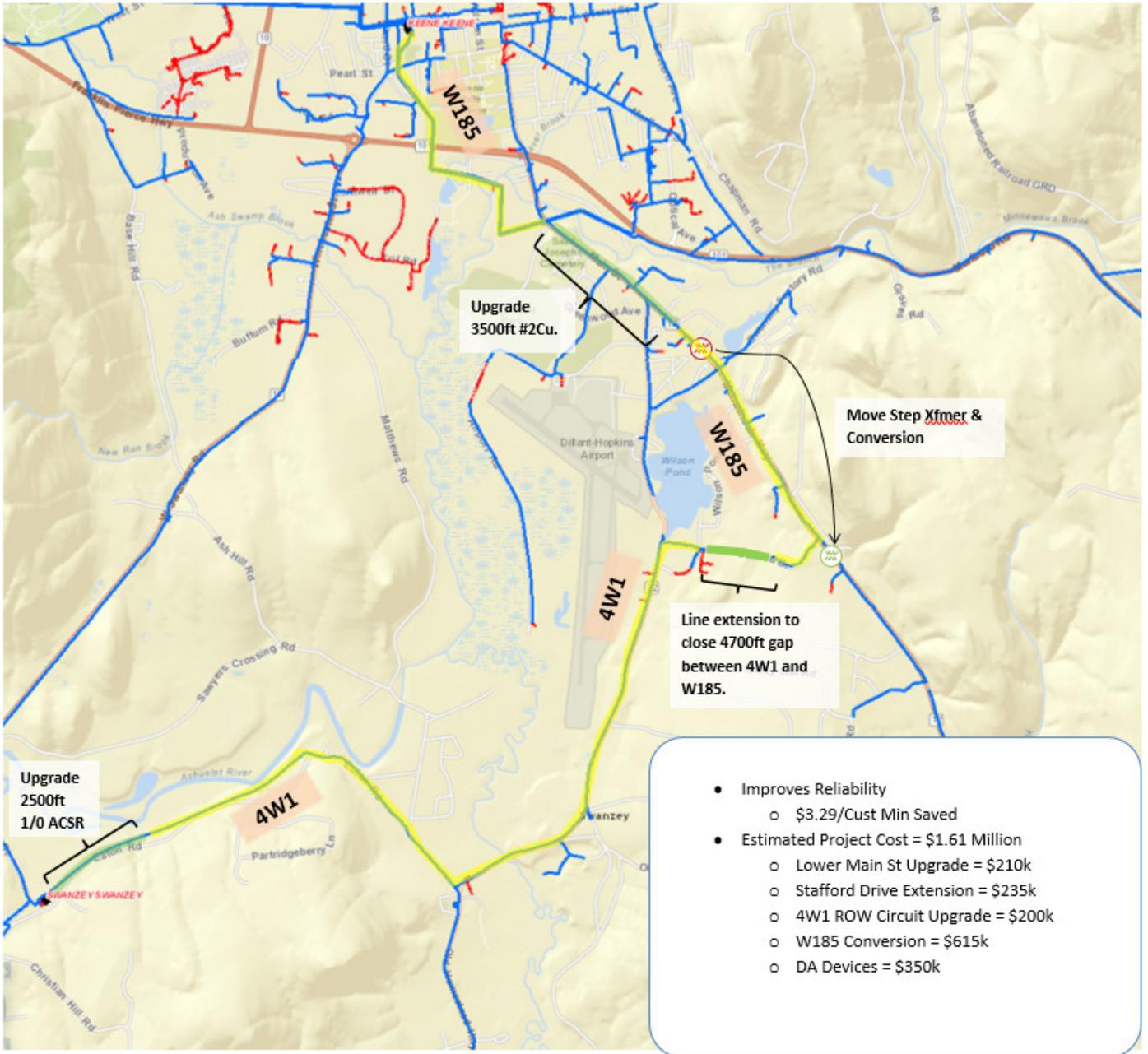
- Upgrade to 477 spacer cable along portions of Lower Main Street on the W185 (3,500')
- Convert a portion of Hwy 12 South beyond Safford Drive from 4 to 12 kV (4,700').
- Close in gap between the 4W1 and the W185 along Safford Drive with spacer cable (1,600')
- Upgrade beginning of 4W1 ROW to 477 spacer cable (2,000')

## Background / Justification

- 4W1 #26 on 2016 Hit List
- Annual Minutes Saved – 487,682
- Ability to move load between Swanzev and Emerald Street Substations

## Cost Estimate and Assumptions

Lower Main Street upgrade to 477 spacer cable:	300K
4W1 ROW upgrade to 477 spacer cable:	200K
Close in gap on Safford Drive with 477 spacer cable:	150K
Conversion to 12.47 kV along Hwy 12:	610K
<u>Contingencies</u>	<u>140K</u>
Total Cost:	\$1,400 K



# Circuit Tie – 3178X3 in Hinsdale

## Executive Summary

In 2014, an express feed circuit numbered the 3178X3 was constructed in ROW from Chestnut Hill S/S in Hinsdale west to Plain Road. This was to be the beginning of a circuit tie to the far end of the 3178X, a perennial top Hit List circuit. This project is to complete this tie with a new spacer cable line built up Plain Road and across Monument Road out to Hwy 119. Total Cost: \$1.4 million.

## Project Need Statement

The 3178X circuit feeds 4,245 customers radially out of Chestnut Hill S/S. Added distributed automation has improved reliability for this circuit to #47 in 2016. This tie would allow flexibility for addressing loading, maintenance, and emergency situations. This project offers the potential to save 291,000 customer minutes annually.

## Project Objectives

Improved reliability for the town of Hinsdale particularly in their manufacturing and commercial areas. Hinsdale is remote from Keene and the ability to swiftly isolate faults will significantly reduce minutes. The objective is to have a flexible and reliable circuit loop for the Hinsdale area.

## Project Scope

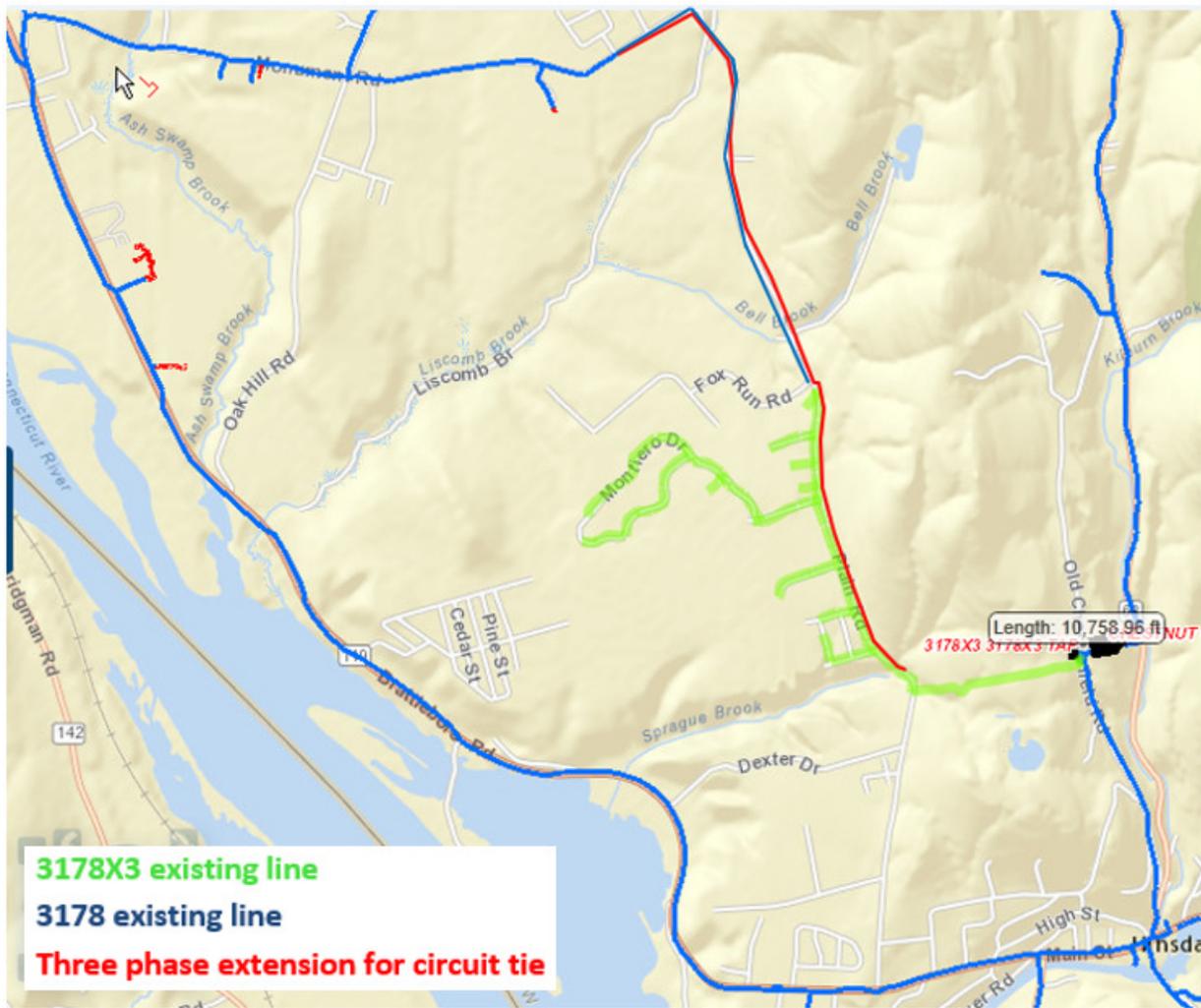
- Upgrade to three phase 477 spacer cable north along Plain Road and Monument Rd. (15,000')
- Convert Monument Rd to 34.5 kV.

## Background / Justification

- 3178X #47 on 2016 Hit List
- Annual Minutes Saved – 291,394

## Cost Estimate and Assumptions

Line Upgrade and Conversion – Plain and Monument Road:	892K
Wire Upgrade along Monument Road:	234K
<u>Contingencies</u>	<u>120K</u>
Total Cost:	\$1,400K



## **VEGETATION MANAGEMENT:**

### **Enhanced Tree Trimming (ETT):**

Program Description:	Trim main lines for reliability using an enhanced tree trimming (ETT) specification to create ground to sky clearance versus the standard maintenance trim zone. Expanded clearance is obtained by performing greater off zone takedowns and clearing, and higher than normal vertical clearing.
Reliability Benefit:	Increasing the trim zone at targeted main line locations significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.
2018 Plan:	The 2018 Vegetation Management plan is still in development
Planned Plant in Service:	\$4,000,000

### **Hazard Tree Removal:**

Program Description:	Remove trees greater than 16 inches in diameter within the trim zone and others outside the trim zone that are identified as a hazard to falling onto primary conductors.
Reliability Benefit:	Identifying and removing trees that have a high likelihood of contacting primary conductors significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.
2018 Plan:	Hazard trees are identified by Company arborists when reviewing circuits scheduled for trimming. Landowners with trees deemed diseased or decayed are approached for permission to remove the trees at the same time trimming is being performed.
Planned Plant in Service:	\$2,000,000